AGENDA
UTILITIES SERVICE BOARD MEETING

Utilities Service Center Boardroom
City of Bloomington Utilities
600 E Miller Dr
Bloomington, IN 47401

Seth Debro, President
Kirk White, Vice President
Jeff Ehman
Amanda Burnham
Jim Sherman
Megan Parmenter
Molly Stewart
David Hittle, ex officio
Matt Flaherty, ex officio

This meeting may be attended electronically via Zoom by using the following link:
Join Zoom Meeting
https://bloomington.zoom.us/j/85762952893?pwd=D22Zb5hNhJWqjvxMglJXhkFPtyhc4O.1
Meeting ID: 857 6295 2893
Passcode: 905695

Monday, February 10th, 2025

4:30 p.m. Bid Opening

I. Call to Order
II. Bid Opening - Blucher Poole Wastewater Treatment Facility SCADA Improvements - Dan Hudson
III. Bid Opening - Monroe WTP Improvements: Chemical Feed Line Replacement and Backwash System Pump Addition and Tank Rehabilitation - Dan Hudson
IV. Petitions and Communications*
V. Adjournment

*Public Comment will be limited to 5 minutes per person

PROJECT MANUAL

FOR

BLUCHER POOLE WASTEWATER TREATMENT FACILITY SCADA IMPROVEMENTS

FOR THE

CITY OF BLOOMINGTON UTILITIES
BLOOMINGTON, INDIANA

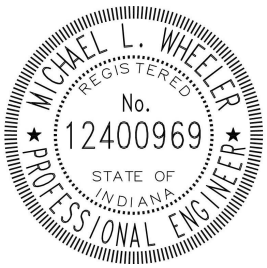
WESSLER ENGINEERING, INC.
INDIANAPOLIS, INDIANA

JANUARY 2025

PROJECT MANUAL
FOR
BLUCHER POOLE WASTEWATER TREATMENT FACILITY SCADA IMPROVEMENTS

FOR THE
CITY OF BLOOMINGTON UTILITIES
BLOOMINGTON, INDIANA

WESSLER ENGINEERING, INC.
INDIANAPOLIS, INDIANA



Certified By:

Michael L. Wheeler
Professional Engineer No. 12400969

JANUARY 2025

TABLE OF CONTENTS

B. TECHNICAL SECTIONS OF THE SPECIFICATIONS

-END-

ADVERTISEMENT FOR BIDS

BLUCHER POOLE WASTEWATER TREATMENT FACILITY
SCADA IMPROVEMENTS

NOTICE IS HEREBY GIVEN THAT THE UTILITIES SERVICE BOARD OF THE CITY OF BLOOMINGTON, INDIANA WILL RECEIVE SEALED BIDS FOR THE BELOW-DESCRIBED WORK AT THE LOCATION INDICATED.

The Work includes furnishing all labor, materials, equipment, supplies and services to replace outdated Supervisory Control and Data Acquisition (SCADA) equipment for the Blucher Poole Wastewater Treatment Plant. The Work includes, but is not limited to, removal, replacement and re-wiring of outdated plant Programmable Logic Controllers, Human Machine Interfaces and associated equipment; Replacement of, and installation of new instrumentation around the facility; and replacement of critical Variable Frequency Drives located in the Influent Lift Station and Residuals Pumping Station locations; and all associated Work complete in place as shown and specified in the Contract Documents.

Sealed bids shall be received by the Utilities Department, at 600 E. Miller Drive, Bloomington, Indiana, 47401, at or before 4:30 pm local time on February 10, 2025. Any bids received after the designated time will be returned unopened.

Bids will be publicly opened and read aloud at the Utilities Service Board's special meeting which begins at 4:30 PM local time on February 10, 2025. The meeting will be held at the Utilities Building Board Room at 600 E. Miller Drive, Bloomington, Indiana, 47401.

Bids will be reviewed, and the award may be made at the February 24, 2025 regular meeting or a subsequent meeting of the Utilities Service Board.

All Bids must be in accordance with the Bidding Documents on file with the Director of Utilities, City of Bloomington, 600 E. Miller Drive, Bloomington, Indiana 47401.

The Bidding Documents, including Specifications may be obtained from the Engineer's office, Wessler Engineering, 6219 South East Street, Indianapolis, Indiana 46227, Telephone (317) 788-4551. All copies are distributed to Contractors and other interested parties by Wessler Engineering, Inc. (www.wesslerengineering.com/planroom/) for a non-refundable fee. A complete digital set of bidding documents is available for $100.00. A complete hard copy set of bidding documents is available for $150.00.

An up to date Planholders List may be viewed at http://wesslerengineering.com/planroom/.

A Pre-Bid Conference will be held at 10:00 am (local time) on January 30, 2025 at 5555 N Bottom Road, Bloomington, Indiana, 47404 in the conference room in the Administration Building. A project related plant tour will be held immediately following the Pre-Bid meeting. Bidders are encouraged to attend the Pre-Bid Conference and plant tour.

Neither the Owner or Engineer has any responsibility for the accuracy, completeness or sufficiency of any bid documents obtained from any other source other than the sources listed herein. Obtaining these documents from any other source(s) may result in obtaining incomplete

and inaccurate information. Obtaining these documents from any other source other than directly from the sources listed herein may also result in failure to receive addenda, corrections, or other revisions to the Bidding Documents that may be issued.

Each Bidder shall file with his or her sealed bid:

(1) a properly executed Non-collusion Affidavit as required by the laws of the State of Indiana;
(2) A Questionnaire Form 96 of the State Board of Accounts;
(3) A properly executed Responsible Bidder Affidavit
(4) A cashier's check or certified check drawn on an acceptable bank or a Bid bond equal to five (5) percent of the total amount of bid;
(5) A properly executed Employee Drug Testing Program Affidavit for a public works project estimated to cost at least $150,000,
(6) A copy of the bidder's written plan for an employee drug testing program to test the employees of the bidder for drugs.
(7) E-Verify affidavit form;
(8) Certification from the State evidencing of Bidder's authority and qualification to do business in the State of Indiana;
(9) Living Wage Ordinance certification.

For bids of $100,000.00 or more, the successful bidder shall furnish performance and payment bonds for one hundred percent (100%) of the contract amount prior to the execution of the contract, and said bonds shall remain in effect for a period of one (1) year after final acceptance of the work.

Each Bidder must ensure that to the greatest extent feasible, opportunities for training and employment should be given to lower income residents of the project area and purchases and/or contract for work in connection with the project should be awarded to small business concerns which are located in, or owned in substantial part, by persons residing in the area of the project.

The City of Bloomington is an equal opportunity employer, and Bidder shall meet all requirements for equal employment under Title VII of the 1964 Civil Rights Act as amended and under the Bloomington Human Rights Ordinance, as amended.

Each Bidder for proposals over $10,000.00 shall submit and have approved by the City of Bloomington Contract Compliance Officer, Audrey Brittingham, his/her written Affirmative Action Plan at least twenty-four (24) hours prior to the deadline for submission of bid. Bids received that do not have an approved Affirmative Action Plan may be returned unopened. Each Bidder must ensure that all employees and applicants for employment are not discriminated against because of race, religion, color, sex, national origin, ancestry, disability, sexual orientation, gender identity, veteran status or housing status. All the protected classes must be included in your Affirmative Action Plan for it to be acceptable. In addition to other requirements, your plan MUST include a workforce breakdown, an internal grievance procedure, a non-retaliation statement, designation of a person by name or position who is responsible for implementation of the Plan, applicability to both applicants and employees, recruitment of minorities, equal access to training programs, and an explanation of your method of communicating the operations of your affirmative action plan to employees and prospective applicants. For Affirmative Action Plan information and approval only, contact Audrey Brittingham, Contract Compliance Officer, at (812) 349-3429, 8:00 AM to 5:00 PM Monday through Friday.

In accordance with Indiana Code 4-13-18-5, each Contractor that submits a bid for a public works project that is estimated to cost $150,000 or more shall submit with his/her bid a written plan for an employee drug testing program to test the employees of the Contractor and Subcontractors for drugs.

For contracts over $300,000.00, in accordance with IC 5-16-13-10 and IC 8-23-10-0.5, Contractor must be qualified under either IC 4-13.6-4 or IC 8-23-10 (Indiana Department of Administration or Indiana Department of Transportation) before doing any work on a public works project.

In accordance with IC 22-5-1.7-11.1, Contractors entering into a contract with the Owner, and contractors of any tier as defined in IC 5-16-13-4, will be required to enroll in and verify the work eligibility status of all newly hired employees through the E-Verify program (effective July 1, 2011), and comply with the reporting requirements of IC 5-16-13-11.

The Utility Service Board reserves the right to waive any informality and to accept or reject any or all bids submitted. Bids may be held by the Utility Service Board for a period not-to-exceed sixty (60) days from the date of the opening of Bids for the purpose of reviewing the Bids and investigating the qualifications of the Bidders prior to awarding the contract.

Utilities Service Board, City of Bloomington, Indiana

Seth Debro, President

-END OF SECTION-

INSTRUCTIONS TO BIDDERS

ARTICLE 1 - DEFINED TERMS

1.01 Terms used in these Instructions to Bidders have the meanings indicated in the General Conditions and Supplementary Conditions.

ARTICLE 2 - COPIES OF BIDDING DOCUMENTS

2.01 Complete sets of the Bidding Documents, in the number and for the nonrefundable fees (if any) stated in the Advertisement for Bidders, may be obtained from www.wesslerengineering.com/planroom/.

2.02 Complete sets of Bidding Documents shall be used in preparing Bids; neither Owner nor Engineer assumes any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents.

2.03 Owner and Engineer, in making copies of Bidding Documents available on the above terms, do so only for the purpose of obtaining Bids for the Work and do not authorize or confer a license for any other use.

ARTICLE 3 - QUALIFICATIONS OF BIDDERS

3.01 To further demonstrate Bidder's qualifications to perform the Work, after submitting its Bid and within the time period stated in the Proposal Form or herein, the apparent successful Bidder and any other Bidder so requested, shall submit the following information:

A. Subcontractor and supplier qualifications information; coordinate with provisions of Article 12 of these Instructions, "Subcontractors, Suppliers, and Others",

B. The names of proposed Construction Superintendent and Project Manager accompanied by experience statements per Article 12 of these Instructions,

C. Within three (3) days of Owner's request, any additional written evidence related to its financial condition, previous experience, and present commitments demonstrating the Bidder's, Subcontractor's, and Supplier's qualifications, and

D. For contracts over $300,000, Bidder's Certificate of Prequalification with the Indiana Department of Administration (IDOA) or the Indiana Department of Transportation (INDOT) shall be submitted with the bid. Any Bidder that fails to submit the Certification of Prequalification within fifteen (15) days of bid opening may result in the Bid being rejected as non-responsive.

3.02 A Bidder's failure to submit required qualification information within the times indicated may disqualify Bidder from receiving an award of the Contract.

3.03 No requirement in this Article 3 to submit information will prejudice the right of Owner to seek additional pertinent information regarding Bidder's qualifications.

3.04 Bidder is advised to carefully review those portions of the Bid Form requiring Bidder's representations and certifications.

ARTICLE 4 - SITE AND OTHER AREAS; EXISTING SITE CONDITIONS; EXAMINATION OF SITE; OWNER'S SAFETY PROGRAM; OTHER WORK AT THE SITE

4.01 Site and Other Areas

A. The Site is identified in the Bidding Documents. By definition, the Site includes rights-of-way, easements, and other lands furnished by Owner for the use of the Contractor. Any additional lands required for temporary construction facilities, construction equipment, or storage of materials and equipment, and any access needed for such additional lands, are to be obtained and paid for by Contractor.

4.02 Existing Site Conditions

A. Subsurface and Physical Conditions; Hazardous Environmental Conditions

1. The Supplementary Conditions identify:
   a. those reports of explorations and tests of subsurface conditions at or contiguous to the Site that Engineer has used in preparing the Bidding Documents.
   b. those drawings of physical conditions relating to existing surface or subsurface structures at or contiguous to the Site (except Underground Facilities) that the Engineer has used in preparing the Bidding Documents
   c. Technical Data contained in such reports and drawings.
2. Owner will make copies of reports and drawings referenced above available to any Bidder on request. These reports and drawings are not part of the Contract Documents, but the Technical Data contained therein upon whose accuracy Bidder is entitled to rely, as provided in the General Conditions, has been identified and established in the Supplementary Conditions. Bidder is responsible for any interpretation or conclusion Bidder draws from any Technical Data or any other data, interpretations, opinions, or information contained in such reports or shown or indicated in such drawings.
3. If the Supplementary Conditions do not identify Technical Data, the default definition of Technical Data set forth in Article 1 of the General Conditions will apply.

B. Underground Facilities: Information and data shown or indicated in the Bidding Documents with respect to existing Underground Facilities at or contiguous to the Site are set forth in the Contract Documents and are based upon information and data furnished to Owner and Engineer by owners of such Underground Facilities, including Owner, or others.

C. Adequacy of Data: Provisions concerning responsibilities for the adequacy of data furnished to prospective Bidders with respect to subsurface conditions, other physical conditions, and Underground Facilities, and possible changes in the Bidding Documents due to differing or unanticipated subsurface or physical conditions appear in Paragraphs 5.03, 5.04, and 5.05 of the General Conditions. Provisions

concerning responsibilities for the adequacy of data furnished to prospective Bidders with respect to a Hazardous Environmental Condition at the Site, if any, and possible changes in the Contract Documents due to any Hazardous Environmental Condition uncovered or revealed at the Site which was not shown or indicated in the Drawings or Specifications or identified in the Contract Documents to be within the scope of the Work, appear in Paragraph 5.06 of the General Conditions.

4.03 Site Visit and Testing by Bidders

A. Bidder shall conduct the required Site visit during normal working hours, and shall not disturb any ongoing operations at the Site.

B. Bidder is not required to conduct any subsurface testing, or exhaustive investigations of Site conditions.

C. Upon request and when scheduled in advance, Owner will provide Bidder access to the Site to conduct such examinations, investigations, explorations, tests, and studies as Bidder deems necessary for submission of a Bid. Bidder shall fill all holes and clean up and restore the Site to its former condition upon completion of such explorations, investigations, tests, and studies. Bidder shall comply with all applicable Laws and Regulations relative to excavation and utility locates., and obtain all permits, and comply with all terms and conditions established by Owner or by property owners or other entities controlling the Site with respect to schedule, access, existing operations, security, liability insurance, and applicable safety programs.

4.04 Owner's Safety Program

A. Site visits and Work at the Site may be governed by an Owner safety program. As the General Conditions indicate, if an Owner safety program exists, it will be noted in the Supplementary Conditions.

4.05 Other Work at the Site

A. Reference is made to Article 8 of the Supplementary Conditions for the identification of the general nature of other work of which Owner is aware (if any) that is to be performed at the Site by Owner or others (such as utilities and other prime contractors) and relates to the Work contemplated by these Bidding Documents. If Owner is party to a written contract for such other work, then on request, Owner will provide to each Bidder access to examine such contracts (other than portions thereof related to price and other confidential matters), if any.

ARTICLE 5 - BIDDER'S REPRESENTATIONS

5.01 It is the responsibility of each Bidder before submitting a Bid to:

A. examine and carefully study the Bidding Documents, and any data and reference items identified in the Bidding Documents;

B. visit the Site, conduct a thorough, alert visual examination of the Site and adjacent areas, and become familiar with and satisfy itself as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work;

C. become familiar with and satisfy itself as to all Laws and Regulations that may affect cost, progress, and performance of the Work;

D. carefully study all: (1) reports of explorations and tests of subsurface conditions at or adjacent to the Site and all drawings of physical conditions relating to existing surface or subsurface structures at the Site that have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings, and (2) reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site that have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings;

E. consider the information known to Bidder itself; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Bidding Documents; and the Site-related reports and drawings identified in the Bidding Documents, with respect to the effect of such information, observations, and documents on (1) the cost, progress, and performance of the Work; (2) the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder; and (3) Bidder's safety precautions and programs;

F. agree, based on the information and observations referred to in the preceding paragraph, that at the time of submitting its Bid no further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of its Bid for performance of the Work at the price bid and within the times required, and in accordance with the other terms and conditions of the Bidding Documents;

G. become aware of the general nature of the work to be performed by Owner and others at the Site that relates to the Work as indicated in the Bidding Documents;

H. promptly give Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder discovers in the Bidding Documents and confirm that the written resolution thereof by Engineer is acceptable to Bidder;

I. determine that the Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance and furnishing of the Work; and

J. agree that the submission of a Bid will constitute an incontrovertible representation by Bidder that Bidder has complied with every requirement of this Article, that without exception the Bid and all prices in the Bid are premised upon performing and furnishing the Work required by the Bidding Documents.

ARTICLE 6 - PRE-BID CONFERENCE

6.01 A Pre-Bid conference will be held at the time and location stated in the Advertisement for Bidders. Representatives of Owner and Engineer will be present to discuss the Project. Bidders are encouraged to attend and participate in the conference. Engineer will transmit to all prospective Bidders of record such Addenda as Engineer considers necessary in response to questions arising at the conference. Oral statements may not be relied upon and will not be binding or legally effective.

ARTICLE 7 - INTERPRETATIONS AND ADDENDA

7.01 All questions about the meaning or intent of the Bidding Documents are to be submitted to Engineer in writing. Interpretations or clarifications considered necessary by Engineer in response to such questions will be issued by Addenda delivered to all parties recorded as having received the Bidding Documents. Questions received less than seven days prior to the date for opening of Bids may not be answered. Only questions answered by Addenda will be binding. Oral and other interpretations or clarifications will be without legal effect.

7.02 Addenda may be issued to clarify, correct, supplement, or change the Bidding Documents.

ARTICLE 8 - BID SECURITY

8.01 A Bid must be accompanied by Bid security as detailed on the Proposal Form.

8.02 The Bid security of the apparent Successful Bidder will be retained until Owner awards the contract to such Bidder, and such Bidder has executed the Contract Documents, furnished the required contract security, and met the other conditions of the Notice of Award, whereupon the Bid security will be released. If the Successful Bidder fails to execute and deliver the Contract Documents and furnish the required contract security within 15 days after the Notice of Award, Owner may consider Bidder to be in default, annul the Notice of Award, and the Bid security of that Bidder will be forfeited. Such forfeiture shall be Owner's exclusive remedy if Bidder defaults.

8.03 The Bid security of other Bidders that Owner believes to have a reasonable chance of receiving the award may be retained by Owner until the earlier of seven days after the Effective Date of the Contract or 61 days after the Bid opening, whereupon Bid security furnished by such Bidders will be released.

8.04 Bid security of other Bidders that Owner believes do not have a reasonable chance of receiving the award will be released within seven days after the Bid opening.

ARTICLE 9 - CONTRACT TIMES

9.01 The number of days within which, or the dates by which, the Work is to be substantially completed and ready for final payment are set forth in the Sample Form Agreement.

ARTICLE 10 - LIQUIDATED DAMAGES

10.01 Provisions for liquidated damages, if any, for failure to timely attain a Milestone, Substantial Completion, or completion of the Work in readiness for final payment, are set forth in the Sample Form Agreement.

ARTICLE 11 - SUBSTITUTE AND "OR-EQUAL" ITEMS

11.01 Unless identified otherwise in the detailed Specifications, the Contract, if awarded, will be on the basis of materials and equipment specified or described in the Bidding Documents without consideration of possible substitute or "or-equal" items. Whenever it is specified or described in the Bidding Documents that a substitute or "or-equal" item of material or equipment may be furnished or used by Contractor if acceptable to Engineer, application for such acceptance will not be considered by Engineer until after the Effective Date of the Agreement.

11.02 All prices that Bidder sets forth in its Bid shall be based on the presumption that the Contractor will furnish the materials and equipment specified or described in the Bidding Documents, as supplemented by Addenda. Any assumptions regarding the possibility of post-Bid approvals of "or-equal" or substitution requests are made at Bidder's sole risk.

ARTICLE 12 - SUBCONTRACTORS, SUPPLIERS, AND OTHERS

12.01 A Bidder shall be prepared to retain specific Subcontractors, Suppliers, or other individuals or entities for the performance of the Work if required by the Bidding Documents (most commonly in the Specifications) to do so. If a prospective Bidder objects to retaining any such Subcontractor, Supplier, or other individual or entity, and the concern is not relieved by an Addendum, then the prospective Bidder should refrain from submitting a Bid.

12.02 Subsequent to the submittal of the Bid, Owner may not require the Successful Bidder or Contractor to retain any Subcontractor, Supplier, or other individual or entity against which Contractor has reasonable objection.

12.03 If requested by Owner, the apparent Successful Bidder, and any other Bidder so requested, shall within the time period stated in the Proposal Form, submit to the Owner an experience statement with pertinent information regarding similar projects and other evidence of qualification for each such Subcontractor, Supplier, or other individual or entity. If Owner or Engineer, after due investigation, has reasonable objection to any proposed Subcontractor, Supplier, individual, or entity, Owner may, before the Notice of Award is given, request apparent Successful Bidder to submit an acceptable substitute, in which case apparent Successful Bidder shall submit a substitute, Bidder's Bid price will be increased (or decreased) by the difference in cost occasioned by such substitution, and Owner may consider such price adjustment in evaluating Bids and making the Contract award.

12.06 If apparent Successful Bidder declines to make any such substitution, Owner may award the Contract to the next lowest Bidder that proposes to use acceptable Subcontractors, Suppliers, or other individuals or entities. Declining to make requested substitutions will constitute grounds for forfeiture of the Bid security of any Bidder. Any Subcontractor,

Supplier, individual, or entity so listed and against which Owner or Engineer makes no written objection prior to the giving of the Notice of Award will be deemed acceptable to Owner and Engineer subject to subsequent revocation of such acceptance as provided in Paragraph 7.06 of the General Conditions.

ARTICLE 13 - PREPARATION OF BID

13.01 The Proposal Form is included with the Bidding Documents.

13.02 All blanks on the Proposal Form shall be completed in ink and signed in ink. Erasures or alterations shall be initialed in ink by the person signing the documents. A Bid price shall be indicated for each section, Bid item, alternate, adjustment unit price item, and unit price item listed therein.

13.03 If the Proposal Form expressly indicates that submitting pricing on a specific alternate item is optional, and Bidder elects to not furnish pricing for such optional alternate item, then Bidder may enter the words “No Bid” or “Not Applicable.”

13.04 A Bid by a corporation shall be executed in the corporate name by a corporate officer (whose title must appear under the signature), accompanied by evidence of authority to sign. The corporate address and state of incorporation shall be shown.

13.05 A Bid by a partnership shall be executed in the partnership name and signed by a partner (whose title must appear under the signature), accompanied by evidence of authority to sign. The official address of the partnership shall be shown.

13.06 A Bid by a limited liability company shall be executed in the name of the firm by a member or other authorized person and accompanied by evidence of authority to sign. The state of formation of the firm and the official address of the firm shall be shown.

13.07 A Bid by an individual shall show the Bidder’s name and official address.

13.08 A Bid by a joint venture shall be executed by an authorized representative of each joint venturer in the manner indicated on the Proposal Form. The official address of the joint venture shall be shown.

13.09 All names shall be printed in ink below the signatures.

13.10 The Bid shall contain an acknowledgment of receipt of all Addenda, the numbers of which shall be filled in on the Proposal Form.

13.11 Postal and e-mail addresses and telephone number for communications regarding the Bid shall be shown.

13.12 The Bid shall contain evidence of Bidder’s authority and qualification to do business in the state where the Project is located, or Bidder shall covenant in writing to obtain such authority and qualification prior to award of the Contract and attach such covenant to the Bid. Bidder’s state contractor license number, if any, shall also be shown on the Bid Form.

ARTICLE 14 - BASIS OF BID

14.01 Lump Sum

A. Bidders shall submit a Bid on a lump sum basis as set forth in the Bid Form.

14.02 Allowances

A. For cash allowances the Bid price shall include such amounts as the Bidder deems proper for Contractor's overhead, costs, profit, and other expenses on account of cash allowances, if any, named in the Contract Documents, in accordance with Paragraph 13.02.B of the General Conditions.

ARTICLE 15 - SUBMITTAL OF BID

15.01 The Proposal Form is to be completed, signed, and submitted with the Bid security and the other documents required to be submitted as listed on the Proposal Form.

15.02 A Bid shall be received no later than the date and time prescribed and at the place indicated in the Advertisement for Bidders and shall be enclosed in a plainly marked package with the Project title (and, if applicable, the designated portion of the Project for which the Bid is submitted), the name and address of Bidder, and shall be accompanied by the Bid security and other required documents. If a Bid is sent by mail or other delivery system, the sealed envelope containing the Bid shall be enclosed in a separate package plainly marked on the outside with the notation “BID ENCLOSED.” A mailed Bid shall be addressed as listed in the Proposal Form.

15.03 Bids received after the date and time prescribed for the opening of bids, or not submitted at the correct location or in the designated manner, will not be accepted and will be returned to the Bidder unopened.

ARTICLE 16 - MODIFICATION AND WITHDRAWAL OF BID

16.01 A Bid may be withdrawn by an appropriate document duly executed in the same manner that a Bid must be executed and delivered to the place where Bids are to be submitted prior to the date and time for the opening of Bids. Upon receipt of such notice, the unopened Bid will be returned to the Bidder.

16.02 If a Bidder wishes to modify its Bid prior to Bid opening, Bidder must withdraw its initial Bid in the manner specified in Paragraph 16.01 and submit a new Bid prior to the date and time for the opening of Bids.

16.03 If within 24 hours after Bids are opened any Bidder files a duly signed written notice with Owner and promptly thereafter demonstrates to the reasonable satisfaction of Owner that there was a material and substantial mistake in the preparation of its Bid, that Bidder may withdraw its Bid, and the Bid security will be returned. Thereafter, if the Work is rebid, that Bidder will be disqualified from further bidding on the Work.

ARTICLE 17 - OPENING OF BIDS

17.01 Bids will be opened at the time and place indicated in the Advertisement for Bidders and, unless obviously non-responsive, read aloud publicly.

ARTICLE 18 - BIDS TO REMAIN SUBJECT TO ACCEPTANCE

18.01 All Bids will remain subject to acceptance for the period of time stated in the Proposal Form, but Owner may, in its sole discretion, release any Bid and return the Bid security prior to the end of this period.

ARTICLE 19 - EVALUATION OF BIDS AND AWARD OF CONTRACT

19.01 Owner reserves the right to reject any or all Bids, including without limitation, nonconforming, nonresponsive, unbalanced, or conditional Bids. Owner will reject the Bid of any Bidder that Owner finds, after reasonable inquiry and evaluation, to not be responsible. If Bidder purports to add terms or conditions to its Bid, takes exception to any provision of the Bidding Documents, or attempts to alter the contents of the Contract Documents for purposes of the Bid, then the Owner will reject the Bid as nonresponsive; provided that Owner also reserves the right to waive all minor informalities not involving price, time, or changes in the Work.

19.02 More than one Bid for the same Work from an individual or entity under the same or different names will not be considered. Reasonable grounds for believing that any Bidder has an interest in more than one Bid for the Work may be cause for disqualification of that Bidder and the rejection of all Bids in which that Bidder has an interest.

19.03 If Owner awards the contract for the Work, such award shall be to the responsible Bidder submitting the lowest responsive Bid.

19.04 Evaluation of Bids

A. In evaluating Bids, Owner will consider whether or not the Bids comply with the prescribed requirements in the Bid Form, and such alternates, unit prices, and other data, as may be requested in the Proposal Form or prior to the Notice of Award.

B. Bids will be compared on the basis of the Lump Sum Base Bid

19.05 In evaluating whether a Bidder is responsible, Owner will consider the qualifications of the Bidder and may consider the qualifications and experience of subcontractors and equipment manufacturers/suppliers proposed for those portions of the Work for which the identity of subcontractors and equipment manufacturers/suppliers must be submitted as provided in the Bidding Documents.

19.06 Owner may conduct such investigations as Owner deems necessary to establish the responsibility, qualifications, and financial ability of Bidders and any proposed Subcontractors or Suppliers.

ARTICLE 20 - BONDS AND INSURANCE

20.01 Article 6 of the General Conditions, as may be modified by the Supplementary Conditions, sets forth Owner's requirements as to performance and payment bonds and insurance. When the Successful Bidder delivers the Agreement (executed by Successful Bidder) to Owner, it shall be accompanied by required bonds and insurance documentation.

ARTICLE 21 - SIGNING OF AGREEMENT

21.01 When Owner issues a Notice of Award to the Successful Bidder, it shall be accompanied by the unexecuted counterparts of the Agreement along with the other Contract Documents as identified in the Agreement. Within 15 days thereafter, Successful Bidder shall execute and deliver the required number of counterparts of the Agreement (and any bonds and insurance documentation required to be delivered by the Contract Documents) to Owner. Within ten days thereafter, Owner shall deliver one fully executed counterpart of the Agreement to Successful Bidder, together with printed and electronic copies of the Contract Documents as stated in either in the General Conditions Paragraph GC-2.02 or the Supplementary Conditions Paragraph SC-2.02.

ARTICLE 22 - SALES AND USE TAXES

22.01 Owner is exempt from Indiana state sales and use taxes on materials and equipment to be incorporated in the Work. Said taxes shall not be included in the Bid. The Owner's General Tax Exemption Certificate Account Number for purchase of materials to be installed as a part of this project will be provided at the Preconstruction Conference. Refer to Paragraph SC-7.09 of the Supplementary Conditions for additional information.

ARTICLE 24 - SUPPLEMENTAL INSTRUCTIONS

24.01 Domestic Product Requirements: All steel and foundry products provided for public works projects, including ferrous and non-ferrous metals, piping, fittings, and piping-related products, shall be manufactured in the United States in accordance with Indiana Code 5-16-8-2 – Public agency contract provisions; rules for determining reasonable pricing; and Consolidated Appropriations Act (2014) Section 436.

24.02 The Contract will be awarded in accordance with the provisions of IC 5-16-13 for public works projects. Pursuant to IC 5-16-13-7, the provisions of the law are incorporated by reference and Contractor agrees that pursuant to IC 5-16-13-8, the public works project will not be structured other than in the Contractor tier structure required by law. Contractor shall further be required to comply with the provisions of IC 5-16-13-13; 14 in all respects including but not limited to document preservation and availability for inspection.

-END-

PROPOSAL FORM

BLUCHER POOLE WASTEWATER TREATMENT FACILITY SCADA IMPROVEMENTS

THIS BID IS SUBMITTED TO:

City of Bloomington Utilities
Office of the Director
600 E. Miller Drive
Bloomington, Indiana 47401

Pursuant to the published "Advertisement for Bids", the undersigned has investigated the conditions affecting the cost of the proposed SCADA Improvements, and having examined the site and understanding the requirements set forth in the Contract Documents, hereby proposes to provide and furnish all labor, materials, tools, equipment, and all utility and transportation services necessary to perform and complete, in a workmanlike manner, all work as required by said Contract Documents, including any and all addenda now on file in the City of Bloomington Utilities, 600 East Miller Drive, Bloomington, Indiana 47401.

LUMP SUM BASE BID

LUMP SUM BID

Lump Sum Base Bid Price (in figures) $_____

Contingency Allowance (in figures) $ 50,000.00

Total Lump Sum Bid Price (in figures) $_____

Total Lump Sum Bid Price (in words) _____

_____ Dollars

All other Work, shown and specified but not described under the lump sum items herein, necessary for a complete project shall be considered incidental. The cost for that incidental Work shall be included in the cost of lump sum and unit price items herein.

CONTINGENCY ALLOWANCE
Total Lump Sum Bid Price = Lump Sum Base Bid Price + Contingency Allowance

The above lump sum base Bid amount includes a contingency allowance for unanticipated work. The contingency allowance amount included in the above lump sum base Bid is **$50,000.00** as listed above. Payment shall only be made for the actual cost of work performed by the Contractor or a subcontractor plus allowable mark-ups based on a signed change order with the Owner. If the entire amount is not expended by the end of the contract the Contract Price will reduced by the appropriate amount by Change Order.

CONTRACT TIMES

The undersigned further agrees that the Work covered by this Proposal will be Substantial Complete within the following numbers of calendar days after the date when Contract Times commence to run as provided in Paragraph 4.01 of the General Conditions. Final Completion shall mean Work is completed and ready for final payment in accordance with Article 15 of the General Conditions.

	Substantial Completion	Final Completion
All Work included in the Contract Documents	240	270

DESIGNATION OF INTENDED SUBCONTRACTORS

Any and all Subcontractors performing work valued over $10,000 shall be listed below. Any subcontractor not listed below at the time of bid, must be approved by the City of Bloomington prior to performing any work on this contract. Subcontractors not listed or approved will not be paid for work under this contract. In accordance with Indiana Code *5-16-13 et seq.,* incorporated herein by reference, any subcontractor performing work on this contract is a Tier 2 contractor.

The Proposal, as submitted, is based upon the following Subcontractors (Enter Subcontractor information):

TRADE / SERVICE	COMPANY NAME	TELEPHONE NO.

BID SECURITY

The undersigned encloses herewith a certified check payable to the City of Bloomington, or an acceptable bidder's bond binding the undersigned and surety to the City of Bloomington, Indiana, in the amount of

_____ dollars and ____ cents
(Price in Words)

($ _____)
(Price in Numerals)

which amount is not less than five percent (5%) of the LUMP SUM BASE BID as set out above, guaranteeing that the undersigned will enter into Contract for the performance of the work if this Proposal is accepted.

ATTACHMENTS TO THIS BID

1. Form 96, "Contractors Bid For Public Works" as prescribed by the Indiana State Board of Accounts, including Section III of Part II "Contractor's Financial Statement" is properly executed and attached hereto. A Non-Collusion Affidavit, as required by the statutes of the State of Indiana, is properly executed and included in Section IV of Part II of Form 96. Bidders Qualifications as described in Sections I and II of part II of Form 96 shall be completed in their entirety.

2. The Responsible Bidder Affidavit is attached.

3. The Compliance Affidavit Regarding Indiana Code Chapter 4-13-18 Drug Testing Of Employees of Public Works Contractors is attached including a copy of the written plan for employee drug testing.

4. Evidence of Bidder's authority and qualification to do business in the state of Indiana. Evidence shall consist of a certification from the state in accordance with IC 4-13.6-4 or IC 8-23-10 if the value of the contract is greater than $300,000.

5. Trench Safety Compliance Affidavit form – Not Required

6. E-Verify Affidavit form – Completed form

7. City of Bloomington Living Wage Ordinance form – Completed form

It is hereby agreed that this proposal shall remain in full force and effect and may not be withdrawn for a period of 90 days from the date of receiving proposals by the City of Bloomington Utilities.

Receipt of Addenda is hereby acknowledged (Enter all Addendums by number and date):

No. Dated

No. Dated

No. Dated

No. Dated

See Next Page for Signatures

Respectfully submitted,

_____
(Company Name)

Individual ☐ Partnership ☐ Corporation ☐

By: _____
(Signature of authorized person)

_____
(Printed Name)

Date: _____

NOTE: The legal status of the Bidder, whether as an individual, partnership, or corporation, must be indicated above, and all pertinent information as required by the Contract Documents must be furnished.

Communications concerning this Bid shall be sent to Bidder at the following address:

_____

_____

_____

E-Mail: _____

Part of State Form 52414 (R2 / 2-13) / Form 96 (Revised 2013)

BID OF

_____ *(Contractor)*

_____ *(Address)*

FOR

PUBLIC WORKS PROJECTS

OF

_____

_____

_____

_____

Filed _____

_____

Action taken _____

_____

_____

CONTRACTOR'S BID FOR PUBLIC WORK - FORM 96

State Form 52414 (R2 / 2-13) / Form 96 (Revised 2013)
Prescribed by State Board of Accounts

PART I
(To be completed for all bids. Please type or print)

Date *(month, day, year)*:_____

1. Governmental Unit (Owner):_____
2. County :_____
3. Bidder (Firm):_____

   Address:_____

   City/State/ZIPcode:_____
4. Telephone Number:_____
5. Agent of Bidder *(if applicable)*:_____

Pursuant to notices given, the undersigned offers to furnish labor and/or material necessary to complete the public works project of _____

(Governmental Unit) in accordance with plans and specifications prepared by _____

_____ and dated _____ for the sum of

_____ $_____

The undersigned further agrees to furnish a bond or certified check with this bid for an amount specified in the notice of the letting. If alternative bids are taken, the undersigned submits a proposal for each in accordance with the notice. Any addendums attached will be specifically referenced at the applicable page.

If additional units of material included in the contract are needed, the cost of units must be the same as that shown in the original contract if accepted by the governmental unit. If the bid is to be awarded on a unit basis, the items and quantities shall be shown on a separate attachment.

The contractor and his subcontractors, if any, shall not discriminate against or intimidate any employee, or applicant for employment to be employed in the performance of this contract, with respect to any matter directly or indirectly related to employment because of race, religion, color, sex, national origin or ancestry. Breach of this covenant may be regarded as a material breach of the contract.

CERTIFICATION OF USE OF UNITED STATES STEEL PRODUCTS
(If applicable)

I, the undersigned bidder or agent as a contractor on a public works project, understand my statutory obligation to use steel products made in the United States (I.C. 5-16-8-2). I hereby certify that I and all subcontractors employed by me for this project will use U.S. steel products on this project if awarded. I understand that violations hereunder may result in forfeiture of contractual payments.

ACCEPTANCE

The above bid is accepted this _____ day of _____, _____, subject to the following conditions: _____

_____

Contracting Authority Members:

_____ _____

_____ _____

_____ _____

PART II

(For projects of $150,000 or more – IC 5-12-4)

Governmental Unit: _____

Bidder (Firm) _____

Date *(month, day, year):* _____

These statements to be submitted under oath by each bidder with and as a part of his bid. Attach additional pages for each section as needed.

SECTION I EXPERIENCE QUESTIONNAIRE

1. What public works projects has your organization completed for the period of one (1) year prior to the date of the current bid?

Contract Amount	Class of Work	Completion Date	Name and Address of Owner

2. What public works projects are now in process of construction by your organization?

Contract Amount	Class of Work	Expected Completion Date	Name and Address of Owner

3. Have you ever failed to complete any work awarded to you? _____ If so, where and why?

4. List references from private firms for which you have performed work.

SECTION II PLAN AND EQUIPMENT QUESTIONNAIRE

1. Explain your plan or layout for performing proposed work. *(Examples could include a narrative of when you could begin work, complete the project, number of workers, etc. and any other information which you believe would enable the governmental unit to consider your bid.)*

2. Please list the names and addresses of all subcontractors *(i.e. persons or firms outside your own firm who have performed part of the work)* that you have used on public works projects during the past five (5) years along with a brief description of the work done by each subcontractor.

3. If you intend to sublet any portion of the work, state the name and address of each subcontractor, equipment to be used by the subcontractor, and whether you will require a bond. However, if you are unable to currently provide a listing, please understand a listing must be provided prior to contract approval. Until the completion of the proposed project, you are under a continuing obligation to immediately notify the governmental unit in the event that you subsequently determine that you will use a subcontractor on the proposed project.

4. What equipment do you have available to use for the proposed project? Any equipment to be used by subcontractors may also be required to be listed by the governmental unit.

5. Have you entered into contracts or received offers for all materials which substantiate the prices used in preparing your proposal? If not, please explain the rationale used which would corroborate the prices listed.

SECTION III CONTRACTOR'S FINANCIAL STATEMENT

Attachment of bidder's financial statement is mandatory. Any bid submitted without said financial statement as required by statute shall thereby be rendered invalid. The financial statement provided hereunder to the governing body awarding the contract must be specific enough in detail so that said governing body can make a proper determination of the bidder's capability for completing the project if awarded.

SECTION IV CONTRACTOR'S NON – COLLUSION AFFIDAVIT

The undersigned bidder or agent, being duly sworn on oath, says that he has not, nor has any other member, representative, or agent of the firm, company, corporation or partnership represented by him, entered into any combination, collusion or agreement with any person relative to the price to be bid by anyone at such letting nor to prevent any person from bidding nor to include anyone to refrain from bidding, and that this bid is made without reference to any other bid and without any agreement, understanding or combination with any other person in reference to such bidding.

He further says that no person or persons, firms, or corporation has, have or will receive directly or indirectly, any rebate, fee, gift, commission or thing of value on account of such sale.

SECTION V OATH AND AFFIRMATION

I HEREBY AFFIRM UNDER THE PENALTIES FOR PERJURY THAT THE FACTS AND INFORMATION CONTAINED IN THE FOREGOING BID FOR PUBLIC WORKS ARE TRUE AND CORRECT.

Dated at _____ this _____ day of _____, _____

_____
(Name of Organization)

By_____

_____
(Title of Person Signing)

ACKNOWLEDGEMENT

STATE OF _____)
) ss
COUNTY OF_____)

Before me, a Notary Public, personally appeared the above-named _____ and swore that the statements contained in the foregoing document are true and correct.

Subscribed and sworn to before me this _____ day of _____, _____.

_____
Notary Public

My Commission Expires:_____

County of Residence:_____

Responsible Bidder Affidavit

Contractor and any subcontractor performing more than $150,000 worth of work on the project shall complete this *Responsible Bidder Affidavit* as required by Chapter 2.29 of the Bloomington Municipal Code. Contractor must submit this affidavit with its bid. Failure to comply with all submission requirements may result in a determination that the Contractor is not a responsible and responsive bidder.

The undersigned _____, as _____ and on behalf of
(Name) (Title)
_____ certifies the following:
(Contractor)

Contractor is compliant with all applicable laws pre-requisite to doing business in Indiana.

Yes [ ] No [ ]

Does Contractor have a Federal Employer Identification Number (EIN) (also known as a Federal Tax Identification Number)?

Yes [ ] No [ ]

Please list your Federal Employer Identification Number: _____

Alternatively, for sole proprietors, list your social security number: _____

Contractor is in compliance with Section 2000(e) of Chapter 21, Title 42 of the United States Code and Federal Executive Order Number 11375 (known as the Equal Opportunity Employer Provisions).

Yes [ ] No [ ]

Contractor has submitted an affirmative action plan as required under § 2.21.070(8) of the Bloomington Municipal Code.

Yes [ ] No [ ]

Contractor affirms that all of its workers who qualify as employees are covered under a current worker's compensation insurance policy, and that all workers who will be part of the project are properly classified as employees or independent contractors.

Yes [ ] No [ ]

Contractor will comply with Indiana Code § 5-16-7 et. seq., known as the Indiana Common Construction Wage Act.

Yes [ ] No [ ]

Contractor confirms that any of its employees designated as apprentices are properly registered with an apprenticeship and training program approved and registered with the United States Department of Labor, Bureau of Apprenticeship and Training.

Yes [ ] No [ ]

Contractor currently has a substance abuse testing policy in place.

Yes [ ] No [ ]

Please list any professional or trade license(s) required by law for any trade or specialty area required to complete work on the present project.

_____

_____

_____

_____

Has the Contractor, or any directors, officers, or managers employed by the Contractor, had any professional or trade license suspended or revoked within the last five (5) years?

Yes [ ] No [ ]

Verification

I certify that I am authorized to execute this affidavit on behalf of the Contractor set forth above, that I have personal knowledge of all the information set forth herein, and that all statements representations, and information contained in this affidavit are true and accurate.

_____

Signature of Authorized Officer

_____

Name of Authorized Officer

_____

Title

_____

Date

Updated February 2024

To: Prospective Bidders/Vendors/Grant recipients

RE: Affirmative Action/Harassment Policy, Living Wage Ordinance, and Drug Testing Policy

FROM: Audrey Brittingham, Assistant City Attorney/Contract Compliance Officer

AFFIRMATIVE ACTION: All bidders, quoters, vendors, and grant recipients with the City of Bloomington for projects in excess of $10,000.00 must submit an affirmative action plan to the City Legal Department. This plan must ensure applicants and employees are treated in a manner that provides equal employment opportunity and tends to eliminate inequality based upon race, religion, color, sex, national origin, ancestry, disability, sexual orientation, gender identity, veteran status and/or housing status.

Even if your company already has a plan on file with the City, you are strongly encouraged to check with City Legal Department to make sure it complies with the City's current requirements, including having a workforce breakdown form that is no more than six months out of date. If you already have a plan, but it does not cover all of the City's current requirements, you may submit a separate supplement with your plan to fill any gaps.

You must submit your written affirmative action plan (or supplement) to City Legal or as part of your bid packet by the bid deadline. Bidders who fail to submit an affirmative action plan by the bid deadline are subject to disqualification. **We strongly recommend you submit your affirmative action plan to the Legal Department prior to the bid deadline so Legal may review your plan to make sure it complies with the City's requirements.** If your bid is chosen and your affirmative action plan does not entirely comply with the City's requirements, you will be required to bring it into compliance prior to the execution of any City contract.

Accompanying this letter you will find the following materials:

1. A sample affirmative action. You are not required to adopt this plan; it is provided for your convenience. Feel free to adopt this plan as your own or to amend it to meet your needs.

2. A workforce breakdown form. You MUST submit a workforce breakdown form (sometimes called a "utilization report") with your affirmative action plan. If you have a different form that includes the same type of information, you may submit a copy of that form instead of using our form. **Your workforce breakdown data cannot be more than six months old.**

3. An affirmative action plan checklist. This is the checklist we use to crosscheck your company's affirmative action plan against the City's requirements. If your plan omits any elements on the checklist, your plan will not be approved.

Additional materials, such as the City of Bloomington's Contract Compliance Regulations, are available from the Legal Department upon request.

Once Legal has approved your affirmative action plan, you will receive a letter that can be used to verify your compliance for any City project or contract that requires an affirmative action plan. This letter will expire six months after you submitted the affirmative action plan. You will be issued a new letter when you submit an updated workforce breakdown form.

HARASSMENT POLICY: All bidders and vendors required to submit an affirmative action plan must also submit a harassment plan. The harassment plan must, at minimum, include a definition of harassment; the name or title of the individual designated to receive and investigate complaints; and a statement that the contractor will not retaliate against an employee for complaining about harassment. A model harassment policy is included for your convenience as part of our attached model affirmative action plan.

LIVING WAGE: Contractors that are considered "covered employers" under City Ordinance 2.28, otherwise known as the "Living Wage Ordinance" or "LWO," are required to pay their covered employees at least a living wage. Currently, the living wage is $15.75 per hour for covered employees. Up to 15% of that amount, or $2.36, may be in the form of the covered employer's contribution to health insurance available to the covered employee.

If the City determines the successful bidder is a covered employer under the LWO, Contractor shall execute the Living Wage Ordinance Affidavit; shall abide by the LWO by paying their employees a living wage and providing the City with information requested in the course of enforcing the LWO; and shall post the Living Wage Poster, provided on the last page of this packet, in areas frequented by their covered employees.

The attached flow chart provides guidance on whether the contractor is a "covered employer." If you have questions, please contact Audrey Brittingham at audrey.brittingham@bloomington.in.gov, or call 812-349-3426.

DRUG TEST POLICY: Finally, please be aware that if you are submitting a bid for a public works project with an estimated cost of $150,000.00 or more, you will need to submit your company's written drug testing plan with your bid. Your plan must comply with I.C. 4-13-18-1. Failure to do so may make you ineligible to be awarded a bid or contract. Please see your bid packet for more details.

If you have any questions, contact the City's Legal Department at 812.349.3426 or email the City at legal@bloomington.in.gov. The office hours are Monday through Friday, 8-5.

Thank you.

Model Affirmative Action Plan and
Harassment Policy

_____, declares its policy to provide equal opportunity in employment, training and advancement, and to administer its employment practices without regard to race, color, religion, sex, national origin, ancestry, disability, sexual orientation, gender identity, veteran status, or housing status. Our policy of nondiscrimination will prevail throughout every aspect of our employment practices, including recruitment, hiring, training and all other terms and conditions of employment. We shall implement this affirmative action plan to make it widely known that equal employment opportunities are available on the basis of individual merit. We shall survey and analyze our employment workforce annually to determine what steps, if any, are needed to conform effectively to this equal employment policy.

Responsible Officer

Mr. or Ms. _____ (or the _____officer) is the equal employment opportunity officer for our company and is responsible for implementing this affirmative action policy.

Publication of Policy

Our employees will be made aware of our commitment to affirmative action through the following procedures:

- posting notices on employee bulletin boards,
- including our policy statement and plan in our personnel manual,
- regularly sending out notices of our policy in paycheck envelopes, and/or
- training supervisors to recognize discriminatory practices.

We will make potential employees aware of our policy through the following procedures:

- including the words "Equal Opportunity Employer" in all of our advertisements and notices for job openings,
- notifying employment agencies about our commitment, and
- sending notice of our policy to unions.

Implementing Our Policy

Our affirmative action plan will be implemented by widening our recruitment sources. We shall advertise in newspapers and other media that reach people in protected classes. We shall send job notices to schools with large percentages of students in the protected classes and to local groups that serve these classes.

We shall examine our hiring practices periodically to insure that we consider only job-related qualifications in filling our positions. We shall discard irrelevant educational requirements and unnecessary physical requirements. We shall ask only job-related questions on our employment applications.

We shall keep affirmative action information on each applicant who voluntarily provides this information, but separate from his or her application. We shall keep records on our hiring decisions to evaluate the success of our affirmative action measures. We shall decide placement, duties, benefits, wages, training prospects, promotions, layoffs and terminations without regard to race, sex, religion, color, national origin, ancestry, disability, sexual orientation, gender identity, veteran status or housing status.

GRIEVANCE PROCEDURE

If an employee or applicant feels she or he has been discriminated against on the basis of race, sex, religion, color, national origin, ancestry, disability, sexual orientation, gender identity, veteran status or housing status, she or he may bring the complaint to her or his immediate supervisor. If the complaint is not resolved readily at that level, she or he may submit it to _____ (personnel officer, corporate president, other) who will make a final decision on its validity. This grievance process does not preclude him or her from complaining to local, state or federal civil rights agencies. We will not retaliate against an employee or applicant for voicing a grievance or for filing a complaint with the appropriate agency.

Our current workforce breakdown is shown on the attached form.

Policy prohibiting harassment in the workplace

It is the policy of _____ (company name) to maintain a workplace free of harassment on the basis of race, sex, color, ancestry, national origin, religion, disability, age, sexual orientation, gender identity, housing status or veteran status. Harassment, as defined herein, is strictly prohibited in the workplace, and is punishable by appropriate discipline up to and including termination.

Harassment means any unwelcome or offensive conduct, whether written, verbal or physical, which is

(a) directed at or to an employee because of his or her actual or perceived race, sex, color, ancestry, national origin, religion, disability, age, sexual orientation, gender identity, housing status or veteran status or

(b) directed toward any person concerning an individual, or a class of individuals, because of the race, sex, color, ancestry, national origin, religion, disability, age, sexual orientation, gender identity, housing status or veteran status of the individual or class of individuals. For example, racial or ethnic slurs or derogatory epithets are prohibited in the workplace, regardless of whether a member of the racial or ethnic group is present when the statement is made.

Harassment does not refer to occasional compliments or other statements of a socially acceptable nature. Harassment refers to behavior which is unwelcome and which is offensive and/or persistent enough to create, or has the potential of creating an intimidating, hostile or offensive working environment for any employee. Harassment includes unwelcome sexual advances or requests for sexual favors, unwelcome touching of a sexual nature and unwelcome and/or offensive sexual comments.

1. This policy applies to all full-time, part-time, permanent and temporary employees, including supervisors and department heads, as well as to volunteers.

2. It is a violation of this policy to use an individual's submission to or rejection of harassing conduct as the basis for any employment decision affecting the individual.

3. An employee who believes she, he or they have been subjected to harassment as defined in this policy shall promptly report the harassment to her, his or their supervisor and/or the director of human resources or designee. _____ (company name) will make reasonable efforts to insure that a human resources representative of each sex is available to receive such complaints. The human resources department shall conduct a thorough and prompt investigation and, if appropriate, take disciplinary action against any offender, including but not limited to discharge. Staff will keep the complaint as confidential as reasonably possible. No one will be retaliated against for filing a harassment complaint.

4. All supervisory personnel who observe or otherwise learn of or have reason to suspect any conduct which may violate this policy shall promptly report such facts to the director of human resources or designee, and shall cooperate fully in any investigation or disciplinary action undertaken pursuant to this policy. Failure to comply with this section shall be grounds for appropriate disciplinary action, up to and including termination.

5. _____ (company name) will provide regular training to employees and supervisors on the subject of harassment in the workplace. We will include information about this policy in our orientation and in our personnel policy. A copy of this policy will be posted on a prominent bulletin board. We take this matter seriously and will do all that is reasonably necessary to maintain a harassment-free workplace for our employees.

_____ _____

Signature Date

WORKFORCE BREAKDOWN FORM

COMPANY NAME: _____

ADDRESS: _____

_____

REPRESENTATIVE: _____

PHONE: _____

E-MAIL ADDRESS: _____

Position, Title Class or Category	Total Number Employees in Each Position	Total Number Minority Employees	Percent of Total	Total Number Female and Non-Binary Employees	Percent of Total	Total Number Employees with Disabilities	Percent of Total

I swear or affirm under penalties of perjury that this workforce breakdown is accurate, to the best of my knowledge.

_____ _____

Signature and Title of Representative: Date:

AFFIRMATIVE ACTION PLAN AND HARASSMENT POLICY CHECKLIST

NOTE: This is **not** an Affirmative Action Plan. This checklist is provided for organizations with existing affirmative action plans to crosscheck their plans against the City's requirements. Each item listed below is required by City ordinance or regulation.

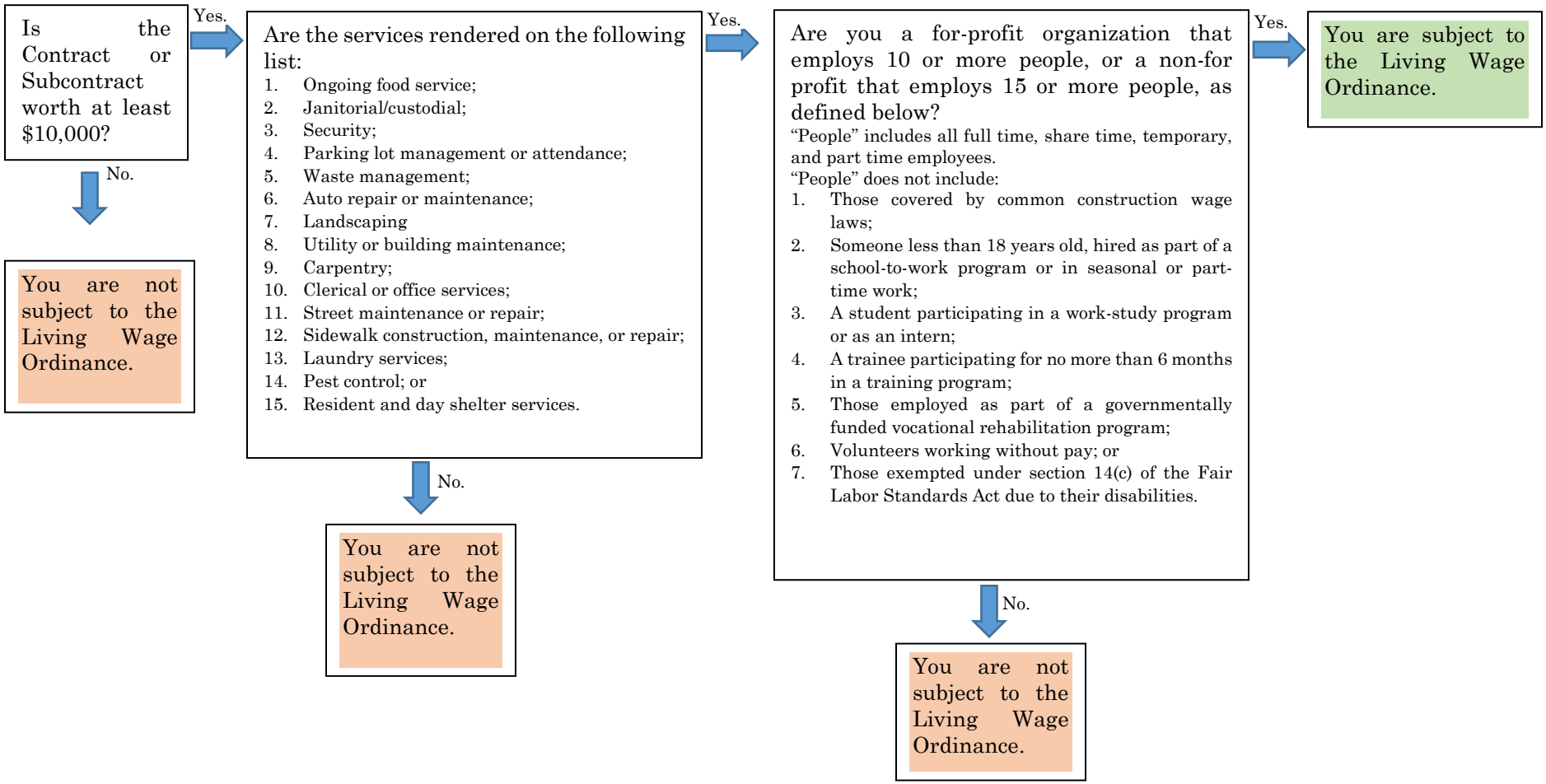
Contractor: Plan MUST Include:		Yes	No	Comments:
Policy statement of equal employment opportunity		☐	☐	
Covers:	Applicants for employment	☐	☐	
	Employees	☐	☐	
On basis of:	Race	☐	☐	
	Religion	☐	☐	
	Color	☐	☐	
	Sex	☐	☐	
	National Origin	☐	☐	
	Ancestry	☐	☐	
	Disability	☐	☐	
	Sexual Orientation	☐	☐	
	Gender Identity	☐	☐	
	Veteran Status	☐	☐	
	Housing Status	☐	☐	
Designates a person responsible for implementation of the Plan		☐	☐	
Provides for communication of the policy:				
	Within the Organization	☐	☐	
	Outside the Organization (e.g., recruitment sources, unions)	☐	☐	
Applies to all terms and conditions of employment (e.g., hiring, placement, promotion, duties, wages, benefits, use of facilities, layoff, discipline, termination)		☐	☐	
Provision for: Recruitment from minority groups		☐	☐	
Provision for: Equal access to training programs		☐	☐	
Grievance Procedure		☐	☐	
Prohibits retaliation for filing grievances		☐	☐	
Workforce Breakdown (figures up to date within 6 months)		☐	☐	
HARASSMENT POLICY CHECKLIST				
Definition of harassment		☐	☐	
Designates a person to receive and Investigate harassment complaints		☐	☐	
Prohibits retaliation for filing a harassment complaint		☐	☐	

The City of Bloomington (CoB) Living Wage Ordinance (LWO) applies to three groups of employers:

1) The CoB;
2) Companies that provide services to the CoB through contracts or subcontracts; or
3) Organizations that receive CoB subsidies or grants.

As an employer under categories 2 or 3, you may or may not be subject to the LWO. To find out, follow the applicable flow chart, below, or contact the City Legal Department.

<u>Companies that Provide Services to the CoB through Contracts or Subcontracts ("Agreement")</u>



Companies or Organizations that Receive CoB Subsidies or Grants

Is the Subsidy or Grant worth at least $25,000?

Yes.

Is the subsidy or grant of at least $25,000 part of one of the following:

1. A tax abatement pursuant to Indiana Code 6-1.1-12.1;
2. A grant from the Business Investment Incentive Loan Fund;
3. An expenditure from the Industrial Development Fund (except those associated with the acquisition of right-of-way for and the design, financing, construction, and maintenance of publicly owned infrastructure serving a Community Revitalization Enhancement District (CRED) pursuant to Indiana Code 36-7-13);
4. A grant from the Community Development Community Development Block Grant Funds; or
5. A grant from the Jack Hopkins Social Services Funding Program.

Yes.

Are you a for-profit organization that employs 10 or more people, or a non-for profit that employs 15 or more people, as defined below?

"People" includes all full time, share time, temporary, and part time employees.

"People" does not include:

1. Those covered by common construction wage laws;
2. Someone less than 18 years old, hired as part of a school-to-work program or in seasonal or part-time work;
3. A student participating in a work-study program or as an intern;
4. A trainee participating for no more than 6 months in a training program;
5. Those employed as part of a governmentally funded vocational rehabilitation program;
6. Volunteers working without pay; or
7. Those exempted under section 14(c) of the Fair Labor Standards Act due to their disabilities.

Yes.

You are subject to the Living Wage Ordinance.

No.

You are not subject to the Living Wage Ordinance.

No.

You are not subject to the Living Wage Ordinance.

No.

You are not subject to the Living Wage Ordinance.

EXHIBIT E
AFFIDAVIT THE LIVING WAGE ORDINANCE

The undersigned, being duly sworn, hereby affirms and says that:

1. The undersigned is the _____ (title) of _____ (company).

2. The company named herein that employs the undersigned has contracted with or is seeking to contract with the City of Bloomington to provide services.

3. The undersigned hereby states that, to the best of their knowledge and belief, the company named herein is subject to Bloomington City Ordinance 2.28, otherwise known as the "Living Wage Ordinance."

4. The projected employment needs under the award include the following: _____
_____.

5. The projected net increase or decrease in jobs for covered employees by job title that will result from awarding the assistance: _____.

6. The undersigned hereby affirms that the smallest hourly wage to be earned by each of their covered employees shall be at least the living wage.

I affirm under the penalties of perjury that the foregoing facts and information are true and correct to the best of my knowledge and belief.

_____ _____
Signature Printed name

STATE OF INDIANA)
) SS:
COUNTY OF _____)

Before me, a Notary Public in and for said County and State, personally appeared _____ _____ and acknowledged the execution of the foregoing this _____ day of _____ _____, 2023.

My Commission Expires:_____ _____
Notary Public

County of Residence:_____ _____
Name Printed

_____
Commission Number

BID BOND

Any singular reference to Bidder, Surety, Owner or other party shall be considered plural where applicable.

BIDDER *(Name and Address)*:

SURETY *(Name, and Address of Principal Place of Business)*:

OWNER *(Name and Address)*:

BID

Bid Due Date:

Description *(Project Name— Include Location)*:

BOND

Bond Number:

Date:

Penal sum _____ $ _____

(Words) (Figures)

Surety and Bidder, intending to be legally bound hereby, subject to the terms set forth below, do each cause this Bid Bond to be duly executed by an authorized officer, agent, or representative.

BIDDER	**SURETY**
_____ (Seal)	_____ (Seal)
Bidder's Name and Corporate Seal	Surety's Name and Corporate Seal
By: _____	By: _____
Signature	Signature (Attach Power of Attorney)
_____	_____
Print Name	Print Name
_____	_____
Title	Title
Attest: _____	Attest: _____
Signature	Signature
Title	Title

Note: Addresses are to be used for giving any required notice.
Provide execution by any additional parties, such as joint venturers, if necessary.

1. Bidder and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to pay to Owner upon default of Bidder the penal sum set forth on the face of this Bond. Payment of the penal sum is the extent of Bidder's and Surety's liability. Recovery of such penal sum under the terms of this Bond shall be Owner's sole and exclusive remedy upon default of Bidder.

2. Default of Bidder shall occur upon the failure of Bidder to deliver within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents.

3. This obligation shall be null and void if:

3.1 Owner accepts Bidder's Bid and Bidder delivers within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents, or

3.2 All Bids are rejected by Owner, or

3.3 Owner fails to issue a Notice of Award to Bidder within the time specified in the Bidding Documents (or any extension thereof agreed to in writing by Bidder and, if applicable, consented to by Surety when required by Paragraph 5 hereof).

4. Payment under this Bond will be due and payable upon default of Bidder and within 30 calendar days after receipt by Bidder and Surety of written notice of default from Owner, which notice will be given with reasonable promptness, identifying this Bond and the Project and including a statement of the amount due.

5. Surety waives notice of any and all defenses based on or arising out of any time extension to issue Notice of Award agreed to in writing by Owner and Bidder, provided that the total time for issuing Notice of Award including extensions shall not in the aggregate exceed 120 days from the Bid due date without Surety's written consent.

6. No suit or action shall be commenced under this Bond prior to 30 calendar days after the notice of default required in Paragraph 4 above is received by Bidder and Surety and in no case later than one year after the Bid due date.

7. Any suit or action under this Bond shall be commenced only in a court of competent jurisdiction located in the state in which the Project is located.

8. Notices required hereunder shall be in writing and sent to Bidder and Surety at their respective addresses shown on the face of this Bond. Such notices may be sent by personal delivery, commercial courier, or by United States Registered or Certified Mail, return receipt requested, postage pre-paid, and shall be deemed to be effective upon receipt by the party concerned.

9. Surety shall cause to be attached to this Bond a current and effective Power of Attorney evidencing the authority of the officer, agent, or representative who executed this Bond on behalf of Surety to execute, seal, and deliver such Bond and bind the Surety thereby.

10. This Bond is intended to conform to all applicable statutory requirements. Any applicable requirement of any applicable statute that has been omitted from this Bond shall be deemed to be included herein as if set forth at length. If any provision of this Bond conflicts with any applicable statute, then the provision of said statute shall govern and the remainder of this Bond that is not in conflict therewith shall continue in full force and effect.

11. The term "Bid" as used herein includes a Bid, offer, or proposal as applicable.

EJCDC
ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

NOTICE OF AWARD

Date of Issuance:

Owner: Owner's Contract No.:

Engineer: Engineer's Project No.:

Project: Contract Name:

Bidder:

Bidder's Address:

TO BIDDER:

You are notified that Owner has accepted your Bid dated [_____] for the above Contract, and that you are the Successful Bidder and are awarded a Contract for:

_____ .

[describe Work, alternates, or sections of Work awarded]

The Contract Price of the awarded Contract is: $_____ *[note if subject to unit prices, or cost-plus]*

[ ] unexecuted counterparts of the Agreement accompany this Notice of Award, and one copy of the Contract Documents accompanies this Notice of Award, or has been transmitted or made available to Bidder electronically. *[revise if multiple copies accompany the Notice of Award]*

☐ a set of the Drawings will be delivered separately from the other Contract Documents.

You must comply with the following conditions precedent within 15 days of the date of receipt of this Notice of Award:

1. Deliver to Owner [____]counterparts of the Agreement, fully executed by Bidder.
2. Deliver with the executed Agreement(s) the Contract security *[e.g., performance and payment bonds]* and insurance documentation as specified in the Instructions to Bidders, Article 20, and General Conditions, Articles 2 and 6.
3. Other conditions precedent (as applicable):
   a. Enroll in and verify the work eligibility status of all its newly hired employees through the E-Verify Program. Submit completed E-Verify Affidavit form to Owner.
   b. Submit E-Verify case verification numbers for each individual required to be verified under IC 22-5-1.7 that will be working on this project.
   c. Submit completed Indiana Iran Investment Certification to Owner.

Failure to comply with these conditions within the time specified will entitle Owner to consider you in default, annul this Notice of Award, and declare your Bid security forfeited.

Within ten days after you comply with the above conditions, Owner will return to you one fully executed counterpart of the Agreement, together with any additional copies of the Contract Documents as indicated in Paragraph 2.02 of the General Conditions.

Owner**:**

Authorized Signature

By:

Title:

Copy: Engineer

AGREEMENT
BETWEEN
CITY OF BLOOMINGTON
UTILITIES DEPARTMENT
AND
(name of Contractor)
FOR
BLUCHER POOLE WASTEWATER TREATMENT FACILITY
SCADA IMPROVEMENTS PROJECT

THIS AGREEMENT is executed by and between the City of Bloomington, Indiana, Utilities Department through the Utilities Service Board (hereinafter the "City"), and _____ (hereinafter the "Contractor").

WHEREAS, City desires to retain Contractor's services for the scope of work generally described in **Attachment "A"**, "Scope of Work", attached hereto and incorporated into this Agreement, and as otherwise specified or indicated in the contract documents (hereinafter the "Work"); and

WHEREAS, Contractor is capable of performing the Work as per its Bid on the Bid Proposal Form/Summary Sheet; and

WHEREAS, in accordance with Indiana Code § 5-16-13 *et seq*., incorporated herein by reference, Contractor is a Tier 1 or General Contractor for this project; and

WHEREAS, Contractor was determined to be the lowest responsible and responsive Bidder for said project.

NOW, THEREFORE, in consideration of the mutual promises hereinafter enumerated, the parties agree as follows:

ARTICLE 1. TERM

1.01 This Agreement shall be in effect upon execution of this Agreement by all parties. In accordance with Indiana Code 5-16-13 *et seq*., incorporated herein by reference, Contractor is a Tier 1 Contractor or general Contractor for this project.

ARTICLE 2. SERVICES

2.01 Contractor shall complete all Work as specified or indicated in the Contract Documents and as generally described in **Attachment "A"**.

2.02 All work required under this Agreement shall be substantially completed by the Contractor within two hundred and forty (240) calendar days from the date of the Notice to Proceed, and completed and ready for final payment within two hundred and seventy (270) calendar days, unless the parties mutually agree to a later completion date. Substantial Completion shall mean that all work is sufficiently completed in accordance with the plans and specifications, as modified by any approved change orders, so that it can be used for its intended purpose.

2.03 It is hereby understood by both parties that time is of the essence in this Agreement. Failure of Contractor to complete all work as herein provided will result in monetary damages to City. It is hereby agreed that City will be damaged for every day the work has not been performed in the manner herein provided. Contractor agrees to pay City $1,000.00 for each calendar day that expires after the times specified in Article 2.02 above. City, at its sole discretion, may withhold monies otherwise due Contractor. It is expressly understood by the parties hereto that these damages relate to the time of performance and do not limit City's other remedies under this Agreement, or as provided by applicable law, for other damages.

2.04 Contractor agrees that no charges or claims for damages shall be made by him or her for any delays or hindrances, from any cause whatsoever during the progress of any portion of the services specified in the Agreement. Such delays or hindrances, if any, may be compensated for by an extension of time for a reasonable period as may be mutually agreed upon between the parties, it being understood, however, that permitting Contractor to proceed to complete any service, or any part of the services / project, after the date to which the time of completion may have been extended, shall in no way operate as a waiver on the part of City of any of its rights herein.

ARTICLE 3. COMPENSATION

3.01 Contractor shall provide services specified or indicated in the Contract Documents and as generally described in **Attachment "A"**.

3.02 City shall pay Contractor for completion of the Work in accordance with the Contract Documents, subject to adjustment under the Contract, at the unit prices stated in Contractor's Bid, attached hereto as **Attachment "B"**. City may withhold payment, in whole or in part, to the extent necessary to protect itself from a loss on account of any of the following:

Defective work.

Evidence indicating the probable filing of claims by other parties against Contractor which may adversely affect City.

Failure of Contractor to make payments due to subcontractors, material suppliers or employees.

Damage to City or a third party.

3.03 The submission of any request for payment shall be deemed a waiver and release by Contractor of all liens and claims with respect to the work and period to which such payment request pertains except as specifically reserved and noted on such request.

3.04 Contractor shall maintain proper account records for the scope of all services of this Agreement and provide an accounting for all charges and expenditures as may be necessary for audit purposes. All such records shall be subject to inspection and examination by City's representatives at reasonable business hours.

3.05 For projects utilizing federal funding the Contractor shall submit time sheets (WH-347) for his or her own and all subcontracted employees, to City Engineer or his or her representative for approval and review, including review for compliance with Davis Bacon requirements, if federal funds are used.

3.06 Engineer The City Of Bloomington Utilities Engineer shall act as the City's representative and assume all duties and responsibilities and have all the rights and authority assigned to the Engineer in the Contract Documents in connection with completion of the Work in accordance with the Contract Documents.

ARTICLE 4. RETAINAGE

For contracts in excess of $100,000 and for which Contractor requested Progressive Payments on its Bid Form, the Owner requires that retainage be held as set out below.

4.02 Retainage Amount The retainage amount shall be five percent (5%) of the dollar value of all work satisfactorily completed and shall be withheld until the Contract work is complete. The retainage amount shall be placed in an escrow account with an escrow agent or shall be held by the Utilities Service Board ("Board"). Yellow Cardinal Group Columbus, Indiana, shall serve as the escrow agent.

4.03 Escrow Agent If the retainage is held by an escrow agent, then the escrow agent, Owner and Contractor shall enter into a written escrow agreement and Contractor shall work directly with the escrow agent to set up the account. The escrow agent shall invest all escrowed principal in obligations selected by the escrow agent. The escrow agent shall be compensated for the agent's services by a reasonable fee, agreed upon by the parties, that is comparable with fees charged for the handling of escrow accounts of similar size and duration. The fee shall be paid from the escrow income. The escrow agent's fee may be determined by specifying an amount of interest the escrow agent will pay on the escrowed amount, with any additional earned interest serving as the escrow agent's fee. The escrow agreement may include other terms and conditions as deemed necessary by the parties. However, if Contractor intends to receive a Single Lump Sum payment upon acceptance of this project, retainage will not be required and an Escrow Agreement will not be required.

4.04 Board If the retainage is held by the Board, then the Owner shall place the funds so retained in a retainage account with the Board. Such deposit shall be made within three business days after the date such payments are made to Contractor. No income will be earned or will be payable on the deposit.

4.05 Payment of Escrow Amount The escrow agent shall hold the escrowed principal and income until receipt of the notice from Owner and Contractor that the Contract work has been substantially completed to the reasonable satisfaction of Owner, at which time Owner shall pay to the Contractor the balance to be paid under this Contract and execute such documents as are necessary to authorize the escrow agent to pay to the Contractor the funds in the escrow account, including both specifying the part of the escrowed principal to be released from the escrow and the person to whom that portion is to be released. After receipt of the notice, the escrow agent shall remit the designated part of the escrowed principal and the escrowed income, minus the escrow agent's fees, to the person specified in the notice. However, nothing in this section shall prohibit Owner from requiring the escrow agent to withhold amounts necessary to complete minor items of the Contract, following substantial completion of the Contract in accordance with the provisions of paragraph 4.07.

4.06 Payment of Retainage Amount by the Board The Board shall hold the retainage until notice from the Owner that the Contract work has been substantially completed to the reasonable satisfaction of the Owner. At this time, the Owner shall pay to the Contractor the balance to be paid under this Contract and execute such documents as are necessary to authorize the Board to

pay the Contractor the retainage. No interest will have been earned or will be payable. Nothing in this section shall prohibit Owner from requiring the Board to withhold amounts necessary to complete minor items of the Contract, following substantial completion of the Contract in accordance with the provisions of paragraph 4.07.

4.07 **Withholding Funds for Completion of Contract** If, upon substantial completion of the Contract, there still remains minor Contract work that needs to be completed, or minor Contract work that needs to be performed to the satisfaction of the Owner, the Owner may direct the escrow agent or the Board to retain and withhold from payment to the Contractor an amount equal to two hundred percent (200%) of the value of said work. The value of said work shall be determined by the architect/engineer. The escrow agent or the Board shall release the funds withheld under this section after receipt of notice from the Owner that all work on the Contract has been satisfactorily completed. In the event that said work is not completed by the Contractor, but by the Owner or another party under contract with Owner, said funds shall be released to Owner.

ARTICLE 5. GENERAL PROVISIONS

5.01 Contractor agrees to indemnify and hold harmless City and its officers, agents, officials and employees for any and all claims, actions, causes of action, judgments and liens arising out of any negligent act or omission by Contractor or any of its officers, agents, officials, employees, or subcontractors or any defect in materials or workmanship of any supply, materials, mechanism or other product or service which it or any of its officers, agents, officials, employees, or subcontractors has supplied to City or has used in connection with this Agreement and regardless of whether or not it is caused in part by a party indemnified herein under. Such indemnity shall include attorney's fees and all costs and other expenses arising there from or incurred in connection therewith and shall not be limited by reason of the enumeration of any insurance coverage required herein.

Contractor shall indemnify and hold harmless City and its officers, agents, officials and employees for any and all damages, actions, costs, (including, but not limited to, attorney's fees, court costs and costs of investigation) judgments and claims by anyone for damage to property, injury or death to persons resulting from the collapse or failure of any trenches, ditches or other excavations constructed under or associated with this contract.

5.02 Abandonment, Default and Termination

5.02.01. City shall have the right to abandon the work contracted for in this Agreement without penalty. If City abandons the work described herein, Contractor shall deliver to City all surveys, notes, drawings, specifications and estimates completed or partially completed and these shall become the property of City. The earned value of the work performed shall be based upon an estimate of the proportion between the work performed by Contractor under this Agreement and the work which Contractor was obligated to perform under this Agreement. This proportion shall be mutually agreed upon by City and Contractor. The payment made to Contractor shall be paid as a final payment in full settlement of his or her services hereunder.

5.02.02. **Default**: If Contractor breaches this Agreement or fails to perform the Work in an acceptable manner, he or she shall be considered in default. Any one or more of the following will be considered a default:

Failure to begin the work under this Agreement within the time specified.
Failure to perform the work with sufficient supervision, workmen, equipment and materials to insure prompt completion of said work within the time limits allowed.
Unsuitable performance of the work as determined by the Engineer or his or her representative.
Neglecting or refusing to remove defective materials or failure to perform anew such work as shall have been rejected.
Discontinuing the prosecution of the work or any part of it.
Inability to finance the work adequately.
If, for any other reason, Contractor breaches this Agreement or fails to carry on the work in an acceptable manner.

5.02.03. City shall send Contractor a written notice of default. If Contractor, or his or her Surety, within a period of seven (7) days after such notice, fails to remedy the default, then City shall have full power and authority, without violation of the Contract, to take the prosecution of the work out of the hands of said Contractor, to appropriate or use any or all materials and equipment on the ground as may be suitable and acceptable, and may, at its option, turn the work over to the Surety, or enter into an agreement with another Contractor for the completion of the Agreement according to the terms and provisions thereof, or City may use such other methods as, in its opinion, shall be required for the completion of said Contract in an acceptable manner.

5.02.04. All cost of completing the work under the Contract shall be deducted from the monies due or which may become due to said Contractor. In case the expenses so incurred by City shall be less than the sum which would have been payable under the Contract if it had been completed by said Contractor, Contractor shall be entitled to receive the difference. However, in case such expense shall exceed the sum which would have been payable under the Contract, Contractor and his or her Surety will be liable and shall pay to City the amount of said excess. By taking over the prosecution of the work, City does not forfeit the right to recover damages from Contractor or his or her Surety for his or her failure to complete the work in the time specified.

5.02.05. Notwithstanding any other provision of this Agreement, if funds for the continued fulfillment of the Agreement by City are at any time not forthcoming or are insufficient, through failure of any entity to appropriate the funds or otherwise, then City shall have the right to terminate this Agreement without penalty by giving prior written notice documenting the lack of funding in which instance, unless otherwise agreed to by the parties, this Agreement shall terminate and become null and void.

5.02.06. City agrees that it will make its best effort to obtain sufficient funds, including but not limited to, including in its budget for each fiscal period during the term hereof a request for sufficient funds to meet its obligations hereunder in full.

5.03 Successors and Assigns

5.03.01 Both parties agree that for the purpose of this Agreement, Contractor shall be an Independent Contractor and not an employee of City.

5.03.02 No portion of this Agreement shall be sublet, assigned, transferred or otherwise disposed of by Contractor except with the written consent of City being first obtained. Consent to sublet,

assign, transfer, or otherwise dispose of any portion of this Agreement shall not be construed to relieve Contractor of any responsibility of the fulfillment of this Agreement.

5.04 Extent of Agreement: Integration

5.04.01 This Agreement consists of the following parts, each of which is as fully a part of this Agreement as if set out herein and are referred to throughout this Agreement as the Contract Documents:

1. This Agreement and its Attachments.
2. All Written Amendments and other documents amending, modifying, or supplementing the Contract Documents which may be delivered or issued after the Effective Date of the Agreement and are not attached hereto.
3. All Addenda to the Bid Documents.
4. The Invitation to Bidders.
5. The Instructions to Bidders.
6. The Special Conditions.
7. All plans as provided for the work that is to be completed.
8. The Supplementary Conditions.
9. The General Conditions.
10. The Specifications.
11. The current Indiana Department of Transportation Standard Specifications and the latest addenda.
12. Contractor's submittals.
13. The Performance Bond and the Payment Bond.
14. The Escrow Agreement.
15. Request for Taxpayer Identification number and certification: Substitute W-9.

5.04.02 In resolving conflicts, errors, discrepancies and disputes concerning the Scope of Work to be performed by Contractor, and other rights and obligations of City and Contractor, the document expressing the greater quantity, quality or other scope of work in question, or imposing the greater obligation upon Contractor and affording the greater right or remedy to City shall govern; otherwise the documents shall be given precedence in the order as enumerated above.

5.05 Insurance

5.05.01 Contractor shall, as a prerequisite to this Agreement, purchase and thereafter maintain such insurance as will protect him or her from the claims set forth below which may arise out of or result from Contractor's operations under this Agreement, whether such operations be by Contractor or by any subcontractors or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable:

a. Comprehensive General Liability Insurance
   i. $1,000,000 for each occurrence;
   ii. $1,000,000 personal injury and advertising injury;
   iii. $2,000,000 products and completed operations aggregate; and
   iv. $2,000,000 general aggregate.
b. Automobile Liability providing coverage for all owned, hired and non-owned autos. The limit of liability required is $1,000,000 each accident.

c. Workers Compensation and Employers Liability (only if statutorily required for Service Provider). The limits required are: Workers Compensation – Statutory; and Employers Liability--$1,000,000 for each accident, for each employee.
d. Umbrella/Excess Liability with a required limit of $1,000,000.

For any agreement where the Contractor receives payment from the City of Bloomington and/or has access to critical City data, Contractor shall also have the following:

a. Cyber Attack and Cyber Extortion
  i. Computer Attack Limit (Annual Aggregate) of $1,000,000;
  ii. Sublimit (Per Occurrence) for Cyber Extortion of $100,000; and
  iii. Computer attack and Cyber Extortion deductible (per occurrence) of $10,000.

b. Network Security Liability
  i. Limit (Annual Aggregate) of $1,000,000; and
  ii. Deductible (per occurrence) of $10,000.

c. Electronic Media Liability
  i. Limit (Annual Aggregate) of $1,000,000; and
  ii. Deductible (Per Occurrence) of $10,000.

d. Fraudulent Impersonator Coverage
  i. Limit (Annual Aggregate) of $250,000; and
  ii. Deductible (Per Occurrence) of $5,000.

5.05.02 Contractor's comprehensive general liability insurance shall also provide coverage for the following:

Premises and operations;
Contractual liability insurance as applicable to any hold-harmless agreements;
Completed operations and products; which also must be maintained for a minimum period of two (2) years after final payment and Contractor shall continue to provide evidence of such coverage to CITY on an annual basis during the aforementioned period;
Broad form property damage - including completed operations;
Fellow employee claims under Personal Injury; and
Independent Contractors.

5.05.03 All insurance policies shall be issued by an insurance company authorized to issue such insurance in the State of Indiana. These policies shall name the City of Bloomington and its Utilities Company, Wessler Engineering, Inc. and the officers, employees, and agents of each as insured under General Liability, Automobile, and Umbrella/Excess Liability policies. Such policies shall stipulate that the insurance will operate as primary insurance and that no other insurance of the City's will be called upon to contribute to a loss hereunder.

5.05.04 Contractor shall provide a Certificate of Insurance showing each insurance policy to the City prior to the commencement of work under this Agreement, and shall provide documentation of any changes to or cancellation of required insurance to the City within ten (10) days. Approval of the insurance by the City shall not relieve or decrease the extent to which Contractor may be held responsible for payment of damages resulting from Contractor's provision of the Services or its operations under this Agreement. If Contractor fails or refuses to procure or maintain the insurance required by these provisions, or fails or refuses to furnish the City's required proof that the insurance has been procured and is in force and paid for, the City shall have the right at its election to terminate the Agreement.

5.06 Necessary Documentation. Contractor certifies that it will furnish City any and all documentation, certification, authorization, license, permit or registration required by the laws or rules and regulations of the City of Bloomington, the State of Indiana and the United States. Contractor further certifies that it is now and will maintain in good standing with such governmental agencies and that it will keep its license, permit registration, authorization or certification in force during the term of this Agreement.

5.07 Applicable Laws. Contractor agrees to comply with all federal, state, and local laws, rules and regulations applicable to Contractor in performing work pursuant to this Agreement, including, but not limited to, discrimination in employment, prevailing wage laws, conflicts of interest, public notice, accounting records and requirements. Contractor shall comply with City of Bloomington Ordinance 2.21.020 and all other federal, state and local laws and regulations governing non-discrimination, including but not limited to employment. This Agreement shall be governed by the laws of the United States, and the State of Indiana, and by all Municipal Ordinances and Codes of the City of Bloomington. Venue of any disputes arising under this Agreement shall be in the Monroe Circuit Court, Monroe County, Indiana.

5.08 Non-Discrimination

5.08.01 Contractor and subcontractors shall not discriminate against any employee or applicant for employment, to be employed in the performance of this Agreement, with respect to hire, tenure, terms, training, conditions or privileges of employment, because of race, sex, color, religion, national origin, ancestry, disability, sexual orientation, gender identity, veteran status or housing status. Breach of this covenant may be regarded as a material breach of the Agreement.

5.08.02 Contractor certifies for itself and all its subcontractors compliance with existing laws of the City of Bloomington, the State of Indiana and the United States regarding:

Prohibition of discrimination in employment practices on the basis of race, sex, color, religion, national origin, ancestry, disability, sexual orientation, gender identity, veteran status, housing status, or any other legally protected classification;

The utilization of Minority and Women Business Enterprises. Contractor further certifies that it:

a. Has formulated its own Affirmative Action plan for the recruitment, training and employment of minorities and women, including goals and timetable; which has been approved by the City's Contract Compliance Officer.

b. Encourages the use of small business, minority-owned business and women-owned business in its operations.

Contractor understands that the City of Bloomington prohibits its employees from engaging in harassment or discrimination of any kind, including harassing or discriminating against independent Contractors doing work for the City. If Contractor believes that a City employee engaged in such conduct towards Contractor and/or any of its employees, Contractor or its employees may file a complaint with the City department head in charge of the Contractor's work and/or with the City human resources department or the Bloomington Human Rights Commission. The City takes all complaints of harassment and discrimination seriously and will take appropriate disciplinary action if it finds that any City employee engaged in such prohibited conduct.

5.08.03 FURTHER, PURSUANT TO INDIANA CODE 5-16-6-1, CONTRACTOR AGREES:

A) That in the hiring of employees for the performance of work under this Agreement or any sub agreement hereunder, no Contractor, or subcontractor, nor any person acting on behalf of such Contractor or subcontractor, shall by reason of race, sex, color, religion, national origin, ancestry, or any other legally protected classification, discriminate against any citizen of the State of Indiana who is qualified and available to perform the work to which the employment relates.

B) That no Contractor, subcontractor, or any person on their behalf, shall, in any manner, discriminate against or intimidate any employee hired for performance of work under this Agreement on account of race, religion, color, sex, national origin, ancestry, or any other legally protected classification.

C) That there may be deducted from the amount payable to Contractor, by City, under this Agreement, penalty of Five Dollars ($5.00) for each person for each calendar day during which such person was discriminated against or intimidated in violation of the provisions of this Agreement. Any such person discriminated against retains the right to file a discrimination complaint with the appropriate civil rights agency or court.

D) That this Agreement may be canceled or terminated by City and all money due or to become hereunder may be forfeited, for a second or any subsequent violations of the terms or conditions under this section of the Agreement.

5.09 Workmanship and Quality of Materials

5.09.01 Contractor shall guarantee the work for a period of one (1) year from the date of substantial completion. Failure of any portion of the work within one (1) year due to improper construction, materials of construction, or design may result in a refund to City of the purchase price of that portion which failed or may result in the forfeiture of Contractor's Performance Bond.

5.09.02 OR EQUAL: Wherever in any of the Agreement Documents an article, material or equipment is defined by describing a proprietary product, or by using the name of a manufacturer or vender, the term "Or Equal" or the term "The Equivalent" if not inserted, shall be implied, and it is done for the express purpose of establishing a basis of durability and efficiency and not for the purpose of limiting completion. Whenever material or equipment is submitted for approval as being equal to that specified, the submittal shall include sufficient information and data to demonstrate that the material or equipment conforms to the Contract requirements. The decision as to whether or not such material or equipment is equal to that specified shall be made by the Engineer. The approval by the Engineer of alternate material or equipment as being equivalent to that specified, shall not in any way relieve Contractor of responsibility for failure of the material or equipment due to faulty design, material, or workmanship, to perform the function required by the Contract Documents. Specifications as determined by other entities within the City of Bloomington such as City Utilities shall only be substituted or changed by their approval which shall be submitted in writing to the Engineer.

5.09.03 City shall be the sole judge of the sufficiency of workmanship and quality of materials. Disputes shall be resolved by the City Engineer and are not subject to arbitration.

5.10 Safety. Contractor shall be responsible for the safety of employees at all times and shall provide all equipment necessary to insure their safety. Contractor shall ensure the enforcement of

all applicable safety rules, regulations, ordinances and laws, whether federal, state or local. Contractor's Superintendent of Safety shall make daily inspections upon the arrival and leaving of the site at the close of each workday.

5.10.01 Contractor is required to comply with IOSHA regulations 29 C.F.R 1926, Subpart P, Excavations for all trenches of at least five (5) feet in depth. All cost for trench safety systems shall be the responsibility of the Contractor and included in the cost of the principal work with which the safety systems are associated. Contractor shall sign an affidavit, attached as **Attachment "C"**, affirming that Contractor shall maintain compliance with IOSHA requirements for excavations of at least five (5) in depth.

5.11 Amendments/Changes

5.11.01 Except as provided in Paragraph 5.11.02, this Agreement may be amended only by written instrument signed by both City and Contractor.

5.11.02 Without invalidating the Agreement and without notice to any surety, City may, at any time or from time to time, order, in writing, additions, deletions, or revisions in the work. Upon receipt of any such document, Contractor shall promptly proceed with the work involved, which will be performed under the applicable conditions of the Contract Documents.

5.11.03 If Contractor believes that any direction of City under paragraph 5.11.02, or any other event or condition, will result in an increase in the Contract time or price, he or she shall file written notice with City no later than twenty (20) calendar days after the occurrence of the event giving rise to the claim and stating the general nature of the claim with supporting data. No claim for any adjustment of the Contract time or price will be valid if not submitted in accordance with this Paragraph.

5.11.04 Contractor shall carry on the work and adhere to the progress schedule during all disputes or disagreements with City. No work shall be delayed or postponed pending resolution of any dispute or disagreement except as Contractor and City may otherwise agree in writing.

5.12 Performance Bond and Payment Bond

5.12.01 For contracts in excess of $100,000, Contractor shall provide City with a Performance Bond and a Payment Bond in the amount of one hundred percent (100%) of the contract amount.

5.12.02 Failure by Contractor to perform the work in a timely or satisfactory fashion may result in forfeiture of Contractor's Performance Bond.

5.12.03 If the surety on any bond furnished by Contractor becomes a party to supervision, liquidation, or rehabilitation action pursuant Indiana Code 27-9 et seq. or its right to do business in the State of Indiana is terminated, Contractor shall, within thirty (30) calendar days thereafter, substitute another bond and surety, both of which must be acceptable to City.

5.13 Payment of Subcontractors Contractor shall pay all subcontractors, laborers, material suppliers and those performing services to Contractor on the project under this Agreement. City may, as a condition precedent to any payment hereunder, require Contractor to submit satisfactory evidence of payments of any and all claims of subcontractors, laborers, material suppliers, and

those furnishing services to Contractor. Upon receipt of a lawful claim, City shall withhold money due to Contractor in a sufficient amount to pay the subcontractors, laborers, material suppliers, and those furnishing services to Contractor.

5.13.01 The surety of the Payment Bond and Performance Bond may not be released until one (1) year after the Board's final settlement with the Contractor.

5.14 Written Notice Written notice shall be considered as served when delivered in person or sent by mail to the individual, firm, or corporation, or to the last business address of such known to Contractor who serves the Notice. Notice shall be sent as follows:

TO CITY: TO CONTRACTOR:

City of Bloomington Utilities Department		
Attn:		
600 E. Miller		
Bloomington, Indiana 47401		

5.15 Severability and Waiver In the event that any clause or provision of this Agreement is held to be invalid by any court of competent jurisdiction, the invalidity of such clause or provision shall not affect any other provision of this Agreement. Failure of either party to insist on strict compliance with any provision of this Agreement shall not constitute waiver of that party's right to demand later compliance with the same or other provisions of this Agreement.

5.16 Notice to Proceed Contractor shall not begin the Work until it receives an official written Notice to Proceed from the City. Contractor shall start active and continuous work on the Agreement within fifteen (15) calendar days after the date of the Notice to Proceed. In no case shall work begin prior to the date of the Notice to Proceed. If a delayed starting date is indicated in the proposal, the fifteen (15) calendar day limitation will be waived. Work day charges will then begin on a date mutually agreed upon, but not later than the delayed starting date specified. In the event that any Agreement is canceled after an award has been made but prior to the issuing of the Notice to Proceed, no reimbursement will be made for any expenses accrued relative to this contract during that period.

5.17 Steel or Foundry Products

5.17.01 To comply with Indiana Code 5-16-8, affecting all contracts for the construction, reconstruction, alteration, repair, improvement or maintenance of public works, the following provision shall be added: If steel or foundry products are to be utilized or supplied in the performance of any contract or subcontract, only domestic steel or foundry products shall be used. Should City feel that the cost of domestic steel or foundry products is unreasonable; City will notify Contractor in writing of this fact.

5.17.02 Domestic Steel products are defined as follows:

> "Products rolled, formed, shaped, drawn, extruded, forged, cast, fabricated or otherwise similarly processed, or processed by a combination of two (2) or more of

such operations, from steel made in the United States by open hearth, basic oxygen, electric furnace, Bessemer or other steel making process."

5.17.03 Domestic Foundry products are defined as follows:

"Products cast from ferrous and nonferrous metals by foundries in the United States."

5.17.04 The United States is defined to include all territory subject to the jurisdiction of the United States.

5.17.05 CITY may not authorize or make any payment to Contractor unless City is satisfied that Contractor has fully complied with this provision.

5.18 Verification of Employees' Immigration Status

Contractor is required to enroll in and verify the work eligibility status of all newly-hired employees through the E-Verify program. (This is not required if the E-Verify program no longer exists). Contractor shall sign an affidavit, attached as **Attachment "D"**, affirming that Contractor does not knowingly employ an unauthorized alien. "Unauthorized alien" is defined at 8 U.S. Code 1324a(h)(3) as a person who is not a U.S. citizen or U.S. national and is not lawfully admitted for permanent residence or authorized to work in the U.S. under 8 U.S. Code Chapter 12 or by the U.S. Attorney General.

Contractor and any of its subcontractors may not knowingly employ or contract with an unauthorized alien, or retain an employee or contract with a person that the Contractor or any of its subcontractors learns is an unauthorized alien. If the City obtains information that the Contractor or any of its subcontractors employs or retains an employee who is an unauthorized alien, the City shall notify the Contractor or its subcontractors of the Agreement violation and require that the violation be remedied within thirty (30) calendar days of the date of notice. If the Contractor or any of its subcontractors verify the work eligibility status of the employee in question through the E-Verify program, there is a rebuttable presumption that the Contractor or its subcontractor did not knowingly employ an unauthorized alien. If the Contractor or its subcontractor fails to remedy the violation within the thirty (30) calendar day period, the City shall terminate the Agreement, unless the City determines that terminating the Agreement would be detrimental to the public interest or public property, in which case the City may allow the Agreement to remain in effect until the City procures a new Contractor. If the City terminates the Agreement, the Contractor or its subcontractor is liable to the City for actual damages.

Contractor shall require any subcontractors performing work under this Agreement to certify to the Contractor that, at the time of certification, the subcontractor does not knowingly employ or contract with an unauthorized alien and the subcontractor has enrolled in and is participating in the E-Verify program. Contractor shall maintain on file all subcontractors' certifications throughout the term of this Agreement with the City.

5.19 Drug Testing Plan

In accordance with Indiana Code 4-13-18 as amended, the Contractor was required to submit with his/her bid a written drug testing policy for a public works project that is estimated to cost

$150,000 or more. Among other things, the law sets forth specific requirements that must be in the plan for a program to test the employees of the Contractor and Subcontractors for drugs. The successful Contractor must comply with all provisions of the statute. This contract is subject to cancellation if Contractor fails to implement its testing program during the term of this contract, fails to provide information regarding this testing at the request of CITY; or provides false information to City regarding Contractor's employee drug testing program. Contractor shall sign an affidavit, attached as **Attachment "E"**, affirming that Contractor has and shall implement Contractor's employee drug testing program throughout the term of this project.

5.20 Living Wage Ordinance. Contractor is a covered employer under City Ordinance 2.28, otherwise known as the "Living Wage Ordinance," or "LWO," and is required to pay its covered employees at least a living wage. Currently, the living wage is $15.75 per hour for covered employees, and up to 15% of that amount, or $2.36, may be in the form of the covered employer's contribution to health insurance available to the covered employee. As of January 1, 2025, the Living Wage shall be $16.22 per hour, up to $2.43 of which may be provided in the form of the covered employer's contribution to health insurance. Contractor signed the Living Wage Ordinance Affidavit, attached as **Attachment "F"** and agrees to abide by the LWO by paying its employees a living wage, and posting the Living Wage Poster in areas frequented by their covered employees.

IN WITNESS WHEREOF, the parties to this Agreement have hereunto set their hands.

CITY: CITY OF BLOOMINGTON, INDIANA
UTILITIES SERVICE BOARD

By: _____
Seth Debro **DATED**
President, Utilities Service Board

_____
Katherine Zaiger, Director **DATED**
City of Bloomington Utilities

_____
Kerry Thomson, Mayor **DATED**
City of Bloomington

CONTRACTOR: _____

By: _____
Authorized Contractor Representative

_____
Printed Name

_____
Title of Contractor Representative

ATTACHMENT "A"

SCOPE OF WORK

SCADA System Modernization

The project includes the replacement of all plant Supervisory Control and Data Acquisition (SCADA) Programmable Logic Controllers (PLCs), Human Machine Interfaces (HMIs), and the instrumentation and associated equipment outlined in the project manual to support new centralized SCADA system servers and operator workstations that will be provided by the Owner. Additionally, the project requires the replacement of the Variable Frequency Drives (VFDs) located in the Influent Lift Station and the Residuals Pumping Station.

Work included in the project shall be provided by qualified Electrical trades and Control System Suppliers.

Work by others: OWNER will provide all SCADA system programming and server hardware, as well as all Operator workstation hardware.

ATTACHMENT "B"

CONTRACTOR'S BID

ATTACHMENT "C" – NOT REQUIRED

BIDDER'S AFFIDAVIT IN COMPLIANCE WITH INDIANA CODE 36-1-12-20 TRENCH SAFETY SYSTEMS; COST RECOVERY

The undersigned, being duly sworn, hereby affirms and says that:

1. The undersigned is the _____ of
(job title)
_____.
(company name)

2. The undersigned is duly authorized and has full authority to execute this Bidder's Affidavit.

3. The company named herein that employs the undersigned:
   i. has contracted with or seeking to contract with the City of Bloomington to provide services; **OR**
   ii. is a subcontractor on a contract to provide services to the City of Bloomington.

4. By submission of this Bid and subsequent execution of a Contract, the undersigned Bidder certifies that as successful Bidder (Contractor) all trench excavation done within his/her control (by his/her own forces or by his/her Subcontractors) shall be accomplished in strict adherence with OSHA trench safety standards contained in 29 C.F.R. 1926, Subpart P, including all subsequent revisions or updates to these standards as adopted by the United States Department of Labor.

5. The undersigned Bidder certifies that as successful Bidder (Contractor) he/she has obtained or will obtain identical certification from any proposed Subcontractors that will perform trench excavation prior to award of the subcontracts and that he/she will retain such certifications in a file for a period of not less than three (3) years following final acceptance.

6. The Bidder acknowledges that included in the various items listed in the Schedule of Bid Prices and in the Total Amount of Bid Prices are costs for complying with I.C. 36-1-12-20. The Bidder further identifies the costs to be summarized below*:

	Trench Safety Measure	Units of Measure	Unit Cost	Unit Quantity	Extended Cost
A.					
B.					
C.					
D.					
				Total	**$_____**

Method of Compliance (Specify) _____

_____

Date: _____, 20_____

_____
Signature

_____
Printed Name

STATE OF INDIANA)
) SS:
COUNTY OF _____)

Before me, a Notary Public in and for said County and State, personally appeared _____ and acknowledged the execution of the foregoing this _____ day of _____, 20_____.

My Commission Expires: _____ _____
Signature of Notary Public

County of Residence: _____ _____
Printed Name of Notary Public

Commission #:_____

*Bidders: Add extra sheet(s), if needed.

If Bidder fails to complete and execute this sworn affidavit, his/her Bid may be declared nonresponsive and rejected by the **CITY OF BLOOMINGTON**.

ATTACHMENT "D"

AFFIDAVIT REGARDING E-VERIFY

The undersigned, being duly sworn, hereby affirms and says that:

1. The undersigned is the _____ of _____.
(job title) (company name)

2. The company named herein that employs the undersigned has contracted with or is seeking to contract with the City of Bloomington to provide services.

3. The undersigned hereby states that, to the best of his/her knowledge and belief, the company named herein does not knowingly employ an "unauthorized alien," as defined at 8 United State Code 1324a(h)(3).

4. The undersigned hereby states that, to the best of his/her knowledge and belief, the company named herein is enrolled in and participates in the E-verify program.

I affirm under the penalties of perjury that the foregoing facts and information are true and correct to the best of my knowledge and belief.

_____
Signature

_____
Printed name

STATE OF INDIANA)
) SS:
COUNTY OF _____)

Before me, a Notary Public in and for said County and State, personally appeared _____ _____ and acknowledged the execution of the foregoing this _____ day of _____, 20___.

My Commission Expires:_____ _____
Notary Public

County of Residence:_____ _____
Name Printed

_____
Commission Number

ATTACHMENT "E"

COMPLIANCE AFFIDAVIT
REGARDING INDIANA CODE CHAPTER 4-13-18
DRUG TESTING OF EMPLOYEES OF PUBLIC WORKS CONTRACTORS

The undersigned, being duly sworn, hereby affirms and says that:

1. The undersigned is the _____ of
(job title)
_____.
(company name)

2. The undersigned is duly authorized and has full authority to execute this Affidavit.

3. The company named herein that employs the undersigned:
   iii. has contracted with or seeking to contract with the City of Bloomington to provide services;
   OR
   iv. is a subcontractor on a contract to provide services to the City of Bloomington.

4. The undersigned certifies that Contractor's submitted written plan for a drug testing program to test employees of the Contractor and Subcontractor for public works projects with an estimated cost of $150,000 is in accordance with Indiana Code 4-13-18 as amended.

5. The undersigned acknowledges that this Contract shall be subject to cancellation should Contractor fail to comply all provisions of the statute.

_____
Signature

_____
Printed Name

STATE OF INDIANA)
) SS:
COUNTY OF _____)

Before me, a Notary Public in and for said County and State, personally appeared _____ and acknowledged the execution of the foregoing this _____ day of _____, 20_____.

My Commission Expires: _____

_____
Signature of Notary Public

County of Residence: _____

_____
Printed Name of Notary Public

My Commission #:_____

ATTACHMENT "F"

AFFIDAVIT REGARDING THE LIVING WAGE ORDINANCE

The undersigned, being duly sworn, hereby affirms and says that:

1. The undersigned is the _____ of _____,
(job title) (company name)

2. The company named herein that employs the undersigned has contracted with or is seeking to contract with the City of Bloomington to provide services.

3. The undersigned hereby states that, to the best of their knowledge and belief, the company named herein is subject to Bloomington City Ordinance 2.28, otherwise known as the "Living Wage Ordinance."

4. The projected employment needs under the award include the following: _____.

5. The projected net increase or decrease in jobs for covered employees by job title that will result from awarding the assistance: _____.

6. The undersigned hereby affirms that the smallest hourly wage to be earned by each of their covered employees shall be at least the living wage.

I affirm under the penalties of perjury that the foregoing facts and information are true and correct to the best of my knowledge and belief.

Dated this _____ day of _____, 20__.

_____
Signature

_____
Printed name

STATE OF INDIANA)
) SS:
COUNTY OF _____)

Before me, a Notary Public in and for said County and State, personally appeared _____ _____ and acknowledged the execution of the foregoing this _____ day of _____ _____, 20__.

My Commission Expires:_____ _____
Notary Public

County of Residence:_____ _____
Name Printed

_____
Commission Number

Kerry Thomson
MAYOR

CITY OF BLOOMINGTON CONTROLLER'S OFFICE

401 N Morton St
Post Office Box 100
Bloomington IN 47402

p 812.349.3412
f 812.349.3456
controller@bloomington.in.gov

SUBSTITUTE W-9 & BANK/EFT FORM

(red boxes are required fields)

(Complete and Save form. Email or Fax to Controller's Office)

REQUEST FOR TAXPAYER IDENTIFICATION NUMBER AND CERTIFICATION: SUBSTITUTE W-9

Name (as shown on your tax return):

Business Name/DBA (if different than above):

Check appropriate box for federal tax classification:

❑ Individual/sole proprietor ❑ C Corporation ❑ S Corporation ❑ Partnership ❑ Trust/estate

❑ Limited liability company. **Enter the tax classification** (C=C corporation, S=S corporation, P=Partnership)► _____

❑ Other ► _____

Exemptions:
Exempt payee code (if any)_____
Exemption from FATCA reporting code (if any)
_____

Address (number, street, and apt. or suite no.):

City, State, and ZIP code:

Telephone number:	**Fax number:**	**Email:**

Check all that apply:

❑ State or Local Government ❑ City Employee ❑ Contractual Employee ❑ Farmer's Market Vendor ❑ Grant Recipient

List city department(s) you are doing business with (Parks, Fire, Utilities etc.):

SELECT

Products or Services provided. Or if you are a Grant Recipient enter Grant.

Primary NAICS Code:

DUNS #:

Taxpayer Identification Number (TIN)

Enter your TIN in the appropriate box. The TIN provided must match the name given on the "Name" line To avoid backup withhold. For individuals, this is your social security number (SSN). However, for a Resident alien, sole proprietor, or disregarded entity, see the Part 1 instructions on page 3 of IRS Form W-9. For other entities, it is your employer identification number (EIN). If you do not have a number, see *How to get a TIN* on page 3 of IRS Form W-9

Note: If the account is in more than one name, see the instructions for line 1 and the chart on page 4.

Social security number

			-			-			

Employer identification number

		-							

Certification

Under penalties of perjury, I certify that:

1. The number shown on this form is my correct taxpayer identification number (or I am waiting for a number to be issued to me), and
2. I am not subject to backup withholding because: (a) I am exempt from backup withholding, or (b) I have not been notified by the Internal Revenue Service (IRS) that I am subject to backup withholding as a result of a failure to report all interest or dividends, or (c) the IRS has notified me that I am no longer subject to backup withholding, and
3. I am a U.S. person or other U.S. person (defined below), and
4. The FATCA codes(s) entered on this form (if any) indicating that I am exempt from FATCA reporting is correct.

Certification Instructions

You must cross out item 2 above if you have been notified by the IRS that you are currently subject to backup withholding because you have failed to report all interest and dividends on your tax return. For real estate transactions, item 2 does not apply. For mortgage interest paid, acquisition or abandonment of secured property, cancellation of debt, contributions to an individual retirement arrangement (IRA), and generally, payments other than interest and dividends, you are not required to sign the certification, but you must provide your correct TIN. See the instructions on page 3 of the IRS Form W-9.

Please mail or fax this complete form as soon as possible to the Controller's Office using the contact information above.
NO PAYMENTS WILL BE SENT UNTIL THIS FORM IS RECEIVED.

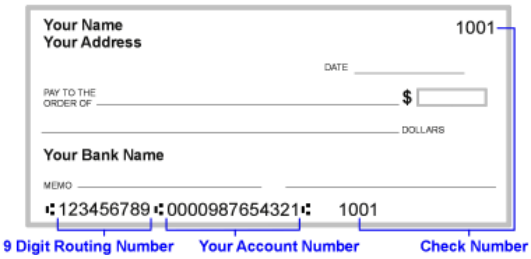
SIGN HERE	Signature of U.S. person ►	Date ►

CITY OF BLOOMINGTON ELECTRONIC FUNDS TRANSFER FORM (EFT)

(Complete and Save form and attach to email)
Email completed forms to: **controller@bloomington.in.gov**
Call 812-349-3412 if you have any questions.

THE CITY'S PREFERRED METHOD OF VENDOR PAYMENT IS ELECTRONIC FUNDS TRANSFER (EFT) DIRECTLY TO THE VENDOR'S BANK. NO PAPER CHECKS WILL BE ISSUED WITHOUT THE APPROVAL OF THE CONTROLLER.

PLEASE COMPLETE THE SECTION BELOW TO ENROLL



BANK INFORMATION FOR EFT TRANSFER

Bank Name:	
Type of Account:	◉ Checking ○ Savings
Routing Number:	
Account Number:	
Name of Account:	
Email for Payment Notification:	

REFERENCES FOR SOLE PROPRIETORS & PARTNERSHIPS

Name:	Address:
Phone:	Email:

Name:	Address:
Phone:	Email:

Name:	Address:
Phone:	Email:

HOW TO COMPLETE THE W-9 SUBSTITUTE FORM

1. Enter your name or business name as shown on your tax returns.
2. If you are doing business under a different name (DBA) enter this name in the second box.
3. Enter your tax classification. See the chart to the right for clarification.
4. Choose your exemptions if applicable.
5. Enter the street address for your home or business.
6. Enter the corresponding city, state, zip code, phone/fax and email address.
7. Enter the City Department who requested you complete this form. Use the drop-down arrow to select from a menu of city departments.
8. Enter the service or product you are providing to the City. Enter GRANT if you are receiving a grant.
9. Enter the tax identification number your taxes are filed under. This will be either a Social Security number, or Employer/Tax Identification number.
   a. Sign and date the form.
   b. Completed the EFT Form.
   c. Return **both forms** to the email address shown below.

IF the entity/person on line 1 is a(n) . . .	THEN check the box for . . .
• Corporation	Corporation
• Individual • Sole proprietorship, or • Single-member limited liability company (LLC) owned by an individual and disregarded for U.S. federal tax purposes.	Individual/sole proprietor or single-member LLC
• LLC treated as a partnership for U.S. federal tax purposes, • LLC that has filed Form 8832 or 2553 to be taxed as a corporation, or • LLC that is disregarded as an entity separate from its owner but the owner is another LLC that is not disregarded for U.S. federal tax purposes.	Limited liability company and enter the appropriate tax classification. (P= Partnership; C= C corporation; or S= S corporation)
• Partnership	Partnership
• Trust/estate	Trust/estate

(Complete and Save form. Attach form and email to controller@bloomington.in.gov or print and fax to 812.349.3456)

AUTHORIZATION CERTIFICATE

First Financial Bank dba Yellow Cardinal Advisory Group ("Yellow Cardinal")

Client Name ("Entity"):	
Type of Entity:	
Principal Address:	
Tax ID:	
Account:	

THE UNDERSIGNED HEREBY CERTIFIES TO YELLOW CARDINAL:

1) That (S)he is authorized, in his/her position as Secretary/President/Member/Manager/General Partner (as applicable) of the Entity, and directed to execute this Authorization Certificate on behalf of Entity.
2) Entity:
    a. Is duly organized, validly existing and in good standing in its state of organization as well as in all jurisdictions where Entity operates.
    b. Has the power and authority to provide this Authorization, to confer the powers identified in this Authorization Certificate, and to carry on its business as currently conducted.
3) That the following resolutions were duly adopted by the directors, trustees or other governing body of Entity in accord with and pursuant to the charter and other organizational documents of Entity and applicable law and are in full force and effect and have not been modified or revoked.

    RESOLVED:
    a. That Yellow Cardinal is hereby appointed as an investment manager with full authority to direct the management, acquisition, and disposition of Entity's assets designated in its agreements with the Yellow Cardinal.
    b. That the following persons ("Agents") are hereby authorized to act on behalf of Entity and appoint Yellow Cardinal as an investment manager with full authority to direct the management, acquisition, and disposition of the Entity's assets as designated in Entity's agreements with Yellow Cardinal and provide instructions to Yellow Cardinal and execute documents with Yellow Cardinal on behalf of Entity.

	Name:	Title
A		
B		
C		
D		

    c. That Yellow Cardinal is authorized to rely upon and to accept as genuine and authorized the facsimile signature of any Agent or such signatures that resemble facsimile signatures, without any duty to determine the genuineness of such signature or whether it was authorized by Entity.
    d. That Entity agrees to the terms, conditions, and applicable rules or regulations of Yellow Cardinal governing accounts and services, as may be amended from time to time pursuant to their terms or as permissible by applicable law or regulation.
    e. That the foregoing resolutions shall remain in full force and effect until written notice of their amendment or rescission shall have been received by Yellow Cardinal, and that receipt of such notice shall not affect any action taken by Yellow Cardinal prior to its receipt of such notice. Entity shall indemnify and hold harmless Yellow Cardinal from any loss or damage arising out of any action by Yellow Cardinal in reliance on, or in furtherance of, these resolutions. All transactions, if any, conducted with Yellow Cardinal prior to the adoption of these resolutions are hereby ratified, approved and confirmed.
    f. That these resolutions supersede all prior resolutions delivered to the Yellow Cardinal, if any, concerning the above referenced accounts.
4) The preceding resolutions and the powers granted therein conform to the organizational documents of Entity now in effect and said resolutions are in full force and effect and have not been amended or rescinded.

ENTITY SEAL
(Optional)

I have subscribed my name to this document on

Signature of Authorized Entity Official

ESCROW AGREEMENT

THIS ESCROW AGREEMENT made as of _____, 20____ by and among the City of Bloomington, Indiana, an Indiana municipal corporation ("Owner"), _____-_____, a(n) _____ ("Contractor"), and **FIRST FINANCIAL BANK, an Ohio state chartered bank, dba YELLOW CARDINAL ADVISORY GROUP** ("Escrow Agent").

1. Recitals.

1.1 The City, and _____ (hereinafter referred to as the "Parties"), simultaneously with the execution and delivery of this Escrow Agreement, have entered into a(n) _____ dated _____ _____, 20 (the "Agreement");

1.2 The City is required by Indiana law to enter into an escrow agreement of funds for construction of public works projects in an amount of $100,000 or more; and

1.3 The City has agreed to place portions of the funds as part of its Agreement with _____ retained by the City ("Deposit") in escrow with Escrow Agent pending the closing of the transactions contemplated by the Agreement or termination thereof prior to closing; and

1.4 Escrow Agent is willing to hold the Deposit in escrow on the terms and conditions hereinafter set forth.

2. Agreement. In consideration of the foregoing, the parties hereto hereby agree as follows:

2.1 The Deposit.

2.1.1 Delivery of Deposit. The City will deliver to Escrow Agency by wire transfer or certified check immediately available funds, such sum constituting the Deposit. Escrow Agent will promptly deposit and maintain the Deposit as set forth below.

Investment of Deposit.

Escrow agent will deposit the escrowed funds in a segregated First Financial wealth management cash sweep money market account managed and administered by the escrow agent or one of its affiliates; No deposit of escrowed funds will be invested in investment grade bonds or public securities except by the express written agreement of the parties. Any interest, dividends, or other income accruing on the Deposit will be credited to the Escrow Account. Escrow Agent makes no representation as to the yield of such investment and will bear no liability for any delays in depositing the Deposit or for any failure to achieve the maximum possible yield from such Deposit.

2.1.2 Net Deposit. The Deposit, less any and all transaction or account fees or charges and out-of-pocket expenses of Escrow Agent attributable to, or incurred in connection with, the deposit thereof in accordance with the terms of this Agreement which items may be deducted by the Escrow Agent from the Deposit as set forth below (such net sum being the "Net Deposit"), will be delivered by Escrow Agent in accordance with the terms of this Escrow Agreement to the person or persons entitled thereto or, if pursuant to Section 3.6 hereof, to a substitute impartial party or a court of competent jurisdiction. Escrow Agent agrees to provide the Parties with copies of each monthly statement for the Escrow

Account for the period for which the Deposit is held by Escrow Agent. As a condition to the delivery of any funds constituting part of the Deposit, Escrow Agent may require from the recipient a receipt therefor and, upon final payment or disposition, may require its release from any liability arising out of the execution or performance hereof, such release to be in a form reasonably satisfactory to Escrow Agent.

2.2 **Delivery of Deposit.** If the transactions contemplated by the Agreement are consummated as provided therein, then upon delivery of the Payment Certificate in the form attached hereto as Exhibit A and executed by both Parties, Escrow Agent will pay the Net Deposit, plus all accrued interest thereon, less any expenses, including but not limited to attorneys' fees, as instructed on the Payment Certificate or other joint instruction that complies with Section 3.1 below.

2.3 **Effect of Termination of Agreement.** If the transactions contemplated by the Agreement are not consummated as provided therein, then upon delivery of the Payment Certificate in the form attached hereto as Exhibit A and executed by both Parties, Escrow Agent will pay the Net Deposit, plus all accrued interest thereon, less any expenses, including but not limited to attorneys' fees, as instructed on the Payment Certificate or other joint instruction that complies with Section 3.1 below.

3. General.

3.1 **Proper Certificate.** In lieu of the presentation of the Payment Certificate described above, any document purporting to be a certificate will be deemed by the Escrow Agent to be a proper certificate, or will suffice as a joint instruction, if it contains: (i) the name of the payee; (ii) the amount of the payment to be made; (iii) the manner of payment (i.e., by certified or cashiers check, by account-to-account transfer, or by wire transfer, whichever is applicable); and (iv) the signatures of each of the parties hereto, excluding the Escrow Agent.

3.2 **Authority of Signatures.** Escrow Agent will be entitled to rely upon the authenticity of any signature (and upon any facsimile of a signature as if it were an original signature) and the genuineness and/or validity of any writing received by Escrow Agent from either of the Parties pursuant to or otherwise relating to this Escrow Agreement.

3.3 **Authority to Execute.** Each signatory to this Escrow Agreement warrants that it has full and complete authority to enter into this Escrow Agreement.

3.4 **Request for Written Instructions.** The Escrow Agent may at any time request written instructions from the Parties with respect to the interpretation hereof or of action to be taken or suffered or not taken hereunder and, notwithstanding any other provision hereof, will be entitled to withhold (and will not be under any liability to any person for withholding) action hereunder until it has received written instructions signed by all of the Parties.

3.5 **Reliance on Advice of Counsel.** The Escrow Agent may act upon advice of counsel in reference to any matter connected herewith, and will not be liable for any mistake of fact or error of judgment or for any acts or omissions of any kind unless caused by its willful misconduct or gross negligence.

3.6 **Inconsistent Notices; Payment Into Court.** In the event of the receipt by the Escrow Agent of any notice, demand, or certificate not provided for or in compliance with this Escrow Agreement or of any inconsistent or conflicting notices or certificates, the Escrow Agent will be protected in taking no action whatsoever with reference to any such notice or

demand, unless such inaction constitutes gross negligence or willful misconduct on the part of the Escrow Agent. In case of: (i) receipt of contradictory instructions from the Parties; (ii) any dispute as to any matter arising under this Agreement; or (iii) any uncertainty as to the meaning or applicability of any of the provisions hereof, Escrow Agent may, at its option at any time thereafter, deposit the Deposit and/or documents or assets then being held by it in escrow into a court having appropriate jurisdiction, or take such affirmative steps as it may elect in order to substitute an impartial bank of comparable financial and industrial standing to hold the Deposit and/or documents and will thereby be discharged and relieved of any and all liability hereunder.

3.7 **Resignation of Escrow Agent.** The Escrow Agent may resign at any time by giving a minimum of 30 days' prior written notice of resignation to the Parties, such resignation to be effective on the date specified in such notice. The Deposit, and any other assets held by the Escrow Agent under the terms of this Escrow Agreement as of the effective date of the resignation, will be delivered to a successor escrow agent designated in writing jointly by the Parties. If no successor escrow agent has been appointed as of the effective date of the resignation, all obligations of the Escrow Agent hereunder will nevertheless cease and terminate, except that the Escrow Agent's sole responsibility thereafter will be to keep safely the Deposit then held by it and to deliver the same to a person designated by both Parties or in accordance with the direction of a final order or judgment or a court of competent jurisdiction.

3.8 **Limitation of Duties.** The Escrow Agent has no responsibility concerning compliance by the Parties with their duties to each other under this Escrow Agreement or any other agreements. Escrow Agent will have only such duties and obligations as are specifically imposed upon it by the terms and conditions of this Escrow Agreement and no implied duties or obligations will be read into this Escrow Agreement against Escrow Agent.

3.9 **Liability of Escrow Agent.** The Parties each agree that Escrow Agent will not be liable to either of the Parties for any act or omission hereunder or any matter or thing arising out of its conduct hereunder, except for Escrow Agent's willful misconduct or gross negligence. Escrow Agent will have no liability of any kind with respect to the Deposit other than to hold, invest (if so provided in Section 2.1.2 above) and release the Deposit or otherwise proceed in accordance with the terms of this Escrow Agreement.

3.10 **Indemnification.** The Parties, jointly and severally, agree to indemnify and hold harmless Escrow Agent from and against any and all costs including its attorney's fees, claims or damages howsoever occasioned that may be incurred by Escrow Agent acting under this Escrow Agreement or to which Escrow Agent may be put in connection with Escrow Agent acting under this Escrow Agreement, except for costs, claims or damages arising out of Escrow Agent's willful misconduct or gross negligence. Following thirty days' notice to each of the Parties, Escrow Agent may charge against the Deposit any amounts still owed to Escrow Agent and may withhold payment of the Deposit as security for any unliquidated claim.

3.11 **Fees of Escrow Agent.** As payment in full for the service to be rendered by Escrow Agent hereunder,_____will timely pay to Escrow Agent the fees payable in accordance with Schedule A attached hereto._____agrees to reimburse Escrow Agent for all reasonable expenses, disbursements and advances incurred or made by Escrow Agent in the performance of its duties hereunder (including reasonable fees, expenses and disbursements of its counsel). It is understood that Escrow Agent's fee schedule may be adjusted, upon thirty days' notice to each of the Parties, from time to time to conform with its then current guidelines.

3.12 **No Obligation to Use Funds.** The Escrow Agent will not be required to use its own funds in the performance of any of its obligations or duties or the exercise of any of its rights or powers, and will not be required to take any action which in Escrow Agent's reasonable judgment would cause it to incur expense or liability unless furnished with security and indemnity which it reasonably deems to be satisfactory.

3.13 **No Representations.** The Escrow Agent makes no representation as to the sufficiency, validity or value of the Deposit or the sufficiency or validity of this Escrow Agreement or any other instrument referred to herein, or as to the correctness of any statement contained herein or therein, except Escrow Agent represents that this Escrow Agreement is binding on Escrow Agent and enforceable against it in accordance with its terms.

3.14 **Bond.** No bond will be required of the Escrow Agent.

3.15 **Notices.** All notices, demands, requests, consents or approvals and other communications required or permitted hereunder will be in writing, and, to the extent required by applicable law, will comply with the requirements of the Uniform Commercial Code then in effect, and will be addressed to such party at the address set forth below or to such other address as any party may give to the other in writing for such purpose:

IF TO _____

_____

_____

Attn: _____

WITH A COPY TO _____

_____

_____

Attn: _____

IF TO _____

_____

_____

Attn: _____

WITH A COPY TO _____

_____

_____

Attn: _____

IF TO ESCROW AGENT YELLOW CARDINAL ADVISORY GROUP

125 3rd Street

Columbus, IN 47201

Attn: Lynda Garber, CTFA, Fiduciary Officer

All such communications, if personally delivered, will be conclusively deemed to have been received by a party hereto and to be effective when so delivered; if given by mail, on the fourth business day after such communication is deposited in the mail with first-class postage prepaid, return receipt requested; or if sent by overnight courier service, on the day after deposit thereof with such service; or if sent by certified or registered mail, on the third business day after the day on which deposited in the mail.

3.16 **Modification.** This Escrow Agreement will be mutually binding on all parties and may not be modified or amended orally, but only by a writing signed by all parties hereto.

3.17 **Headings.** The headings contained in this Escrow Agreement are for reference purposes only and will not affect the meaning or interpretation of such instruments.

3.18 **Amendments and Modifications.** This Escrow Agreement may be amended, modified, superseded, cancelled, renewed or extended and the terms or covenants hereof may be waived only by a written instrument executed by all the parties hereto.

3.19 **Entire Agreement.** This Escrow Agreement contains the entire agreement between the parties with respect to the escrow transaction contemplated herein and may not be changed or terminated orally.

3.20 **Governing Law.** This Escrow Agreement will be governed by and construed in accordance with the laws of the State of Indiana, without regard to conflict of law principles.

3.21 **Jurisdiction.** The Parties hereby irrevocably submit to the jurisdiction of the state court or federal district court having jurisdiction in Monroe County, Indiana, or by written consent of the parties, any state or federal court(s) located within any other county, state or jurisdiction where Escrow Agent is located, in any action or proceeding arising out of or relating to this Escrow Agreement and the parties hereto irrevocably agree that all claims with respect to such action or proceeding will be heard and determined in such federal court.

3.22 **Binding Nature; No Third Party Beneficiaries; Assignment.** This Escrow Agreement will be binding upon and inure solely to the benefit of the parties hereto and their respective heirs, administrators, successors and assigns, and will not be enforceable by or inure to

the benefit of any third party, except any successor escrow agent. No party may assign any of its rights or obligations under this Escrow Agreement without the written consent of the other parties, except that either of the Parties may assign its rights and obligations hereunder in connection with a permitted assignment of its rights and obligations under the Agreement in which case any signatures required hereunder will be those of such assignee.

3.23 **Counterparts.** This Escrow Agreement may be executed in any number of counterparts and by different parties hereto in separate counterparts, each of which when so executed will be deemed to be an original and all of which taken together will constitute one and the same agreement. Any party so executing this Agreement by facsimile transmission shall promptly deliver a manually executed counterpart, provided that any failure to do so shall not affect the validity of the counterpart executed by facsimile transmission.

ESCROW AGENT:

YELLOW CARDINAL ADVISORY GROUP

By:_____

Name:_____

Title: _____

ESCROW PARTIES:

CONTRACTOR

By:_____

Name:_____

Title: _____

CITY OF BLOOMINGTON

By:_____

Name:_____

Title: _____

By:_____

Name:_____

Title: _____

Reviewed and Approved By:

_____

Jeffery Underwood, Controller

EXHIBIT A
(FORM OF PAYMENT CERTIFICATE)
[DATE]

_____
_____
_____
_____

Attn: _____

Ladies and Gentlemen:

Pursuant to that certain Escrow Agreement dated as of_____, 20_by and among you as Escrow Agent and the undersigned (the "Escrow Agreement"), the undersigned hereby jointly notify and instruct you to wire transfer the balance in the Escrow Account as follows:

The Net Deposit:
Bank:_____
ABA Wire Number: _____
In the account of: _____
Reference: _____

Interest on the Deposit:
Bank: _____
ABA Wire Number: _____
In the account of: _____
Reference: _____

The undersigned, in consideration of the release of funds being held by Escrow Agent, and other good and valuable consideration, receipt of which is hereby acknowledged, hereby releases, acquits and forever discharges the Escrow Agent, and it employees, officers, directors, agents, accountants, attorneys and parent companies, and all direct directors, agents, accounts and attorneys of such parent companies and all employees, officers, and heirs, executors, administrators, successors and assigns of all of the foregoing, jointly and severally (collectively, the "Bank Parties"), of and from all and any manner of action, actions, cause and causes of action, suits, debts, dues, sums of money, accounts, bonds, bills, covenants, contracts, agreements, promises, obligations, defenses, offsets, counterclaims, damages, judgments, claims, demands and liabilities of any kind or character whatsoever, known or unknown, suspected or unsuspected, in contract or in tort, in law or in equity, that any one or more of the undersigned had, have, may have or may in the future have against any one or more of the Bank Parties arising out of, for or by reason of or resulting from or in any way related, directly or indirectly, to the Escrow Agreement. In addition, the undersigned, jointly and severally, agree not to commence, aid, cause, permit, join in, prosecute or participate in any suit or other proceeding in a position which is adverse to any of the Bank Parties, which suit or proceeding arises from or relates to, in whole or in part, directly or indirectly, any of the foregoing matters.

Sincerely,

THE ESCROW PARTIES:

By: _____
Name: _____
Title: _____

By:_____
Name:_____
Title: _____

SCHEDULE A

ESCROW FEE SCHEDULE

Escrow Agreement dated_____, 20___, between _____ _____,_____, and_____.

The Escrow Agent will receive the following fee pursuant to the Yellow Cardinal Advisory Group published schedule, enclosed.

yellow CARDINAL GROUP ADVISORY | a first financial company

Schedule of Fees
Escrow Account

For normal services of Firsl Financial Bank dbo Yellow Cardinal Advisory Group ("Yellow Cardinal") as Escrow Agenl Under Agreemcnl, Yellow Cardinal's fees are based on iniliol market value, as determined by Yellow Cardinal. Separate charges and fees may apply for addilional escrow lronsactions. **Fees arc charged lo lhe ccounl or billed lo lhe client. Fees ore as follows:**

Market Value Fee *			Escrow Transaction Fee *	
Account Value	*Number of Transactions*	*Annual Fee*	*Transactions*	*Annual Fee*
<$1,000,000	1 per month	$500	1 per month	No charge
$1,000,001-$5,000,000	1 per month	$1000	2-4 per month	$500
$5,000,001- $10,000,000	1 per month	$1500	5-7 per month	$1,000
$ I 0,000,00 I - $20,000,000	1 per month	$2000	8- 10 per month	$1,500
> $20,000,001	I per month	TBD	> I I per month	TBD

* **The City of Bloomington Escrow accounts will be charged a flat fee of $100.00 per account, per year.**

The Mulual Fund Compensolion Disclosure and the relevant muluol fund prospecluses conlain informalion regarding mulual fund fees and expenses and campensalion which may be paid lo Yellow Cardinal for services provided to cerlain muluol funds. You may obloin lhe Muluol Fund Compensation Disclosure and prospectuses from your account **representative.**

First Financial Wealth Management ulilizes a firsl Financial Bonk sponsored money markel sweep deposil account as the primary sweep vehicle for this account. This sweep vehicle will not be subiecl lo redemption fees or suspended withdrawals.

Terminalian Fees

Upon closing account and distribution of property, escrow agency may charge a reasonable termination fee.

Tax Reporting

An occounl will be charged for the preparation of federal and state income lox docurnenls as required by low.

Addilionol tnlormotion

Olher out-of-pockel expenses moy be charged lo the account, if and when incurred, which may include but are not limited to, the following:

- Regislered mail services;
- Courier delivery services;
- Unusual or complicated asset re-registration;
- Unusual or complicated asset transfers;
- Excessive statement reproduction requests; or,
- Olher extraordinary demands;
- Wire fees; and
- Legal fees as incurred.

COMMENTS: The City of Bloomington Escrow accounts will be charged a flat fee of $100.00 per account, per year.

Client will be advised of any revisions to this schedule June 2022

fIRST
first financial bank

Form #8558

Beneficial Ownership Certification Form -1-2021

GENERAL INSTRUCTIONS

What is this form?

To help the government fight financial crime, Federal regulation requires certain financial institutions to obtain, verify, and record information about the beneficial owners of legal entity customers. Legal entities can be abused to disguise involvement in terrorist financing, money laundering, tax evasion, corruption, fraud, and other financial crimes. Requiring the disclosure of key individuals who own or control a legal entity (i.e., the beneficial owners) helps law enforcement investigate and prosecute these crimes.

Who has to complete this form?

This form must be completed by the person opening a new account on behalf of a legal entity with any of the following U.S. financial institutions: (i) a bank or credit union; (ii) a broker or dealer in securities; (iii) a mutual fund; (iv) a futures commission merchant; or (v) an introducing broker in commodities.

For the purposes of this form, a legal entity includes a corporation, limited liability company, or other entity that is created by a filing of a public document with a Secretary of State or similar office, a general partnership, and any similar business entity formed in the United States or a foreign country. Legal entity does not include sole proprietorships, unincorporated associations, or natural persons opening accounts on their own behalf.

What information do I have to provide?

This form requires you to provide the name, address, date of birth and Social Security number (or passport number or other similar information, in the case of Non-U.S. Persons) for the following individuals (i.e., the beneficial owners):

i. Each individual, if any, who owns, directly or indirectly, 25 percent or more of the equity interests of the legal entity customer (e.g., each natural person that owns 25 percent or more of the shares of a corporation).

and

ii. An individual with significant responsibility for managing the legal entity customer (e.g., a Chief Executive Officer, Chief Financial Officer, Chief Operating Officer, Managing Member, General Partner, President, Vice President, or Treasurer).

The number of individuals that satisfy this definition of “beneficial owner” may vary. Under section (i), depending on the factual circumstances, up to four individuals (but as few as zero) may need to be identified. Regardless of the number of individuals identified under section (i), you must provide the identifying information of one individual under section (ii). It is possible that in some circumstances the same individual might be identified under both sections (e.g., the President of Acme, Inc. who also holds a 30 percent equity interest). Thus, a completed form will contain the identifying information of at least one individual (under section (ii)), and up to five individuals (i.e., one individual under section (ii) and four 25 percent equity holders under section (i)). The financial institution may also ask to see a copy of a driver’s license or other identifying document for each beneficial owner listed on this form.

Form

Beneficial Ownership Certification Form - 1-2021

CERTIFICATION OF BENEFICIAL OWNER(S)

(Check One) ☐ **New Customer** ☐ **Existing Customer** ☐ **Triggering Event**

Persons opening an account on behalf of a legal entity must provide the following information:

a. Name and Title of Natural Person Opening Account:

b. Name, Type, and Address of Legal Entity for Which the Account is Being Opened:

c. The following information for each individual, if any, who, directly or indirectly, through any contract, arrangement, understanding, relationship or otherwise, owns 25 percent or more of the equity interests of the legal entity listed above:

Name	Date of Birth	Home Address	For U.S. Persons: Social Security Number	For Non-U.S. Persons: Social Security Number, Passport Number and Country of Issuance, or other similar identification number[1]	Ownership Percentage

Version #:1

NOTE: Use this document's electronic form to clarify any discrepancies as it is the most accurate.

(If no individual meets this definition, please write "Not Applicable.")

(Nonprofit Corporations only complete Part d.)

[1] In lieu of a passport number, Non-U.S. persons may also provide a Social Security Number, an alien identification card number, or number and country of issuance of any other government-issued document evidencing nationality or residence and bearing a photograph or similar safeguard.

d. The following information for one individual with significant responsibility for managing the legal entity listed above, such as:
   a. An executive officer or senior manager (e.g., Chief Executive Officer, Chief Financial Officer, Chief Operating Officer, Managing Member, General Partner, President, Vice President, Treasurer); or
   b. Any other individual who regularly performs similar functions. (If appropriate, an individual listed under section (c) above may also be listed in this section (d)).

Name / Title	Date of Birth	Address (Residential or Business Street Address)	For U.S. Persons: Social Security Number	For Non-U.S. Persons: Social Security Number, Passport Number and Country of Issuance, or other similar identification number[1]

[1] In lieu of a passport number, Non-U.S. persons may also provide a Social Security Number, an alien identification card number, or number and country of issuance of any other government-issued document evidencing nationality or residence and bearing a photograph or similar safeguard.

I, _____ (*name of natural person opening account*), hereby certify, to the best of my knowledge, that the information provided above is complete and correct.

Signature: _____ Date: _____

Legal Entity Identifier: _____ (Optional)

Beneficial Ownership Certification Form - 1-2021

For Institution Use Only:

	Type of Document	**Document ID Number**	**Place of Issuance**	**Date of Issuance**	**Expiration Date**
Owner 1					
Owner 2					
Owner 3					
Owner 4					
Control Person					

Verified By:_ _____Date: _ _____

NOTE: Use this document's electronic form to clarify any discrepancies as it is the most accurate.

EJCDC
ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

PERFORMANCE BOND

CONTRACTOR *(name and address)*:

SURETY *(name and address of principal place of business)*:

OWNER *(name and address)*:

CONSTRUCTION CONTRACT
Effective Date of the Agreement:
Amount:
Description *(name and location)*:

BOND
Bond Number:
Date *(not earlier than the Effective Date of the Agreement of the Construction Contract)*:
Amount:
Modifications to this Bond Form: ☐ None ☐ See Paragraph 16

Surety and Contractor, intending to be legally bound hereby, subject to the terms set forth below, do each cause this Performance Bond to be duly executed by an authorized officer, agent, or representative.

CONTRACTOR AS PRINCIPAL

_____ *(seal)*
Contractor's Name and Corporate Seal

By: _____
Signature

_____
Print Name

_____
Title

Attest: _____
Signature

_____
Title

SURETY

_____ *(seal)*
Surety's Name and Corporate Seal

By: _____
Signature *(attach power of attorney)*

_____
Print Name

_____
Title

Attest: _____
Signature

_____
Title

Notes: (1) Provide supplemental execution by any additional parties, such as joint venturers. (2) Any singular reference to Contractor, Surety, Owner, or other party shall be considered plural where applicable.

1. The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to the Owner for the performance of the Construction Contract, which is incorporated herein by reference.

2. If the Contractor performs the Construction Contract, the Surety and the Contractor shall have no obligation under this Bond, except when applicable to participate in a conference as provided in Paragraph 3.

3. If there is no Owner Default under the Construction Contract, the Surety's obligation under this Bond shall arise after:

3.1 The Owner first provides notice to the Contractor and the Surety that the Owner is considering declaring a Contractor Default. Such notice shall indicate whether the Owner is requesting a conference among the Owner, Contractor, and Surety to discuss the Contractor's performance. If the Owner does not request a conference, the Surety may, within five (5) business days after receipt of the Owner's notice, request such a conference. If the Surety timely requests a conference, the Owner shall attend. Unless the Owner agrees otherwise, any conference requested under this Paragraph 3.1 shall be held within ten (10) business days of the Surety's receipt of the Owner's notice. If the Owner, the Contractor, and the Surety agree, the Contractor shall be allowed a reasonable time to perform the Construction Contract, but such an agreement shall not waive the Owner's right, if any, subsequently to declare a Contractor Default;

3.2 The Owner declares a Contractor Default, terminates the Construction Contract and notifies the Surety; and

3.3 The Owner has agreed to pay the Balance of the Contract Price in accordance with the terms of the Construction Contract to the Surety or to a contractor selected to perform the Construction Contract.

4. Failure on the part of the Owner to comply with the notice requirement in Paragraph 3.1 shall not constitute a failure to comply with a condition precedent to the Surety's obligations, or release the Surety from its obligations, except to the extent the Surety demonstrates actual prejudice.

5. When the Owner has satisfied the conditions of Paragraph 3, the Surety shall promptly and at the Surety's expense take one of the following actions:

5.1 Arrange for the Contractor, with the consent of the Owner, to perform and complete the Construction Contract;

5.2 Undertake to perform and complete the Construction Contract itself, through its agents or independent contractors;

5.3 Obtain bids or negotiated proposals from qualified contractors acceptable to the Owner for a contract for performance and completion of the Construction Contract, arrange for a contract to be prepared for execution by the Owner and a contractor selected with the Owners concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Construction Contract, and pay to the Owner the amount of damages as described in Paragraph 7 in excess of the Balance of the Contract Price incurred by the Owner as a result of the Contractor Default; or

5.4 Waive its right to perform and complete, arrange for completion, or obtain a new contractor, and with reasonable promptness under the circumstances:

5.4.1 After investigation, determine the amount for which it may be liable to the Owner and, as soon as practicable after the amount is determined, make payment to the Owner; or

5.4.2 Deny liability in whole or in part and notify the Owner, citing the reasons for denial.

6. If the Surety does not proceed as provided in Paragraph 5 with reasonable promptness, the Surety shall be deemed to be in default on this Bond seven days after receipt of an additional written notice from the Owner to the Surety demanding that the Surety perform its obligations under this Bond, and the Owner shall be entitled to enforce any remedy available to the Owner. If the Surety proceeds as provided in Paragraph 5.4, and the Owner refuses the payment or the Surety has denied liability, in whole or in part, without further notice the Owner shall be entitled to enforce any remedy available to the Owner.

7. If the Surety elects to act under Paragraph 5.1, 5.2, or 5.3, then the responsibilities of the Surety to the Owner shall not be greater than those of the Contractor under the Construction Contract, and the responsibilities of the Owner to the Surety shall not be greater than those of the Owner under the Construction Contract. Subject to the commitment by the Owner to pay the Balance of the Contract Price, the Surety is obligated, without duplication for:

7.1 the responsibilities of the Contractor for correction of defective work and completion of the Construction Contract;

7.2 additional legal, design professional, and delay costs resulting from the Contractor's Default, and resulting from the actions or failure to act of the Surety under Paragraph 5; and

7.3 liquidated damages, or if no liquidated damages are specified in the Construction Contract, actual damages caused by delayed performance or non-performance of the Contractor.

8. If the Surety elects to act under Paragraph 5.1, 5.3, or 5.4, the Surety's liability is limited to the amount of this Bond.

9. The Surety shall not be liable to the Owner or others for obligations of the Contractor that are unrelated to the Construction Contract, and the Balance of the Contract Price shall not be reduced

or set off on account of any such unrelated obligations. No right of action shall accrue on this Bond to any person or entity other than the Owner or its heirs, executors, administrators, successors, and assigns.

10. The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders, and other obligations.

11. Any proceeding, legal or equitable, under this Bond may be instituted in any court of competent jurisdiction in the location in which the work or part of the work is located and shall be instituted within two years after a declaration of Contractor Default or within two years after the Contractor ceased working or within two years after the Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this paragraph are void or prohibited by law, the minimum periods of limitations available to sureties as a defense in the jurisdiction of the suit shall be applicable.

12. Notice to the Surety, the Owner, or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears.

13. When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

14. Definitions

14.1 Balance of the Contract Price: The total amount payable by the Owner to the Contractor under the Construction Contract after all proper adjustments have been made including allowance for the Contractor for any amounts received or to be received by the Owner in settlement of insurance or other claims for damages to which the Contractor is entitled, reduced by all valid and proper payments made to or on behalf of the Contractor under the Construction Contract.

14.2 Construction Contract: The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and changes made to the agreement and the Contract Documents.

14.3 Contractor Default: Failure of the Contractor, which has not been remedied or waived, to perform or otherwise to comply with a material term of the Construction Contract.

14.4 Owner Default: Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

14.5 Contract Documents: All the documents that comprise the agreement between the Owner and Contractor.

15. If this Bond is issued for an agreement between a contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

16. Modifications to this Bond are as follows:

EJCDC
ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

PAYMENT BOND

CONTRACTOR *(name and address)*:

SURETY *(name and address of principal place of business)*:

OWNER *(name and address)*:

CONSTRUCTION CONTRACT

Effective Date of the Agreement:
Amount:
Description *(name and location)*:

BOND

Bond Number:
Date *(not earlier than the Effective Date of the Agreement of the Construction Contract)*:
Amount:
Modifications to this Bond Form: ☐ None ☐ See Paragraph 18

Surety and Contractor, intending to be legally bound hereby, subject to the terms set forth below, do each cause this Payment Bond to be duly executed by an authorized officer, agent, or representative.

CONTRACTOR AS PRINCIPAL	**SURETY**
_____ *(seal)*	_____ *(seal)*
Contractor's Name and Corporate Seal	Surety's Name and Corporate Seal
By: _____	**By:** _____
Signature	Signature *(attach power of attorney)*
_____	_____
Print Name	Print Name
_____	_____
Title	Title
Attest: _____	**Attest:** _____
Signature	Signature
_____	_____
Title	Title

Notes: (1) Provide supplemental execution by any additional parties, such as joint venturers. (2) Any singular reference to Contractor, Surety, Owner, or other party shall be considered plural where applicable.

1. The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to the Owner to pay for labor, materials, and equipment furnished for use in the performance of the Construction Contract, which is incorporated herein by reference, subject to the following terms.

2. If the Contractor promptly makes payment of all sums due to Claimants, and defends, indemnifies, and holds harmless the Owner from claims, demands, liens, or suits by any person or entity seeking payment for labor, materials, or equipment furnished for use in the performance of the Construction Contract, then the Surety and the Contractor shall have no obligation under this Bond.

3. If there is no Owner Default under the Construction Contract, the Surety's obligation to the Owner under this Bond shall arise after the Owner has promptly notified the Contractor and the Surety (at the address described in Paragraph 13) of claims, demands, liens, or suits against the Owner or the Owner's property by any person or entity seeking payment for labor, materials, or equipment furnished for use in the performance of the Construction Contract, and tendered defense of such claims, demands, liens, or suits to the Contractor and the Surety.

4. When the Owner has satisfied the conditions in Paragraph 3, the Surety shall promptly and at the Surety's expense defend, indemnify, and hold harmless the Owner against a duly tendered claim, demand, lien, or suit.

5. The Surety's obligations to a Claimant under this Bond shall arise after the following:

   5.1 Claimants who do not have a direct contract with the Contractor,

      5.1.1 have furnished a written notice of non-payment to the Contractor, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were, or equipment was, furnished or supplied or for whom the labor was done or performed, within ninety (90) days after having last performed labor or last furnished materials or equipment included in the Claim; and

      5.1.2 have sent a Claim to the Surety (at the address described in Paragraph 13).

   5.2 Claimants who are employed by or have a direct contract with the Contractor have sent a Claim to the Surety (at the address described in Paragraph 13).

6. If a notice of non-payment required by Paragraph 5.1.1 is given by the Owner to the Contractor, that is sufficient to satisfy a Claimant's obligation to furnish a written notice of non-payment under Paragraph 5.1.1.

7. When a Claimant has satisfied the conditions of Paragraph 5.1 or 5.2, whichever is applicable, the Surety shall promptly and at the Surety's expense take the following actions:

   7.1 Send an answer to the Claimant, with a copy to the Owner, within sixty (60) days after receipt of the Claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed; and

   7.2 Pay or arrange for payment of any undisputed amounts.

   7.3 The Surety's failure to discharge its obligations under Paragraph 7.1 or 7.2 shall not be deemed to constitute a waiver of defenses the Surety or Contractor may have or acquire as to a Claim, except as to undisputed amounts for which the Surety and Claimant have reached agreement. If, however, the Surety fails to discharge its obligations under Paragraph 7.1 or 7.2, the Surety shall indemnify the Claimant for the reasonable attorney's fees the Claimant incurs thereafter to recover any sums found to be due and owing to the Claimant.

8. The Surety's total obligation shall not exceed the amount of this Bond, plus the amount of reasonable attorney's fees provided under Paragraph 7.3, and the amount of this Bond shall be credited for any payments made in good faith by the Surety.

9. Amounts owed by the Owner to the Contractor under the Construction Contract shall be used for the performance of the Construction Contract and to satisfy claims, if any, under any construction performance bond. By the Contractor furnishing and the Owner accepting this Bond, they agree that all funds earned by the Contractor in the performance of the Construction Contract are dedicated to satisfy obligations of the Contractor and Surety under this Bond, subject to the Owner's priority to use the funds for the completion of the work.

10. The Surety shall not be liable to the Owner, Claimants, or others for obligations of the Contractor that are unrelated to the Construction Contract. The Owner shall not be liable for the payment of any costs or expenses of any Claimant under this Bond, and shall have under this Bond no obligation to make payments to or give notice on behalf of Claimants, or otherwise have any obligations to Claimants under this Bond.

11. The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders, and other obligations.

12. No suit or action shall be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the state in which the project that is the subject of the Construction Contract is located or after the expiration of one year from the date (1) on which the Claimant sent a Claim to the Surety pursuant to Paragraph 5.1.2 or 5.2, or (2) on which the last labor or service was performed by anyone or the last materials or equipment were furnished by anyone under the Construction Contract, whichever of (1) or (2) first occurs. If the provisions of this paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

13. Notice and Claims to the Surety, the Owner, or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears. Actual receipt of notice or Claims, however accomplished, shall be sufficient compliance as of the date received.

14. When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

15. Upon requests by any person or entity appearing to be a potential beneficiary of this Bond, the Contractor and Owner shall promptly furnish a copy of this Bond or shall permit a copy to be made.

16. **Definitions**

    16.1 **Claim:** A written statement by the Claimant including at a minimum:

        1. The name of the Claimant;
        2. The name of the person for whom the labor was done, or materials or equipment furnished;
        3. A copy of the agreement or purchase order pursuant to which labor, materials, or equipment was furnished for use in the performance of the Construction Contract;
        4. A brief description of the labor, materials, or equipment furnished;
        5. The date on which the Claimant last performed labor or last furnished materials or equipment for use in the performance of the Construction Contract;
        6. The total amount earned by the Claimant for labor, materials, or equipment furnished as of the date of the Claim;
        7. The total amount of previous payments received by the Claimant; and
        8. The total amount due and unpaid to the Claimant for labor, materials, or equipment furnished as of the date of the Claim.

    16.2 **Claimant:** An individual or entity having a direct contract with the Contractor or with a subcontractor of the Contractor to furnish labor, materials, or equipment for use in the performance of the Construction Contract. The term Claimant also includes any individual or entity that has rightfully asserted a claim under an applicable mechanic's lien or similar statute against the real property upon which the Project is located. The intent of this Bond shall be to include without limitation in the terms of "labor, materials, or equipment" that part of the water, gas, power, light, heat, oil, gasoline, telephone service, or rental equipment used in the Construction Contract, architectural and engineering services required for performance of the work of the Contractor and the Contractor's subcontractors, and all other items for which a mechanic's lien may be asserted in the jurisdiction where the labor, materials, or equipment were furnished.

    16.3 **Construction Contract:** The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and all changes made to the agreement and the Contract Documents.

    16.4 **Owner Default**: Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

    16.5 **Contract Documents:** All the documents that comprise the agreement between the Owner and Contractor.

17. If this Bond is issued for an agreement between a contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

18. Modifications to this Bond are as follows:

EJCDC
ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

NOTICE TO PROCEED

Owner:	Owner's Contract No.:
Contractor:	Contractor's Project No.:
Engineer:	Engineer's Project No.:
Project:	Contract Name:
	Effective Date of Contract:

TO CONTRACTOR:

Owner hereby notifies Contractor that the Contract Times under the above Contract will commence to run on [_____, 20__]. *[see Paragraph 4.01 of the General Conditions]*

On that date, Contractor shall start performing its obligations under the Contract Documents. No Work shall be done at the Site prior to such date. In accordance with the Agreement, [the date of Substantial Completion is _____, and the date of readiness for final payment is_____] ***or*** [the number of days to achieve Substantial Completion is _____, and the number of days to achieve readiness for final payment is _____].

Before starting any Work at the Site, Contractor must comply with the following:
[Note any access limitations, security procedures, or other restrictions]

Owner**:**

Authorized Signature

By:

Title:

Date Issued:

Copy: Engineer

FTM NO. 000

WESSLER ENGINEERING, INC.
BLOOMINGTON BLUCHER POOLE WWTF SCADA IMPROVEMENTS
FIELD TRANSMITTAL MEMORANDUM

CONTRACTOR

MONTH	DAY	YEAR

SUBJECT:

REFERENCE:

---

cc: Owner
Wessler RPR
Wessler Project Manager
Wessler File

WESSLER ENGINEERING, INC.

By
Name: Title:

EJCDC
ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

Change Order No. _____

Date of Issuance:	Effective Date:
Owner:	Owner's Contract No.:
Contractor:	Contractor's Project No.:
Engineer:	Engineer's Project No.:
Project:	Contract Name:

The Contract is modified as follows upon execution of this Change Order:

Description:

Attachments: *[List documents supporting change]*

CHANGE IN CONTRACT PRICE	**CHANGE IN CONTRACT TIMES** *[note changes in Milestones if applicable]*
Original Contract Price: $_____	Original Contract Times: Substantial Completion: _____ Ready for Final Payment: _____ days or dates
[Increase] [Decrease] from previously approved Change Orders No. ___ to No. ___: $_____	[Increase] [Decrease] from previously approved Change Orders No. ___ to No. ___: Substantial Completion: _____ Ready for Final Payment: _____ days
Contract Price prior to this Change Order: $_____	Contract Times prior to this Change Order: Substantial Completion: _____ Ready for Final Payment: _____ days or dates
[Increase] [Decrease] of this Change Order: $_____	[Increase] [Decrease] of this Change Order: Substantial Completion: _____ Ready for Final Payment: _____ days or dates
Contract Price incorporating this Change Order: $_____	Contract Times with all approved Change Orders: Substantial Completion: _____ Ready for Final Payment: _____ days or dates

RECOMMENDED:	ACCEPTED:	ACCEPTED:
By: _____	By: _____	By: _____
Engineer (if required)	Owner (Authorized Signature)	Contractor (Authorized Signature)
Title: _____	Title _____	Title _____
Date: _____	Date _____	Date _____

Approved by Funding Agency (if applicable)

By: _____ Date:

Title: _____

EJCDC
ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

CERTIFICATE OF SUBSTANTIAL COMPLETION

Owner:	Owner's Contract No.:
Contractor:	Contractor's Project No.:
Engineer:	Engineer's Project No.:
Project:	Contract Name:

This [preliminary] [final] Certificate of Substantial Completion applies to:

☐ All Work ☐ The following specified portions of the Work:

Date of Substantial Completion

The Work to which this Certificate applies has been inspected by authorized representatives of Owner, Contractor, and Engineer, and found to be substantially complete. The Date of Substantial Completion of the Work or portion thereof designated above is hereby established, subject to the provisions of the Contract pertaining to Substantial Completion. The date of Substantial Completion in the final Certificate of Substantial Completion marks the commencement of the contractual correction period and applicable warranties required by the Contract.

A punch list of items to be completed or corrected is attached to this Certificate. This list may not be all-inclusive, and the failure to include any items on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract.

The responsibilities between Owner and Contractor for security, operation, safety, maintenance, heat, utilities, insurance, and warranties upon Owner's use or occupancy of the Work shall be as provided in the Contract, except as amended as follows: *[Note: Amendments of contractual responsibilities recorded in this Certificate should be the product of mutual agreement of Owner and Contractor; see Paragraph 15.03.D of the General Conditions.]*

Amendments to Owner's responsibilities: ☐ None ☐ As follows

Amendments to Contractor's responsibilities: ☐ None ☐ As follows:

The following documents are attached to and made a part of this Certificate: *[punch list; others]*

This Certificate does not constitute an acceptance of Work not in accordance with the Contract Documents, nor is it a release of Contractor's obligation to complete the Work in accordance with the Contract.

EXECUTED BY ENGINEER:	RECEIVED:	RECEIVED:
By: _____ (Authorized signature)	By: _____ Owner (Authorized Signature)	By: _____ Contractor (Authorized Signature)
Title: _____	Title: _____	Title: _____
Date: _____	Date: _____	Date: _____

This document has important legal consequences; consultation with an attorney is encouraged with respect to its use or modification. This document should be adapted to the particular circumstances of the contemplated Project and the controlling Laws and Regulations.

STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

Prepared by

EJCDC®
ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

Issued and Published Jointly by

ACEC
AMERICAN COUNCIL OF ENGINEERING COMPANIES

ASCE
AMERICAN SOCIETY OF CIVIL ENGINEERS

National Society of Professional Engineers®

Endorsed by

CSI NUCA
REPRESENTING UTILITY & EXCAVATION CONTRACTORS

These General Conditions have been prepared for use with the Agreement Between Owner and Contractor for Construction Contract (EJCDC® C-520, Stipulated Sum, or C-525, Cost-Plus, 2013 Editions). Their provisions are interrelated and a change in one may necessitate a change in the other.

To prepare supplementary conditions that are coordinated with the General Conditions, use EJCDC's Guide to the Preparation of Supplementary Conditions (EJCDC® C-800, 2013 Edition). The full EJCDC Construction series of documents is discussed in the Commentary on the 2013 EJCDC Construction Documents (EJCDC® C-001, 2013 Edition).

National Society of Professional Engineers

1420 King Street, Alexandria, VA 22314-2794

(703) 684-2882

www.nspe.org

American Council of Engineering Companies

1015 15th Street N.W., Washington, DC 20005

(202) 347-7474

www.acec.org

American Society of Civil Engineers

1801 Alexander Bell Drive, Reston, VA 20191-4400

(800) 548-2723

www.asce.org

NOTE: EJCDC publications may be purchased at www.ejcdc.org, or from any of the sponsoring organizations above.

STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

TABLE OF CONTENTS

ARTICLE 1 – DEFINITIONS AND TERMINOLOGY

1.01 *Defined Terms*

A. Wherever used in the Bidding Requirements or Contract Documents, a term printed with initial capital letters, including the term's singular and plural forms, will have the meaning indicated in the definitions below. In addition to terms specifically defined, terms with initial capital letters in the Contract Documents include references to identified articles and paragraphs, and the titles of other documents or forms.

1. *Addenda*—Written or graphic instruments issued prior to the opening of Bids which clarify, correct, or change the Bidding Requirements or the proposed Contract Documents.

2. *Agreement*—The written instrument, executed by Owner and Contractor, that sets forth the Contract Price and Contract Times, identifies the parties and the Engineer, and designates the specific items that are Contract Documents.

3. *Application for Payment*—The form acceptable to Engineer which is to be used by Contractor during the course of the Work in requesting progress or final payments and which is to be accompanied by such supporting documentation as is required by the Contract Documents.

4. *Bid*—The offer of a Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.

5. *Bidder*—An individual or entity that submits a Bid to Owner.

6. *Bidding Documents*—The Bidding Requirements, the proposed Contract Documents, and all Addenda.

7. *Bidding Requirements*—The advertisement or invitation to bid, Instructions to Bidders, Bid Bond or other Bid security, if any, the Bid Form, and the Bid with any attachments.

8. *Change Order*—A document which is signed by Contractor and Owner and authorizes an addition, deletion, or revision in the Work or an adjustment in the Contract Price or the Contract Times, or other revision to the Contract, issued on or after the Effective Date of the Contract.

9. *Change Proposal*—A written request by Contractor, duly submitted in compliance with the procedural requirements set forth herein, seeking an adjustment in Contract Price or Contract Times, or both; contesting an initial decision by Engineer concerning the requirements of the Contract Documents or the acceptability of Work under the Contract Documents; challenging a set-off against payments due; or seeking other relief with respect to the terms of the Contract.

10. *Claim*—(a) A demand or assertion by Owner directly to Contractor, duly submitted in compliance with the procedural requirements set forth herein: seeking an adjustment of Contract Price or Contract Times, or both; contesting an initial decision by Engineer concerning the requirements of the Contract Documents or the acceptability of Work under the Contract Documents; contesting Engineer's decision regarding a Change Proposal; seeking resolution of a contractual issue that Engineer has declined to address; or seeking other relief with respect to the terms of the Contract; or (b) a demand or assertion by Contractor directly to Owner, duly submitted in compliance with the procedural requirements set forth herein, contesting Engineer's decision regarding a Change Proposal; or seeking resolution of a contractual issue that Engineer

has declined to address. A demand for money or services by a third party is not a Claim.

11. *Constituent of Concern*—Asbestos, petroleum, radioactive materials, polychlorinated biphenyls (PCBs), hazardous waste, and any substance, product, waste, or other material of any nature whatsoever that is or becomes listed, regulated, or addressed pursuant to (a) the Comprehensive Environmental Response, Compensation and Liability Act, 42 U.S.C. §§9601 et seq. ("CERCLA"); (b) the Hazardous Materials Transportation Act, 49 U.S.C. §§5101 et seq.; (c) the Resource Conservation and Recovery Act, 42 U.S.C. §§6901 et seq. ("RCRA"); (d) the Toxic Substances Control Act, 15 U.S.C. §§2601 et seq.; (e) the Clean Water Act, 33 U.S.C. §§1251 et seq.; (f) the Clean Air Act, 42 U.S.C. §§7401 et seq.; or (g) any other federal, state, or local statute, law, rule, regulation, ordinance, resolution, code, order, or decree regulating, relating to, or imposing liability or standards of conduct concerning, any hazardous, toxic, or dangerous waste, substance, or material.

12. *Contract*—The entire and integrated written contract between the Owner and Contractor concerning the Work.

13. *Contract Documents*—Those items so designated in the Agreement, and which together comprise the Contract.

14. *Contract Price*—The money that Owner has agreed to pay Contractor for completion of the Work in accordance with the Contract Documents. .

15. *Contract Times*—The number of days or the dates by which Contractor shall: (a) achieve Milestones, if any; (b) achieve Substantial Completion; and (c) complete the Work.

16. *Contractor*—The individual or entity with which Owner has contracted for performance of the Work.

17. *Cost of the Work*—See Paragraph 13.01 for definition.

18. *Drawings*—The part of the Contract that graphically shows the scope, extent, and character of the Work to be performed by Contractor.

19. *Effective Date of the Contract*—The date, indicated in the Agreement, on which the Contract becomes effective.

20. *Engineer*—The individual or entity named as such in the Agreement.

21. *Field Order*—A written order issued by Engineer which requires minor changes in the Work but does not change the Contract Price or the Contract Times.

22. *Hazardous Environmental Condition*—The presence at the Site of Constituents of Concern in such quantities or circumstances that may present a danger to persons or property exposed thereto. The presence at the Site of materials that are necessary for the execution of the Work, or that are to be incorporated in the Work, and that are controlled and contained pursuant to industry practices, Laws and Regulations, and the requirements of the Contract, does not establish a Hazardous Environmental Condition.

23. *Laws and Regulations; Laws or Regulations*—Any and all applicable laws, statutes, rules, regulations, ordinances, codes, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.

24. *Liens*—Charges, security interests, or encumbrances upon Contract-related funds, real property, or personal property.

25. *Milestone*—A principal event in the performance of the Work that the Contract requires Contractor to achieve by an intermediate completion date or by a time prior to Substantial Completion of all the Work.

26. *Notice of Award*—The written notice by Owner to a Bidder of Owner's acceptance of the Bid.

27. *Notice to Proceed*—A written notice by Owner to Contractor fixing the date on which the Contract Times will commence to run and on which Contractor shall start to perform the Work.

28. *Owner*—The individual or entity with which Contractor has contracted regarding the Work, and which has agreed to pay Contractor for the performance of the Work, pursuant to the terms of the Contract.

29. *Progress Schedule*—A schedule, prepared and maintained by Contractor, describing the sequence and duration of the activities comprising the Contractor's plan to accomplish the Work within the Contract Times.

30. *Project*—The total undertaking to be accomplished for Owner by engineers, contractors, and others, including planning, study, design, construction, testing, commissioning, and start-up, and of which the Work to be performed under the Contract Documents is a part.

31. *Project Manual*—The written documents prepared for, or made available for, procuring and constructing the Work, including but not limited to the Bidding Documents or other construction procurement documents, geotechnical and existing conditions information, the Agreement, bond forms, General Conditions, Supplementary Conditions, and Specifications. The contents of the Project Manual may be bound in one or more volumes.

32. *Resident Project Representative*—The authorized representative of Engineer assigned to assist Engineer at the Site. As used herein, the term Resident Project Representative or "RPR" includes any assistants or field staff of Resident Project Representative.

33. *Samples*—Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and that establish the standards by which such portion of the Work will be judged.

34. *Schedule of Submittals*—A schedule, prepared and maintained by Contractor, of required submittals and the time requirements for Engineer's review of the submittals and the performance of related construction activities.

35. *Schedule of Values*—A schedule, prepared and maintained by Contractor, allocating portions of the Contract Price to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

36. *Shop Drawings*—All drawings, diagrams, illustrations, schedules, and other data or information that are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work. Shop Drawings, whether approved or not, are not Drawings and are not Contract Documents.

37. *Site*—Lands or areas indicated in the Contract Documents as being furnished by Owner upon which the Work is to be performed, including rights-of-way and easements, and such other lands furnished by Owner which are designated for the use of Contractor.

38. *Specifications*—The part of the Contract that consists of written requirements for materials, equipment, systems, standards, and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable to the Work.

39. *Subcontractor*—An individual or entity having a direct contract with Contractor or with any other Subcontractor for the performance of a part of the Work.

40. *Substantial Completion*—The time at which the Work (or a specified part thereof) has progressed to the point where, in the opinion of Engineer, the Work (or a specified part thereof) is sufficiently complete, in accordance with the Contract Documents, so that the Work (or a specified part thereof) can be utilized for the purposes for which it is intended. The terms "substantially complete" and "substantially completed" as applied to all or part of the Work refer to Substantial Completion thereof.

41. *Successful Bidder*—The Bidder whose Bid the Owner accepts, and to which the Owner makes an award of contract, subject to stated conditions.

42. *Supplementary Conditions*—The part of the Contract that amends or supplements these General Conditions.

43. *Supplier*—A manufacturer, fabricator, supplier, distributor, materialman, or vendor having a direct contract with Contractor or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by Contractor or a Subcontractor.

44. *Technical Data*—Those items expressly identified as Technical Data in the Supplementary Conditions, with respect to either (a) subsurface conditions at the Site, or physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities) or (b) Hazardous Environmental Conditions at the Site. If no such express identifications of Technical Data have been made with respect to conditions at the Site, then the data contained in boring logs, recorded measurements of subsurface water levels, laboratory test results, and other factual, objective information regarding conditions at the Site that are set forth in any geotechnical or environmental report prepared for the Project and made available to Contractor are hereby defined as Technical Data with respect to conditions at the Site under Paragraphs 5.03, 5.04, and 5.06.

45. *Underground Facilities*—All underground pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or attachments, and any encasements containing such facilities, including but not limited to those that convey electricity, gases, steam, liquid petroleum products, telephone or other communications, fiber optic transmissions, cable television, water, wastewater, storm water, other liquids or chemicals, or traffic or other control systems.

46. *Unit Price Work*—Work to be paid for on the basis of unit prices.

47. *Work*—The entire construction or the various separately identifiable parts thereof required to be provided under the Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce such construction; furnishing, installing, and incorporating all materials and equipment into such construction; and may include related services such as testing, start-up, and commissioning, all as required by the Contract Documents.

48. *Work Change Directive*—A written directive to Contractor issued on or after the Effective Date of the Contract, signed by Owner and recommended by Engineer, ordering an addition, deletion, or revision in the Work.

1.02 *Terminology*

A. The words and terms discussed in the following paragraphs are not defined but, when used in the Bidding Requirements or Contract Documents, have the indicated meaning.

B. *Intent of Certain Terms or Adjectives*:

1. The Contract Documents include the terms "as allowed," "as approved," "as ordered," "as directed" or terms of like effect or import to authorize an exercise of professional judgment by Engineer. In addition, the adjectives "reasonable," "suitable," "acceptable," "proper," "satisfactory," or adjectives of like effect or import are used to describe an action or determination of Engineer as to the Work. It is intended that such exercise of professional judgment, action, or determination will be solely to evaluate, in general, the Work for compliance with the information in the Contract Documents and with the design concept of the Project as a functioning whole as shown or indicated in the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective is not intended to and shall not be effective to assign to Engineer any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility contrary to the provisions of Article 10 or any other provision of the Contract Documents.

C. *Day*:

1. The word "day" means a calendar day of 24 hours measured from midnight to the next midnight.

D. *Defective*:

1. The word "defective," when modifying the word "Work," refers to Work that is unsatisfactory, faulty, or deficient in that it:

a. does not conform to the Contract Documents; or

b. does not meet the requirements of any applicable inspection, reference standard, test, or approval referred to in the Contract Documents; or

c. has been damaged prior to Engineer's recommendation of final payment (unless responsibility for the protection thereof has been assumed by Owner at Substantial Completion in accordance with Paragraph 15.03 or 15.04).

E. *Furnish, Install, Perform, Provide*:

1. The word "furnish," when used in connection with services, materials, or equipment, shall mean to supply and deliver said services, materials, or equipment to the Site (or some other specified location) ready for use or installation and in usable or operable condition.

2. The word "install," when used in connection with services, materials, or equipment, shall mean to put into use or place in final position said services, materials, or equipment complete and ready for intended use.

3. The words “perform” or “provide,” when used in connection with services, materials, or equipment, shall mean to furnish and install said services, materials, or equipment complete and ready for intended use.

4. If the Contract Documents establish an obligation of Contractor with respect to specific services, materials, or equipment, but do not expressly use any of the four words “furnish,” “install,” “perform,” or “provide,” then Contractor shall furnish and install said services, materials, or equipment complete and ready for intended use.

F. Unless stated otherwise in the Contract Documents, words or phrases that have a well-known technical or construction industry or trade meaning are used in the Contract Documents in accordance with such recognized meaning.

ARTICLE 2 – PRELIMINARY MATTERS

2.01 *Delivery of Bonds and Evidence of Insurance*

A. *Bonds*: When Contractor delivers the executed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner such bonds as Contractor may be required to furnish.

B. *Evidence of Contractor’s Insurance*: When Contractor delivers the executed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner, with copies to each named insured and additional insured (as identified in the Supplementary Conditions or elsewhere in the Contract), the certificates and other evidence of insurance required to be provided by Contractor in accordance with Article 6.

C. *Evidence of Owner’s Insurance*: After receipt of the executed counterparts of the Agreement and all required bonds and insurance documentation, Owner shall promptly deliver to Contractor, with copies to each named insured and additional insured (as identified in the Supplementary Conditions or otherwise), the certificates and other evidence of insurance required to be provided by Owner under Article 6.

2.02 *Copies of Documents*

A. Owner shall furnish to Contractor four printed copies of the Contract (including one fully executed counterpart of the Agreement), and one copy in electronic portable document format (PDF). Additional printed copies will be furnished upon request at the cost of reproduction.

B. Owner shall maintain and safeguard at least one original printed record version of the Contract, including Drawings and Specifications signed and sealed by Engineer and other design professionals. Owner shall make such original printed record version of the Contract available to Contractor for review. Owner may delegate the responsibilities under this provision to Engineer.

2.03 *Before Starting Construction*

A. *Preliminary Schedules*: Within 10 days after the Effective Date of the Contract (or as otherwise specifically required by the Contract Documents), Contractor shall submit to Engineer for timely review:

1. a preliminary Progress Schedule indicating the times (numbers of days or dates) for starting and completing the various stages of the Work, including any Milestones specified in the Contract;

2. a preliminary Schedule of Submittals; and

3. a preliminary Schedule of Values for all of the Work which includes quantities and prices of items which when added together equal the Contract Price and subdivides the Work into component parts in sufficient detail to serve as the basis for progress payments during performance of the Work. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work.

2.04 *Preconstruction Conference; Designation of Authorized Representatives*

A. Before any Work at the Site is started, a conference attended by Owner, Contractor, Engineer, and others as appropriate will be held to establish a working understanding among the parties as to the Work and to discuss the schedules referred to in Paragraph 2.03.A, procedures for handling Shop Drawings, Samples, and other submittals, processing Applications for Payment, electronic or digital transmittals, and maintaining required records.

B. At this conference Owner and Contractor each shall designate, in writing, a specific individual to act as its authorized representative with respect to the services and responsibilities under the Contract. Such individuals shall have the authority to transmit and receive information, render decisions relative to the Contract, and otherwise act on behalf of each respective party.

2.05 *Initial Acceptance of Schedules*

A. At least 10 days before submission of the first Application for Payment a conference, attended by Contractor, Engineer, and others as appropriate, will be held to review for acceptability to Engineer as provided below the schedules submitted in accordance with Paragraph 2.03.A. Contractor shall have an additional 10 days to make corrections and adjustments and to complete and resubmit the schedules. No progress payment shall be made to Contractor until acceptable schedules are submitted to Engineer.

1. The Progress Schedule will be acceptable to Engineer if it provides an orderly progression of the Work to completion within the Contract Times. Such acceptance will not impose on Engineer responsibility for the Progress Schedule, for sequencing, scheduling, or progress of the Work, nor interfere with or relieve Contractor from Contractor's full responsibility therefor.

2. Contractor's Schedule of Submittals will be acceptable to Engineer if it provides a workable arrangement for reviewing and processing the required submittals.

3. Contractor's Schedule of Values will be acceptable to Engineer as to form and substance if it provides a reasonable allocation of the Contract Price to the component parts of the Work.

2.06 *Electronic Transmittals*

A. Except as otherwise stated elsewhere in the Contract, the Owner, Engineer, and Contractor may transmit, and shall accept, Project-related correspondence, text, data, documents, drawings, information, and graphics, including but not limited to Shop Drawings and other submittals, in electronic media or digital format, either directly, or through access to a secure Project website.

B. If the Contract does not establish protocols for electronic or digital transmittals, then Owner, Engineer, and Contractor shall jointly develop such protocols.

C. When transmitting items in electronic media or digital format, the transmitting party makes no representations as to long term compatibility, usability, or readability of the items resulting from the recipient's use of software application packages, operating systems, or

computer hardware differing from those used in the drafting or transmittal of the items, or from those established in applicable transmittal protocols.

ARTICLE 3 – DOCUMENTS: INTENT, REQUIREMENTS, REUSE

3.01 *Intent*

A. The Contract Documents are complementary; what is required by one is as binding as if required by all.

B. It is the intent of the Contract Documents to describe a functionally complete project (or part thereof) to be constructed in accordance with the Contract Documents.

C. Unless otherwise stated in the Contract Documents, if there is a discrepancy between the electronic or digital versions of the Contract Documents (including any printed copies derived from such electronic or digital versions) and the printed record version, the printed record version shall govern.

D. The Contract supersedes prior negotiations, representations, and agreements, whether written or oral.

E. Engineer will issue clarifications and interpretations of the Contract Documents as provided herein.

3.02 *Reference Standards*

A. Standards Specifications, Codes, Laws and Regulations

1. Reference in the Contract Documents to standard specifications, manuals, reference standards, or codes of any technical society, organization, or association, or to Laws or Regulations, whether such reference be specific or by implication, shall mean the standard specification, manual, reference standard, code, or Laws or Regulations in effect at the time of opening of Bids (or on the Effective Date of the Contract if there were no Bids), except as may be otherwise specifically stated in the Contract Documents.

2. No provision of any such standard specification, manual, reference standard, or code, or any instruction of a Supplier, shall be effective to change the duties or responsibilities of Owner, Contractor, or Engineer, or any of their subcontractors, consultants, agents, or employees, from those set forth in the part of the Contract Documents prepared by or for Engineer. No such provision or instruction shall be effective to assign to Owner, Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, any duty or authority to supervise or direct the performance of the Work or any duty or authority to undertake responsibility inconsistent with the provisions of the part of the Contract Documents prepared by or for Engineer.

3.03 *Reporting and Resolving Discrepancies*

A. *Reporting Discrepancies*:

1. *Contractor's Verification of Figures and Field Measurements*: Before undertaking each part of the Work, Contractor shall carefully study the Contract Documents, and check and verify pertinent figures and dimensions therein, particularly with respect to applicable field measurements. Contractor shall promptly report in writing to Engineer any conflict, error, ambiguity, or discrepancy that Contractor discovers, or has actual knowledge of, and shall not proceed with any Work affected thereby until the conflict,

error, ambiguity, or discrepancy is resolved, by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract Documents issued pursuant to Paragraph 11.01.

2. *Contractor's Review of Contract Documents*: If, before or during the performance of the Work, Contractor discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents, or between the Contract Documents and (a) any applicable Law or Regulation, (b) actual field conditions, (c) any standard specification, manual, reference standard, or code, or (d) any instruction of any Supplier, then Contractor shall promptly report it to Engineer in writing. Contractor shall not proceed with the Work affected thereby (except in an emergency as required by Paragraph 7.15) until the conflict, error, ambiguity, or discrepancy is resolved, by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract Documents issued pursuant to Paragraph 11.01.

3. Contractor shall not be liable to Owner or Engineer for failure to report any conflict, error, ambiguity, or discrepancy in the Contract Documents unless Contractor had actual knowledge thereof.

B. *Resolving Discrepancies*:

1. Except as may be otherwise specifically stated in the Contract Documents, the provisions of the part of the Contract Documents prepared by or for Engineer shall take precedence in resolving any conflict, error, ambiguity, or discrepancy between such provisions of the Contract Documents and:

a. the provisions of any standard specification, manual, reference standard, or code, or the instruction of any Supplier (whether or not specifically incorporated by reference as a Contract Document); or

b. the provisions of any Laws or Regulations applicable to the performance of the Work (unless such an interpretation of the provisions of the Contract Documents would result in violation of such Law or Regulation).

3.04 *Requirements of the Contract Documents*

A. During the performance of the Work and until final payment, Contractor and Owner shall submit to the Engineer all matters in question concerning the requirements of the Contract Documents (sometimes referred to as requests for information or interpretation—RFIs), or relating to the acceptability of the Work under the Contract Documents, as soon as possible after such matters arise. Engineer will be the initial interpreter of the requirements of the Contract Documents, and judge of the acceptability of the Work thereunder.

B. Engineer will, with reasonable promptness, render a written clarification, interpretation, or decision on the issue submitted, or initiate an amendment or supplement to the Contract Documents. Engineer's written clarification, interpretation, or decision will be final and binding on Contractor, unless it appeals by submitting a Change Proposal, and on Owner, unless it appeals by filing a Claim.

C. If a submitted matter in question concerns terms and conditions of the Contract Documents that do not involve (1) the performance or acceptability of the Work under the Contract Documents, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, then Engineer will promptly give written notice to Owner and Contractor that Engineer is unable to provide a decision or interpretation. If Owner and Contractor are unable to agree on resolution of such a matter in question, either party may pursue resolution as provided in Article 12.

3.05 *Reuse of Documents*

A. Contractor and its Subcontractors and Suppliers shall not:

1. have or acquire any title to or ownership rights in any of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of Engineer or its consultants, including electronic media editions, or reuse any such Drawings, Specifications, other documents, or copies thereof on extensions of the Project or any other project without written consent of Owner and Engineer and specific written verification or adaptation by Engineer; or

2. have or acquire any title or ownership rights in any other Contract Documents, reuse any such Contract Documents for any purpose without Owner's express written consent, or violate any copyrights pertaining to such Contract Documents.

B. The prohibitions of this Paragraph 3.05 will survive final payment, or termination of the Contract. Nothing herein shall preclude Contractor from retaining copies of the Contract Documents for record purposes.

ARTICLE 4 – COMMENCEMENT AND PROGRESS OF THE WORK

4.01 *Commencement of Contract Times; Notice to Proceed*

A. The Contract Times will commence to run on the thirtieth day after the Effective Date of the Contract or, if a Notice to Proceed is given, on the day indicated in the Notice to Proceed. A Notice to Proceed may be given at any time within 30 days after the Effective Date of the Contract. In no event will the Contract Times commence to run later than the sixtieth day after the day of Bid opening or the thirtieth day after the Effective Date of the Contract, whichever date is earlier.

4.02 *Starting the Work*

A. Contractor shall start to perform the Work on the date when the Contract Times commence to run. No Work shall be done at the Site prior to such date.

4.03 *Reference Points*

A. Owner shall provide engineering surveys to establish reference points for construction which in Engineer's judgment are necessary to enable Contractor to proceed with the Work. Contractor shall be responsible for laying out the Work, shall protect and preserve the established reference points and property monuments, and shall make no changes or relocations without the prior written approval of Owner. Contractor shall report to Engineer whenever any reference point or property monument is lost or destroyed or requires relocation because of necessary changes in grades or locations, and shall be responsible for the accurate replacement or relocation of such reference points or property monuments by professionally qualified personnel.

4.04 *Progress Schedule*

A. Contractor shall adhere to the Progress Schedule established in accordance with Paragraph 2.05 as it may be adjusted from time to time as provided below.

1. Contractor shall submit to Engineer for acceptance (to the extent indicated in Paragraph 2.05) proposed adjustments in the Progress Schedule that will not result in changing the Contract Times.

2. Proposed adjustments in the Progress Schedule that will change the Contract Times shall be submitted in accordance with the requirements of Article 11.

B. Contractor shall carry on the Work and adhere to the Progress Schedule during all disputes or disagreements with Owner. No Work shall be delayed or postponed pending resolution of any disputes or disagreements, or during any appeal process, except as permitted by Paragraph 16.04, or as Owner and Contractor may otherwise agree in writing.

4.05 *Delays in Contractor's Progress*

A. If Owner, Engineer, or anyone for whom Owner is responsible, delays, disrupts, or interferes with the performance or progress of the Work, then Contractor shall be entitled to an equitable adjustment in the Contract Times and Contract Price. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.

B. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for delay, disruption, or interference caused by or within the control of Contractor. Delay, disruption, and interference attributable to and within the control of a Subcontractor or Supplier shall be deemed to be within the control of Contractor.

C. If Contractor's performance or progress is delayed, disrupted, or interfered with by unanticipated causes not the fault of and beyond the control of Owner, Contractor, and those for which they are responsible, then Contractor shall be entitled to an equitable adjustment in Contract Times. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times. Such an adjustment shall be Contractor's sole and exclusive remedy for the delays, disruption, and interference described in this paragraph. Causes of delay, disruption, or interference that may give rise to an adjustment in Contract Times under this paragraph include but are not limited to the following:

1. severe and unavoidable natural catastrophes such as fires, floods, epidemics, and earthquakes;

2. abnormal weather conditions;

3. acts or failures to act of utility owners (other than those performing other work at or adjacent to the Site by arrangement with the Owner, as contemplated in Article 8); and

4. acts of war or terrorism.

D. Delays, disruption, and interference to the performance or progress of the Work resulting from the existence of a differing subsurface or physical condition, an Underground Facility that was not shown or indicated by the Contract Documents, or not shown or indicated with reasonable accuracy, and those resulting from Hazardous Environmental Conditions, are governed by Article 5.

E. Paragraph 8.03 governs delays, disruption, and interference to the performance or progress of the Work resulting from the performance of certain other work at or adjacent to the Site.

F. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for any delay, disruption, or interference if such delay is concurrent with a delay, disruption, or interference caused by or within the control of Contractor.

G. Contractor must submit any Change Proposal seeking an adjustment in Contract Price or Contract Times under this paragraph within 30 days of the commencement of the delaying, disrupting, or interfering event.

ARTICLE 5 – AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS

5.01 *Availability of Lands*

A. Owner shall furnish the Site. Owner shall notify Contractor of any encumbrances or restrictions not of general application but specifically related to use of the Site with which Contractor must comply in performing the Work.

B. Upon reasonable written request, Owner shall furnish Contractor with a current statement of record legal title and legal description of the lands upon which permanent improvements are to be made and Owner's interest therein as necessary for giving notice of or filing a mechanic's or construction lien against such lands in accordance with applicable Laws and Regulations.

C. Contractor shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.

5.02 *Use of Site and Other Areas*

A. *Limitation on Use of Site and Other Areas*:

1. Contractor shall confine construction equipment, temporary construction facilities, the storage of materials and equipment, and the operations of workers to the Site, adjacent areas that Contractor has arranged to use through construction easements or otherwise, and other adjacent areas permitted by Laws and Regulations, and shall not unreasonably encumber the Site and such other adjacent areas with construction equipment or other materials or equipment. Contractor shall assume full responsibility for (a) damage to the Site; (b) damage to any such other adjacent areas used for Contractor's operations; (c) damage to any other adjacent land or areas; and (d) for injuries and losses sustained by the owners or occupants of any such land or areas; provided that such damage or injuries result from the performance of the Work or from other actions or conduct of the Contractor or those for which Contractor is responsible.

2. If a damage or injury claim is made by the owner or occupant of any such land or area because of the performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible, Contractor shall (a) take immediate corrective or remedial action as required by Paragraph 7.12, or otherwise; (b) promptly attempt to settle the claim as to all parties through negotiations with such owner or occupant, or otherwise resolve the claim by arbitration or other dispute resolution proceeding, or at law; and (c) to the fullest extent permitted by Laws and Regulations, indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against any such claim, and against all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any claim or action, legal or equitable, brought by any such owner or occupant against Owner, Engineer, or any other party indemnified hereunder to the extent caused directly or indirectly, in whole or in part

by, or based upon, Contractor's performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible.

B. *Removal of Debris During Performance of the Work*: During the progress of the Work the Contractor shall keep the Site and other adjacent areas free from accumulations of waste materials, rubbish, and other debris. Removal and disposal of such waste materials, rubbish, and other debris shall conform to applicable Laws and Regulations.

C. *Cleaning*: Prior to Substantial Completion of the Work Contractor shall clean the Site and the Work and make it ready for utilization by Owner. At the completion of the Work Contractor shall remove from the Site and adjacent areas all tools, appliances, construction equipment and machinery, and surplus materials and shall restore to original condition all property not designated for alteration by the Contract Documents.

D. *Loading of Structures*: Contractor shall not load nor permit any part of any structure to be loaded in any manner that will endanger the structure, nor shall Contractor subject any part of the Work or adjacent structures or land to stresses or pressures that will endanger them.

5.03 *Subsurface and Physical Conditions*

A. *Reports and Drawings*: The Supplementary Conditions identify:

1. those reports known to Owner of explorations and tests of subsurface conditions at or adjacent to the Site;

2. those drawings known to Owner of physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities); and

3. Technical Data contained in such reports and drawings.

B. *Reliance by Contractor on Technical Data Authorized*: Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely upon the accuracy of the Technical Data (as defined in Article 1) contained in any geotechnical or environmental report prepared for the Project and made available to Contractor. Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, with respect to:

1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto; or

2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings; or

3. any Contractor interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions, or information.

5.04 *Differing Subsurface or Physical Conditions*

A. *Notice by Contractor*: If Contractor believes that any subsurface or physical condition that is uncovered or revealed at the Site either:

1. is of such a nature as to establish that any Technical Data on which Contractor is entitled to rely as provided in Paragraph 5.03 is materially inaccurate; or

2. is of such a nature as to require a change in the Drawings or Specifications; or

3. differs materially from that shown or indicated in the Contract Documents; or

4. is of an unusual nature, and differs materially from conditions ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents;

then Contractor shall, promptly after becoming aware thereof and before further disturbing the subsurface or physical conditions or performing any Work in connection therewith (except in an emergency as required by Paragraph 7.15), notify Owner and Engineer in writing about such condition. Contractor shall not further disturb such condition or perform any Work in connection therewith (except with respect to an emergency) until receipt of a written statement permitting Contractor to do so.

B. *Engineer's Review*: After receipt of written notice as required by the preceding paragraph, Engineer will promptly review the subsurface or physical condition in question; determine the necessity of Owner's obtaining additional exploration or tests with respect to the condition; conclude whether the condition falls within any one or more of the differing site condition categories in Paragraph 5.04.A above; obtain any pertinent cost or schedule information from Contractor; prepare recommendations to Owner regarding the Contractor's resumption of Work in connection with the subsurface or physical condition in question and the need for any change in the Drawings or Specifications; and advise Owner in writing of Engineer's findings, conclusions, and recommendations.

C. *Owner's Statement to Contractor Regarding Site Condition*: After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the subsurface or physical condition in question, addressing the resumption of Work in connection with such condition, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations, in whole or in part.

D. *Possible Price and Times Adjustments*:

1. Contractor shall be entitled to an equitable adjustment in Contract Price or Contract Times, or both, to the extent that the existence of a differing subsurface or physical condition, or any related delay, disruption, or interference, causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:

a. such condition must fall within any one or more of the categories described in Paragraph 5.04.A;

b. with respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraph 13.03; and,

c. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.

2. Contractor shall not be entitled to any adjustment in the Contract Price or Contract Times with respect to a subsurface or physical condition if:

a. Contractor knew of the existence of such condition at the time Contractor made a commitment to Owner with respect to Contract Price and Contract Times by the submission of a Bid or becoming bound under a negotiated contract, or otherwise; or

b. the existence of such condition reasonably could have been discovered or revealed as a result of any examination, investigation, exploration, test, or study of the Site and contiguous areas expressly required by the Bidding Requirements or Contract Documents to be conducted by or for Contractor prior to Contractor's making such commitment; or

c. Contractor failed to give the written notice as required by Paragraph 5.04.A.

3. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, or both, then any such adjustment shall be set forth in a Change Order.

4. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, or both, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the subsurface or physical condition in question.

5.05 *Underground Facilities*

A. *Contractor's Responsibilities*: The information and data shown or indicated in the Contract Documents with respect to existing Underground Facilities at or adjacent to the Site is based on information and data furnished to Owner or Engineer by the owners of such Underground Facilities, including Owner, or by others. Unless it is otherwise expressly provided in the Supplementary Conditions:

1. Owner and Engineer do not warrant or guarantee the accuracy or completeness of any such information or data provided by others; and

2. the cost of all of the following will be included in the Contract Price, and Contractor shall have full responsibility for:

a. reviewing and checking all information and data regarding existing Underground Facilities at the Site;

b. locating all Underground Facilities shown or indicated in the Contract Documents as being at the Site;

c. coordination of the Work with the owners (including Owner) of such Underground Facilities, during construction; and

d. the safety and protection of all existing Underground Facilities at the Site, and repairing any damage thereto resulting from the Work.

B. *Notice by Contractor*: If Contractor believes that an Underground Facility that is uncovered or revealed at the Site was not shown or indicated in the Contract Documents, or was not shown or indicated with reasonable accuracy, then Contractor shall, promptly after

becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency as required by Paragraph 7.15), identify the owner of such Underground Facility and give written notice to that owner and to Owner and Engineer.

C. *Engineer's Review*: Engineer will promptly review the Underground Facility and conclude whether such Underground Facility was not shown or indicated in the Contract Documents, or was not shown or indicated with reasonable accuracy; obtain any pertinent cost or schedule information from Contractor; prepare recommendations to Owner regarding the Contractor's resumption of Work in connection with the Underground Facility in question; determine the extent, if any, to which a change is required in the Drawings or Specifications to reflect and document the consequences of the existence or location of the Underground Facility; and advise Owner in writing of Engineer's findings, conclusions, and recommendations. During such time, Contractor shall be responsible for the safety and protection of such Underground Facility.

D. *Owner's Statement to Contractor Regarding Underground Facility*: After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the Underground Facility in question, addressing the resumption of Work in connection with such Underground Facility, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations in whole or in part.

E. *Possible Price and Times Adjustments*:

1. Contractor shall be entitled to an equitable adjustment in the Contract Price or Contract Times, or both, to the extent that any existing Underground Facility at the Site that was not shown or indicated in the Contract Documents, or was not shown or indicated with reasonable accuracy, or any related delay, disruption, or interference, causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:

    a. Contractor did not know of and could not reasonably have been expected to be aware of or to have anticipated the existence or actual location of the Underground Facility in question;

    b. With respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraph 13.03;

    c. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times; and

    d. Contractor gave the notice required in Paragraph 5.05.B.

2. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, or both, then any such adjustment shall be set forth in a Change Order.

3. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, or both, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the Underground Facility in question.

5.06 *Hazardous Environmental Conditions at Site*

A. *Reports and Drawings*: The Supplementary Conditions identify:

1. those reports and drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site; and

2. Technical Data contained in such reports and drawings.

B. *Reliance by Contractor on Technical Data Authorized*: Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely on the accuracy of the Technical Data (as defined in Article 1) contained in any geotechnical or environmental report prepared for the Project and made available to Contractor. Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors with respect to:

1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences and procedures of construction to be employed by Contractor and safety precautions and programs incident thereto; or

2. other data, interpretations, opinions and information contained in such reports or shown or indicated in such drawings; or

3. any Contractor interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions or information.

C. Contractor shall not be responsible for removing or remediating any Hazardous Environmental Condition encountered, uncovered, or revealed at the Site unless such removal or remediation is expressly identified in the Contract Documents to be within the scope of the Work.

D. Contractor shall be responsible for controlling, containing, and duly removing all Constituents of Concern brought to the Site by Contractor, Subcontractors, Suppliers, or anyone else for whom Contractor is responsible, and for any associated costs; and for the costs of removing and remediating any Hazardous Environmental Condition created by the presence of any such Constituents of Concern.

E. If Contractor encounters, uncovers, or reveals a Hazardous Environmental Condition whose removal or remediation is not expressly identified in the Contract Documents as being within the scope of the Work, or if Contractor or anyone for whom Contractor is responsible creates a Hazardous Environmental Condition, then Contractor shall immediately: (1) secure or otherwise isolate such condition; (2) stop all Work in connection with such condition and in any area affected thereby (except in an emergency as required by Paragraph 7.15); and (3) notify Owner and Engineer (and promptly thereafter confirm such notice in writing). Owner shall promptly consult with Engineer concerning the necessity for Owner to retain a qualified expert to evaluate such condition or take corrective action, if any. Promptly after consulting with Engineer, Owner shall take such actions as are necessary to permit Owner to timely obtain required permits and provide Contractor the written notice required by Paragraph 5.06.F. If Contractor or anyone for whom Contractor is responsible created the Hazardous Environmental Condition in question, then Owner may remove and remediate the Hazardous Environmental Condition, and impose a set-off against payments to account for the associated costs.

F. Contractor shall not resume Work in connection with such Hazardous Environmental Condition or in any affected area until after Owner has obtained any required permits related thereto, and delivered written notice to Contractor either (1) specifying that such condition and any affected area is or has been rendered safe for the resumption of Work, or (2) specifying any special conditions under which such Work may be resumed safely.

G. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times, or both, as a result of such Work stoppage or such special conditions under which Work is agreed to be resumed by Contractor, then within 30 days of Owner's written notice regarding the resumption of Work, Contractor may submit a Change Proposal, or Owner may impose a set-off.

H. If after receipt of such written notice Contractor does not agree to resume such Work based on a reasonable belief it is unsafe, or does not agree to resume such Work under such special conditions, then Owner may order the portion of the Work that is in the area affected by such condition to be deleted from the Work, following the contractual change procedures in Article 11. Owner may have such deleted portion of the Work performed by Owner's own forces or others in accordance with Article 8.

I. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition, provided that such Hazardous Environmental Condition (1) was not shown or indicated in the Drawings, Specifications, or other Contract Documents, identified as Technical Data entitled to limited reliance pursuant to Paragraph 5.06.B, or identified in the Contract Documents to be included within the scope of the Work, and (2) was not created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.I shall obligate Owner to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

J. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the failure to control, contain, or remove a Constituent of Concern brought to the Site by Contractor or by anyone for whom Contractor is responsible, or to a Hazardous Environmental Condition created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.J shall obligate Contractor to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

K. The provisions of Paragraphs 5.03, 5.04, and 5.05 do not apply to the presence of Constituents of Concern or to a Hazardous Environmental Condition uncovered or revealed at the Site.

ARTICLE 6 – BONDS AND INSURANCE

6.01 *Performance, Payment, and Other Bonds*

A. Contractor shall furnish a performance bond and a payment bond, each in an amount at least equal to the Contract Price, as security for the faithful performance and payment of all of Contractor's obligations under the Contract. These bonds shall remain in effect until one year after the date when final payment becomes due or until completion of the correction period specified in Paragraph 15.08, whichever is later, except as provided otherwise by Laws or Regulations, the Supplementary Conditions, or other specific provisions of the Contract. Contractor shall also furnish such other bonds as are required by the Supplementary Conditions or other specific provisions of the Contract.

B. All bonds shall be in the form prescribed by the Contract except as provided otherwise by Laws or Regulations, and shall be executed by such sureties as are named in "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Circular 570 (as amended and supplemented) by the Financial Management Service, Surety Bond Branch, U.S. Department of the Treasury. A bond signed by an agent or attorney-in-fact must be accompanied by a certified copy of that individual's authority to bind the surety. The evidence of authority shall show that it is effective on the date the agent or attorney-in-fact signed the accompanying bond.

C. Contractor shall obtain the required bonds from surety companies that are duly licensed or authorized in the jurisdiction in which the Project is located to issue bonds in the required amounts.

D. If the surety on a bond furnished by Contractor is declared bankrupt or becomes insolvent, or its right to do business is terminated in any state or jurisdiction where any part of the Project is located, or the surety ceases to meet the requirements above, then Contractor shall promptly notify Owner and Engineer and shall, within 20 days after the event giving rise to such notification, provide another bond and surety, both of which shall comply with the bond and surety requirements above.

E. If Contractor has failed to obtain a required bond, Owner may exclude the Contractor from the Site and exercise Owner's termination rights under Article 16.

F. Upon request, Owner shall provide a copy of the payment bond to any Subcontractor, Supplier, or other person or entity claiming to have furnished labor or materials used in the performance of the Work.

6.02 *Insurance—General Provisions*

A. Owner and Contractor shall obtain and maintain insurance as required in this Article and in the Supplementary Conditions.

B. All insurance required by the Contract to be purchased and maintained by Owner or Contractor shall be obtained from insurance companies that are duly licensed or authorized, in the state or jurisdiction in which the Project is located, to issue insurance policies for the required limits and coverages. Unless a different standard is indicated in the Supplementary Conditions, all companies that provide insurance policies required under this Contract shall have an A.M. Best rating of A-VII or better.

C. Contractor shall deliver to Owner, with copies to each named insured and additional insured (as identified in this Article, in the Supplementary Conditions, or elsewhere in the Contract), certificates of insurance establishing that Contractor has obtained and is

maintaining the policies, coverages, and endorsements required by the Contract. Upon request by Owner or any other insured, Contractor shall also furnish other evidence of such required insurance, including but not limited to copies of policies and endorsements, and documentation of applicable self-insured retentions and deductibles. Contractor may block out (redact) any confidential premium or pricing information contained in any policy or endorsement furnished under this provision.

D. Owner shall deliver to Contractor, with copies to each named insured and additional insured (as identified in this Article, the Supplementary Conditions, or elsewhere in the Contract), certificates of insurance establishing that Owner has obtained and is maintaining the policies, coverages, and endorsements required of Owner by the Contract (if any). Upon request by Contractor or any other insured, Owner shall also provide other evidence of such required insurance (if any), including but not limited to copies of policies and endorsements, and documentation of applicable self-insured retentions and deductibles. Owner may block out (redact) any confidential premium or pricing information contained in any policy or endorsement furnished under this provision.

E. Failure of Owner or Contractor to demand such certificates or other evidence of the other party's full compliance with these insurance requirements, or failure of Owner or Contractor to identify a deficiency in compliance from the evidence provided, shall not be construed as a waiver of the other party's obligation to obtain and maintain such insurance.

F. If either party does not purchase or maintain all of the insurance required of such party by the Contract, such party shall notify the other party in writing of such failure to purchase prior to the start of the Work, or of such failure to maintain prior to any change in the required coverage.

G. If Contractor has failed to obtain and maintain required insurance, Owner may exclude the Contractor from the Site, impose an appropriate set-off against payment, and exercise Owner's termination rights under Article 16.

H. Without prejudice to any other right or remedy, if a party has failed to obtain required insurance, the other party may elect to obtain equivalent insurance to protect such other party's interests at the expense of the party who was required to provide such coverage, and the Contract Price shall be adjusted accordingly.

I. Owner does not represent that insurance coverage and limits established in this Contract necessarily will be adequate to protect Contractor or Contractor's interests.

J. The insurance and insurance limits required herein shall not be deemed as a limitation on Contractor's liability under the indemnities granted to Owner and other individuals and entities in the Contract.

6.03 *Contractor's Insurance*

A. *Workers' Compensation*: Contractor shall purchase and maintain workers' compensation and employer's liability insurance for:

1. claims under workers' compensation, disability benefits, and other similar employee benefit acts.

2. United States Longshoreman and Harbor Workers' Compensation Act and Jones Act coverage (if applicable).

3. claims for damages because of bodily injury, occupational sickness or disease, or death of Contractor's employees (by stop-gap endorsement in monopolist worker's compensation states).

4. Foreign voluntary worker compensation (if applicable).

B. *Commercial General Liability—Claims Covered*: Contractor shall purchase and maintain commercial general liability insurance, covering all operations by or on behalf of Contractor, on an occurrence basis, against:

1. claims for damages because of bodily injury, sickness or disease, or death of any person other than Contractor's employees.

2. claims for damages insured by reasonably available personal injury liability coverage.

3. claims for damages, other than to the Work itself, because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom.

C. *Commercial General Liability—Form and Content*: Contractor's commercial liability policy shall be written on a 1996 (or later) ISO commercial general liability form (occurrence form) and include the following coverages and endorsements:

1. Products and completed operations coverage:

a. Such insurance shall be maintained for three years after final payment.

b. Contractor shall furnish Owner and each other additional insured (as identified in the Supplementary Conditions or elsewhere in the Contract) evidence of continuation of such insurance at final payment and three years thereafter.

2. Blanket contractual liability coverage, to the extent permitted by law, including but not limited to coverage of Contractor's contractual indemnity obligations in Paragraph 7.18.

3. Broad form property damage coverage.

4. Severability of interest.

5. Underground, explosion, and collapse coverage.

6. Personal injury coverage.

7. Additional insured endorsements that include both ongoing operations and products and completed operations coverage through ISO Endorsements CG 20 10 10 01 and CG 20 37 10 01 (together); or CG 20 10 07 04 and CG 20 37 07 04 (together); or their equivalent.

8. For design professional additional insureds, ISO Endorsement CG 20 32 07 04, "Additional Insured—Engineers, Architects or Surveyors Not Engaged by the Named Insured" or its equivalent.

D. *Automobile liability*: Contractor shall purchase and maintain automobile liability insurance against claims for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance, or use of any motor vehicle. The automobile liability policy shall be written on an occurrence basis.

E. *Umbrella or excess liability*: Contractor shall purchase and maintain umbrella or excess liability insurance written over the underlying employer's liability, commercial general liability, and automobile liability insurance described in the paragraphs above. Subject to industry-standard exclusions, the coverage afforded shall follow form as to each and every one of the underlying policies.

F. *Contractor's pollution liability insurance*: Contractor shall purchase and maintain a policy covering third-party injury and property damage claims, including clean-up costs, as a result

of pollution conditions arising from Contractor's operations and completed operations. This insurance shall be maintained for no less than three years after final completion.

G. *Additional insureds*: The Contractor's commercial general liability, automobile liability, umbrella or excess, and pollution liability policies shall include and list as additional insureds Owner and Engineer, and any individuals or entities identified in the Supplementary Conditions; include coverage for the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of all such additional insureds; and the insurance afforded to these additional insureds shall provide primary coverage for all claims covered thereby (including as applicable those arising from both ongoing and completed operations) on a non-contributory basis. Contractor shall obtain all necessary endorsements to support these requirements.

H. *Contractor's professional liability insurance*: If Contractor will provide or furnish professional services under this Contract, through a delegation of professional design services or otherwise, then Contractor shall be responsible for purchasing and maintaining applicable professional liability insurance. This insurance shall provide protection against claims arising out of performance of professional design or related services, and caused by a negligent error, omission, or act for which the insured party is legally liable. It shall be maintained throughout the duration of the Contract and for a minimum of two years after Substantial Completion. If such professional design services are performed by a Subcontractor, and not by Contractor itself, then the requirements of this paragraph may be satisfied through the purchasing and maintenance of such insurance by such Subcontractor.

I. *General provisions*: The policies of insurance required by this Paragraph 6.03 shall:

1. include at least the specific coverages provided in this Article.

2. be written for not less than the limits of liability provided in this Article and in the Supplementary Conditions, or required by Laws or Regulations, whichever is greater.

3. contain a provision or endorsement that the coverage afforded will not be canceled, materially changed, or renewal refused until at least 10 days prior written notice has been given to Contractor. Within three days of receipt of any such written notice, Contractor shall provide a copy of the notice to Owner, Engineer, and each other insured under the policy.

4. remain in effect at least until final payment (and longer if expressly required in this Article) and at all times thereafter when Contractor may be correcting, removing, or replacing defective Work as a warranty or correction obligation, or otherwise, or returning to the Site to conduct other tasks arising from the Contract Documents.

5. be appropriate for the Work being performed and provide protection from claims that may arise out of or result from Contractor's performance of the Work and Contractor's other obligations under the Contract Documents, whether it is to be performed by Contractor, any Subcontractor or Supplier, or by anyone directly or indirectly employed by any of them to perform any of the Work, or by anyone for whose acts any of them may be liable.

J. The coverage requirements for specific policies of insurance must be met by such policies, and not by reference to excess or umbrella insurance provided in other policies.

6.04 *Owner's Liability Insurance*

A. In addition to the insurance required to be provided by Contractor under Paragraph 6.03, Owner, at Owner's option, may purchase and maintain at Owner's expense Owner's own liability insurance as will protect Owner against claims which may arise from operations under the Contract Documents.

B. Owner's liability policies, if any, operate separately and independently from policies required to be provided by Contractor, and Contractor cannot rely upon Owner's liability policies for any of Contractor's obligations to the Owner, Engineer, or third parties.

6.05 *Property Insurance*

A. *Builder's Risk*: Unless otherwise provided in the Supplementary Conditions, Contractor shall purchase and maintain builder's risk insurance upon the Work on a completed value basis, in the amount of the full insurable replacement cost thereof (subject to such deductible amounts as may be provided in the Supplementary Conditions or required by Laws and Regulations). This insurance shall:

1. include the Owner and Contractor as named insureds, and all Subcontractors, and any individuals or entities required by the Supplementary Conditions to be insured under such builder's risk policy, as insureds or named insureds. For purposes of the remainder of this Paragraph 6.05, Paragraphs 6.06 and 6.07, and any corresponding Supplementary Conditions, the parties required to be insured shall collectively be referred to as "insureds."

2. be written on a builder's risk "all risk" policy form that shall at least include insurance for physical loss or damage to the Work, temporary buildings, falsework, and materials and equipment in transit, and shall insure against at least the following perils or causes of loss: fire; lightning; windstorm; riot; civil commotion; terrorism; vehicle impact; aircraft; smoke; theft; vandalism and malicious mischief; mechanical breakdown, boiler explosion, and artificially generated electric current; earthquake; volcanic activity, and other earth movement; flood; collapse; explosion; debris removal; demolition occasioned by enforcement of Laws and Regulations; water damage (other than that caused by flood); and such other perils or causes of loss as may be specifically required by the Supplementary Conditions. If insurance against mechanical breakdown, boiler explosion, and artificially generated electric current; earthquake; volcanic activity, and other earth movement; or flood, are not commercially available under builder's risk policies, by endorsement or otherwise, such insurance may be provided through other insurance policies acceptable to Owner and Contractor.

3. cover, as insured property, at least the following: (a) the Work and all materials, supplies, machinery, apparatus, equipment, fixtures, and other property of a similar nature that are to be incorporated into or used in the preparation, fabrication, construction, erection, or completion of the Work, including Owner-furnished or assigned property; (b) spare parts inventory required within the scope of the Contract; and (c) temporary works which are not intended to form part of the permanent constructed Work but which are intended to provide working access to the Site, or to the Work under construction, or which are intended to provide temporary support for the Work under construction, including scaffolding, form work, fences, shoring, falsework, and temporary structures.

4. cover expenses incurred in the repair or replacement of any insured property (including but not limited to fees and charges of engineers and architects).

5. extend to cover damage or loss to insured property while in temporary storage at the Site or in a storage location outside the Site (but not including property stored at the premises of a manufacturer or Supplier).

6. extend to cover damage or loss to insured property while in transit.

7. allow for partial occupation or use of the Work by Owner, such that those portions of the Work that are not yet occupied or used by Owner shall remain covered by the builder's risk insurance.

8. allow for the waiver of the insurer's subrogation rights, as set forth below.

9. provide primary coverage for all losses and damages caused by the perils or causes of loss covered.

10. not include a co-insurance clause.

11. include an exception for ensuing losses from physical damage or loss with respect to any defective workmanship, design, or materials exclusions.

12. include performance/hot testing and start-up.

13. be maintained in effect, subject to the provisions herein regarding Substantial Completion and partial occupancy or use of the Work by Owner, until the Work is complete.

B. *Notice of Cancellation or Change*: All the policies of insurance (and the certificates or other evidence thereof) required to be purchased and maintained in accordance with this Paragraph 6.05 will contain a provision or endorsement that the coverage afforded will not be canceled or materially changed or renewal refused until at least 10 days prior written notice has been given to the purchasing policyholder. Within three days of receipt of any such written notice, the purchasing policyholder shall provide a copy of the notice to each other insured.

C. *Deductibles*: The purchaser of any required builder's risk or property insurance shall pay for costs not covered because of the application of a policy deductible.

D. *Partial Occupancy or Use by Owner*: If Owner will occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work as provided in Paragraph 15.04, then Owner (directly, if it is the purchaser of the builder's risk policy, or through Contractor) will provide notice of such occupancy or use to the builder's risk insurer. The builder's risk insurance shall not be canceled or permitted to lapse on account of any such partial use or occupancy; rather, those portions of the Work that are occupied or used by Owner may come off the builder's risk policy, while those portions of the Work not yet occupied or used by Owner shall remain covered by the builder's risk insurance.

E. *Additional Insurance*: If Contractor elects to obtain other special insurance to be included in or supplement the builder's risk or property insurance policies provided under this Paragraph 6.05, it may do so at Contractor's expense.

F. *Insurance of Other Property*: If the express insurance provisions of the Contract do not require or address the insurance of a property item or interest, such as tools, construction equipment, or other personal property owned by Contractor, a Subcontractor, or an employee of Contractor or a Subcontractor, then the entity or individual owning such property item will be responsible for deciding whether to insure it, and if so in what amount.

6.06 *Waiver of Rights*

A. All policies purchased in accordance with Paragraph 6.05, expressly including the builder's risk policy, shall contain provisions to the effect that in the event of payment of any loss or damage the insurers will have no rights of recovery against any insureds thereunder, or against Engineer or its consultants, or their officers, directors, members, partners, employees, agents, consultants, or subcontractors. Owner and Contractor waive all rights against each other and the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, or resulting from any of the perils or causes of loss covered by such policies and any other property insurance applicable to the Work; and, in addition, waive all such rights against Engineer, its consultants, all Subcontractors, all individuals or entities identified in the Supplementary Conditions as insureds, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, under such policies for losses and damages so caused. None of the above waivers shall extend to the rights that any party making such waiver may have to the proceeds of insurance held by Owner or Contractor as trustee or fiduciary, or otherwise payable under any policy so issued.

B. Owner waives all rights against Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, for:

1. loss due to business interruption, loss of use, or other consequential loss extending beyond direct physical loss or damage to Owner's property or the Work caused by, arising out of, or resulting from fire or other perils whether or not insured by Owner; and

2. loss or damage to the completed Project or part thereof caused by, arising out of, or resulting from fire or other insured peril or cause of loss covered by any property insurance maintained on the completed Project or part thereof by Owner during partial occupancy or use pursuant to Paragraph 15.04, after Substantial Completion pursuant to Paragraph 15.03, or after final payment pursuant to Paragraph 15.06.

C. Any insurance policy maintained by Owner covering any loss, damage or consequential loss referred to in Paragraph 6.06.B shall contain provisions to the effect that in the event of payment of any such loss, damage, or consequential loss, the insurers will have no rights of recovery against Contractor, Subcontractors, or Engineer, or the officers, directors, members, partners, employees, agents, consultants, or subcontractors of each and any of them.

D. Contractor shall be responsible for assuring that the agreement under which a Subcontractor performs a portion of the Work contains provisions whereby the Subcontractor waives all rights against Owner, Contractor, all individuals or entities identified in the Supplementary Conditions as insureds, the Engineer and its consultants, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, relating to, or resulting from any of the perils or causes of loss covered by builder's risk insurance and any other property insurance applicable to the Work.

6.07 *Receipt and Application of Property Insurance Proceeds*

A. Any insured loss under the builder's risk and other policies of insurance required by Paragraph 6.05 will be adjusted and settled with the named insured that purchased the

policy. Such named insured shall act as fiduciary for the other insureds, and give notice to such other insureds that adjustment and settlement of a claim is in progress. Any other insured may state its position regarding a claim for insured loss in writing within 15 days after notice of such claim.

B. Proceeds for such insured losses may be made payable by the insurer either jointly to multiple insureds, or to the named insured that purchased the policy in its own right and as fiduciary for other insureds, subject to the requirements of any applicable mortgage clause. A named insured receiving insurance proceeds under the builder's risk and other policies of insurance required by Paragraph 6.05 shall distribute such proceeds in accordance with such agreement as the parties in interest may reach, or as otherwise required under the dispute resolution provisions of this Contract or applicable Laws and Regulations.

C. If no other special agreement is reached, the damaged Work shall be repaired or replaced, the money so received applied on account thereof, and the Work and the cost thereof covered by Change Order, if needed.

ARTICLE 7 – CONTRACTOR'S RESPONSIBILITIES

7.01 *Supervision and Superintendence*

A. Contractor shall supervise, inspect, and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents. Contractor shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction.

B. At all times during the progress of the Work, Contractor shall assign a competent resident superintendent who shall not be replaced without written notice to Owner and Engineer except under extraordinary circumstances.

7.02 *Labor; Working Hours*

A. Contractor shall provide competent, suitably qualified personnel to survey and lay out the Work and perform construction as required by the Contract Documents. Contractor shall at all times maintain good discipline and order at the Site.

B. Except as otherwise required for the safety or protection of persons or the Work or property at the Site or adjacent thereto, and except as otherwise stated in the Contract Documents, all Work at the Site shall be performed during regular working hours, Monday through Friday. Contractor will not perform Work on a Saturday, Sunday, or any legal holiday. Contractor may perform Work outside regular working hours or on Saturdays, Sundays, or legal holidays only with Owner's written consent, which will not be unreasonably withheld.

7.03 *Services, Materials, and Equipment*

A. Unless otherwise specified in the Contract Documents, Contractor shall provide and assume full responsibility for all services, materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and all other facilities and incidentals necessary for the performance, testing, start up, and completion of the Work, whether or not such items are specifically called for in the Contract Documents.

B. All materials and equipment incorporated into the Work shall be of good quality and new, except as otherwise provided in the Contract Documents. All special warranties and

guarantees required by the Specifications shall expressly run to the benefit of Owner. If required by Engineer, Contractor shall furnish satisfactory evidence (including reports of required tests) as to the source, kind, and quality of materials and equipment.

C. All materials and equipment shall be stored, applied, installed, connected, erected, protected, used, cleaned, and conditioned in accordance with instructions of the applicable Supplier, except as otherwise may be provided in the Contract Documents.

7.04 *"Or Equals"*

A. Whenever an item of material or equipment is specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular Supplier, the Contract Price has been based upon Contractor furnishing such item as specified. The specification or description of such an item is intended to establish the type, function, appearance, and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent, or "or equal" item is permitted, Contractor may request that Engineer authorize the use of other items of material or equipment, or items from other proposed suppliers under the circumstances described below.

1. If Engineer in its sole discretion determines that an item of material or equipment proposed by Contractor is functionally equal to that named and sufficiently similar so that no change in related Work will be required, Engineer shall deem it an "or equal" item. For the purposes of this paragraph, a proposed item of material or equipment will be considered functionally equal to an item so named if:

a. in the exercise of reasonable judgment Engineer determines that:

1) it is at least equal in materials of construction, quality, durability, appearance, strength, and design characteristics;

2) it will reliably perform at least equally well the function and achieve the results imposed by the design concept of the completed Project as a functioning whole;

3) it has a proven record of performance and availability of responsive service; and

4) it is not objectionable to Owner.

b. Contractor certifies that, if approved and incorporated into the Work:

1) there will be no increase in cost to the Owner or increase in Contract Times; and

2) it will conform substantially to the detailed requirements of the item named in the Contract Documents.

B. *Contractor's Expense*: Contractor shall provide all data in support of any proposed "or equal" item at Contractor's expense.

C. *Engineer's Evaluation and Determination*: Engineer will be allowed a reasonable time to evaluate each "or-equal" request. Engineer may require Contractor to furnish additional data about the proposed "or-equal" item. Engineer will be the sole judge of acceptability. No "or-equal" item will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an "or-equal", which will be evidenced by an approved Shop Drawing or other written communication. Engineer will advise Contractor in writing of any negative determination.

D. *Effect of Engineer's Determination*: Neither approval nor denial of an "or-equal" request shall result in any change in Contract Price. The Engineer's denial of an "or-equal" request shall be final and binding, and may not be reversed through an appeal under any provision of the Contract Documents.

E. *Treatment as a Substitution Request*: If Engineer determines that an item of material or equipment proposed by Contractor does not qualify as an "or-equal" item, Contractor may request that Engineer considered the proposed item as a substitute pursuant to Paragraph 7.05.

7.05 *Substitutes*

A. Unless the specification or description of an item of material or equipment required to be furnished under the Contract Documents contains or is followed by words reading that no substitution is permitted, Contractor may request that Engineer authorize the use of other items of material or equipment under the circumstances described below. To the extent possible such requests shall be made before commencement of related construction at the Site.

1. Contractor shall submit sufficient information as provided below to allow Engineer to determine if the item of material or equipment proposed is functionally equivalent to that named and an acceptable substitute therefor. Engineer will not accept requests for review of proposed substitute items of material or equipment from anyone other than Contractor.

2. The requirements for review by Engineer will be as set forth in Paragraph 7.05.B, as supplemented by the Specifications, and as Engineer may decide is appropriate under the circumstances.

3. Contractor shall make written application to Engineer for review of a proposed substitute item of material or equipment that Contractor seeks to furnish or use. The application:

a. shall certify that the proposed substitute item will:

1) perform adequately the functions and achieve the results called for by the general design,

2) be similar in substance to that specified, and

3) be suited to the same use as that specified.

b. will state:

1) the extent, if any, to which the use of the proposed substitute item will necessitate a change in Contract Times,

2) whether use of the proposed substitute item in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with Owner for other work on the Project) to adapt the design to the proposed substitute item, and

3) whether incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty.

c. will identify:

1) all variations of the proposed substitute item from that specified, and

2) available engineering, sales, maintenance, repair, and replacement services.

d. shall contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including but not limited to changes in Contract Price, shared savings, costs of redesign, and claims of other contractors affected by any resulting change.

B. *Engineer's Evaluation and Determination*: Engineer will be allowed a reasonable time to evaluate each substitute request, and to obtain comments and direction from Owner. Engineer may require Contractor to furnish additional data about the proposed substitute item. Engineer will be the sole judge of acceptability. No substitute will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an acceptable substitute. Engineer's determination will be evidenced by a Field Order or a proposed Change Order accounting for the substitution itself and all related impacts, including changes in Contract Price or Contract Times. Engineer will advise Contractor in writing of any negative determination.

C. *Special Guarantee*: Owner may require Contractor to furnish at Contractor's expense a special performance guarantee or other surety with respect to any substitute.

D. *Reimbursement of Engineer's Cost*: Engineer will record Engineer's costs in evaluating a substitute proposed or submitted by Contractor. Whether or not Engineer approves a substitute so proposed or submitted by Contractor, Contractor shall reimburse Owner for the reasonable charges of Engineer for evaluating each such proposed substitute. Contractor shall also reimburse Owner for the reasonable charges of Engineer for making changes in the Contract Documents (or in the provisions of any other direct contract with Owner) resulting from the acceptance of each proposed substitute.

E. *Contractor's Expense*: Contractor shall provide all data in support of any proposed substitute at Contractor's expense.

F. *Effect of Engineer's Determination*: If Engineer approves the substitution request, Contractor shall execute the proposed Change Order and proceed with the substitution. The Engineer's denial of a substitution request shall be final and binding, and may not be reversed through an appeal under any provision of the Contract Documents. Contractor may challenge the scope of reimbursement costs imposed under Paragraph 7.05.D, by timely submittal of a Change Proposal.

7.06 *Concerning Subcontractors, Suppliers, and Others*

A. Contractor may retain Subcontractors and Suppliers for the performance of parts of the Work. Such Subcontractors and Suppliers must be acceptable to Owner.

B. Contractor shall retain specific Subcontractors, Suppliers, or other individuals or entities for the performance of designated parts of the Work if required by the Contract to do so.

C. Subsequent to the submittal of Contractor's Bid or final negotiation of the terms of the Contract, Owner may not require Contractor to retain any Subcontractor, Supplier, or other individual or entity to furnish or perform any of the Work against which Contractor has reasonable objection.

D. Prior to entry into any binding subcontract or purchase order, Contractor shall submit to Owner the identity of the proposed Subcontractor or Supplier (unless Owner has already deemed such proposed Subcontractor or Supplier acceptable, during the bidding process or otherwise). Such proposed Subcontractor or Supplier shall be deemed acceptable to Owner unless Owner raises a substantive, reasonable objection within five days.

E. Owner may require the replacement of any Subcontractor, Supplier, or other individual or entity retained by Contractor to perform any part of the Work. Owner also may require Contractor to retain specific replacements; provided, however, that Owner may not require a replacement to which Contractor has a reasonable objection. If Contractor has submitted the identity of certain Subcontractors, Suppliers, or other individuals or entities for acceptance by Owner, and Owner has accepted it (either in writing or by failing to make written objection thereto), then Owner may subsequently revoke the acceptance of any such Subcontractor, Supplier, or other individual or entity so identified solely on the basis of substantive, reasonable objection after due investigation. Contractor shall submit an acceptable replacement for the rejected Subcontractor, Supplier, or other individual or entity.

F. If Owner requires the replacement of any Subcontractor, Supplier, or other individual or entity retained by Contractor to perform any part of the Work, then Contractor shall be entitled to an adjustment in Contract Price or Contract Times, or both, with respect to the replacement; and Contractor shall initiate a Change Proposal for such adjustment within 30 days of Owner's requirement of replacement.

G. No acceptance by Owner of any such Subcontractor, Supplier, or other individual or entity, whether initially or as a replacement, shall constitute a waiver of the right of Owner to the completion of the Work in accordance with the Contract Documents.

H. On a monthly basis Contractor shall submit to Engineer a complete list of all Subcontractors and Suppliers having a direct contract with Contractor, and of all other Subcontractors and Suppliers known to Contractor at the time of submittal.

I. Contractor shall be fully responsible to Owner and Engineer for all acts and omissions of the Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work just as Contractor is responsible for Contractor's own acts and omissions.

J. Contractor shall be solely responsible for scheduling and coordinating the work of Subcontractors, Suppliers, and all other individuals or entities performing or furnishing any of the Work.

K. Contractor shall restrict all Subcontractors, Suppliers, and such other individuals or entities performing or furnishing any of the Work from communicating with Engineer or Owner, except through Contractor or in case of an emergency, or as otherwise expressly allowed herein.

L. The divisions and sections of the Specifications and the identifications of any Drawings shall not control Contractor in dividing the Work among Subcontractors or Suppliers or delineating the Work to be performed by any specific trade.

M. All Work performed for Contractor by a Subcontractor or Supplier shall be pursuant to an appropriate contractual agreement that specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract Documents for the benefit of Owner and Engineer.

N. Owner may furnish to any Subcontractor or Supplier, to the extent practicable, information about amounts paid to Contractor on account of Work performed for Contractor by the particular Subcontractor or Supplier.

O. Nothing in the Contract Documents:

1. shall create for the benefit of any such Subcontractor, Supplier, or other individual or entity any contractual relationship between Owner or Engineer and any such Subcontractor, Supplier, or other individual or entity; nor

2. shall create any obligation on the part of Owner or Engineer to pay or to see to the payment of any money due any such Subcontractor, Supplier, or other individual or entity except as may otherwise be required by Laws and Regulations.

7.07 *Patent Fees and Royalties*

A. Contractor shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product, or device which is the subject of patent rights or copyrights held by others. If a particular invention, design, process, product, or device is specified in the Contract Documents for use in the performance of the Work and if, to the actual knowledge of Owner or Engineer, its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights shall be disclosed by Owner in the Contract Documents.

B. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, and its officers, directors, members, partners, employees, agents, consultants, and subcontractors from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device specified in the Contract Documents, but not identified as being subject to payment of any license fee or royalty to others required by patent rights or copyrights.

C. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device not specified in the Contract Documents.

7.08 *Permits*

A. Unless otherwise provided in the Contract Documents, Contractor shall obtain and pay for all construction permits and licenses. Owner shall assist Contractor, when necessary, in obtaining such permits and licenses. Contractor shall pay all governmental charges and inspection fees necessary for the prosecution of the Work which are applicable at the time of the submission of Contractor's Bid (or when Contractor became bound under a negotiated contract). Owner shall pay all charges of utility owners for connections for providing permanent service to the Work

7.09 *Taxes*

A. Contractor shall pay all sales, consumer, use, and other similar taxes required to be paid by Contractor in accordance with the Laws and Regulations of the place of the Project which are applicable during the performance of the Work.

7.10 *Laws and Regulations*

A. Contractor shall give all notices required by and shall comply with all Laws and Regulations applicable to the performance of the Work. Except where otherwise expressly required by applicable Laws and Regulations, neither Owner nor Engineer shall be responsible for monitoring Contractor's compliance with any Laws or Regulations.

B. If Contractor performs any Work or takes any other action knowing or having reason to know that it is contrary to Laws or Regulations, Contractor shall bear all resulting costs and losses, and shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such Work or other action. It shall not be Contractor's responsibility to make certain that the Work described in the Contract Documents is in accordance with Laws and Regulations, but this shall not relieve Contractor of Contractor's obligations under Paragraph 3.03.

C. Owner or Contractor may give notice to the other party of any changes after the submission of Contractor's Bid (or after the date when Contractor became bound under a negotiated contract) in Laws or Regulations having an effect on the cost or time of performance of the Work, including but not limited to changes in Laws or Regulations having an effect on procuring permits and on sales, use, value-added, consumption, and other similar taxes. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times resulting from such changes, then within 30 days of such notice Contractor may submit a Change Proposal, or Owner may initiate a Claim.

7.11 *Record Documents*

A. Contractor shall maintain in a safe place at the Site one printed record copy of all Drawings, Specifications, Addenda, Change Orders, Work Change Directives, Field Orders, written interpretations and clarifications, and approved Shop Drawings. Contractor shall keep such record documents in good order and annotate them to show changes made during construction. These record documents, together with all approved Samples, will be available to Engineer for reference. Upon completion of the Work, Contractor shall deliver these record documents to Engineer.

7.12 *Safety and Protection*

A. Contractor shall be solely responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the Work. Such responsibility does not relieve Subcontractors of their responsibility for the safety of persons or property in the performance of their work, nor for compliance with applicable safety Laws and Regulations. Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury, or loss to:

1. all persons on the Site or who may be affected by the Work;

2. all the Work and materials and equipment to be incorporated therein, whether in storage on or off the Site; and

3. other property at the Site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, other work in progress, utilities, and Underground Facilities not designated for removal, relocation, or replacement in the course of construction.

B. Contractor shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss; and shall erect and maintain all necessary safeguards for such safety and protection. Contractor shall notify Owner; the owners of adjacent property, Underground Facilities, and other utilities; and other contractors and utility owners performing work at or adjacent to the Site, when prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property or work in progress.

C. Contractor shall comply with the applicable requirements of Owner's safety programs, if any. The Supplementary Conditions identify any Owner's safety programs that are applicable to the Work.

D. Contractor shall inform Owner and Engineer of the specific requirements of Contractor's safety program with which Owner's and Engineer's employees and representatives must comply while at the Site.

E. All damage, injury, or loss to any property referred to in Paragraph 7.12.A.2 or 7.12.A.3 caused, directly or indirectly, in whole or in part, by Contractor, any Subcontractor, Supplier, or any other individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, shall be remedied by Contractor at its expense (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of Owner or Engineer or anyone employed by any of them, or anyone for whose acts any of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of Contractor or any Subcontractor, Supplier, or other individual or entity directly or indirectly employed by any of them).

F. Contractor's duties and responsibilities for safety and protection shall continue until such time as all the Work is completed and Engineer has issued a notice to Owner and Contractor in accordance with Paragraph 15.06.B that the Work is acceptable (except as otherwise expressly provided in connection with Substantial Completion).

G. Contractor's duties and responsibilities for safety and protection shall resume whenever Contractor or any Subcontractor or Supplier returns to the Site to fulfill warranty or correction obligations, or to conduct other tasks arising from the Contract Documents.

7.13 *Safety Representative*

A. Contractor shall designate a qualified and experienced safety representative at the Site whose duties and responsibilities shall be the prevention of accidents and the maintaining and supervising of safety precautions and programs.

7.14 *Hazard Communication Programs*

A. Contractor shall be responsible for coordinating any exchange of material safety data sheets or other hazard communication information required to be made available to or

exchanged between or among employers at the Site in accordance with Laws or Regulations.

7.15 *Emergencies*

A. In emergencies affecting the safety or protection of persons or the Work or property at the Site or adjacent thereto, Contractor is obligated to act to prevent threatened damage, injury, or loss. Contractor shall give Engineer prompt written notice if Contractor believes that any significant changes in the Work or variations from the Contract Documents have been caused thereby or are required as a result thereof. If Engineer determines that a change in the Contract Documents is required because of the action taken by Contractor in response to such an emergency, a Work Change Directive or Change Order will be issued.

7.16 *Shop Drawings, Samples, and Other Submittals*

A. *Shop Drawing and Sample Submittal Requirements*:

1. Before submitting a Shop Drawing or Sample, Contractor shall have:

a. reviewed and coordinated the Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents;

b. determined and verified all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect thereto;

c. determined and verified the suitability of all materials and equipment offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and

d. determined and verified all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto.

2. Each submittal shall bear a stamp or specific written certification that Contractor has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review of that submittal, and that Contractor approves the submittal.

3. With each submittal, Contractor shall give Engineer specific written notice of any variations that the Shop Drawing or Sample may have from the requirements of the Contract Documents. This notice shall be set forth in a written communication separate from the Shop Drawings or Sample submittal; and, in addition, in the case of Shop Drawings by a specific notation made on each Shop Drawing submitted to Engineer for review and approval of each such variation.

B. *Submittal Procedures for Shop Drawings and Samples*: Contractor shall submit Shop Drawings and Samples to Engineer for review and approval in accordance with the accepted Schedule of Submittals. Each submittal will be identified as Engineer may require.

1. *Shop Drawings*:

a. Contractor shall submit the number of copies required in the Specifications.

b. Data shown on the Shop Drawings will be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show Engineer the services, materials, and equipment Contractor proposes to

provide and to enable Engineer to review the information for the limited purposes required by Paragraph 7.16.D.

2. *Samples*:

   a. Contractor shall submit the number of Samples required in the Specifications.

   b. Contractor shall clearly identify each Sample as to material, Supplier, pertinent data such as catalog numbers, the use for which intended and other data as Engineer may require to enable Engineer to review the submittal for the limited purposes required by Paragraph 7.16.D.

3. Where a Shop Drawing or Sample is required by the Contract Documents or the Schedule of Submittals, any related Work performed prior to Engineer's review and approval of the pertinent submittal will be at the sole expense and responsibility of Contractor.

C. *Other Submittals*: Contractor shall submit other submittals to Engineer in accordance with the accepted Schedule of Submittals, and pursuant to the applicable terms of the Specifications.

D. *Engineer's Review*:

1. Engineer will provide timely review of Shop Drawings and Samples in accordance with the Schedule of Submittals acceptable to Engineer. Engineer's review and approval will be only to determine if the items covered by the submittals will, after installation or incorporation in the Work, conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.

2. Engineer's review and approval will not extend to means, methods, techniques, sequences, or procedures of construction or to safety precautions or programs incident thereto.

3. Engineer's review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

4. Engineer's review and approval of a Shop Drawing or Sample shall not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has complied with the requirements of Paragraph 7.16.A.3 and Engineer has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample. Engineer will document any such approved variation from the requirements of the Contract Documents in a Field Order.

5. Engineer's review and approval of a Shop Drawing or Sample shall not relieve Contractor from responsibility for complying with the requirements of Paragraph 7.16.A and B.

6. Engineer's review and approval of a Shop Drawing or Sample, or of a variation from the requirements of the Contract Documents, shall not, under any circumstances, change the Contract Times or Contract Price, unless such changes are included in a Change Order.

7. Neither Engineer's receipt, review, acceptance or approval of a Shop Drawing, Sample, or other submittal shall result in such item becoming a Contract Document.

8. Contractor shall perform the Work in compliance with the requirements and commitments set forth in approved Shop Drawings and Samples, subject to the provisions of Paragraph 7.16.D.4.

E. *Resubmittal Procedures*:

1. Contractor shall make corrections required by Engineer and shall return the required number of corrected copies of Shop Drawings and submit, as required, new Samples for review and approval. Contractor shall direct specific attention in writing to revisions other than the corrections called for by Engineer on previous submittals.

2. Contractor shall furnish required submittals with sufficient information and accuracy to obtain required approval of an item with no more than three submittals. Engineer will record Engineer's time for reviewing a fourth or subsequent submittal of a Shop Drawings, sample, or other item requiring approval, and Contractor shall be responsible for Engineer's charges to Owner for such time. Owner may impose a set-off against payments due to Contractor to secure reimbursement for such charges.

3. If Contractor requests a change of a previously approved submittal item, Contractor shall be responsible for Engineer's charges to Owner for its review time, and Owner may impose a set-off against payments due to Contractor to secure reimbursement for such charges, unless the need for such change is beyond the control of Contractor.

7.17 *Contractor's General Warranty and Guarantee*

A. Contractor warrants and guarantees to Owner that all Work will be in accordance with the Contract Documents and will not be defective. Engineer and its officers, directors, members, partners, employees, agents, consultants, and subcontractors shall be entitled to rely on Contractor's warranty and guarantee.

B. Contractor's warranty and guarantee hereunder excludes defects or damage caused by:

1. abuse, modification, or improper maintenance or operation by persons other than Contractor, Subcontractors, Suppliers, or any other individual or entity for whom Contractor is responsible; or

2. normal wear and tear under normal usage.

C. Contractor's obligation to perform and complete the Work in accordance with the Contract Documents shall be absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents or a release of Contractor's obligation to perform the Work in accordance with the Contract Documents:

1. observations by Engineer;

2. recommendation by Engineer or payment by Owner of any progress or final payment;

3. the issuance of a certificate of Substantial Completion by Engineer or any payment related thereto by Owner;

4. use or occupancy of the Work or any part thereof by Owner;

5. any review and approval of a Shop Drawing or Sample submittal;

6. the issuance of a notice of acceptability by Engineer;

7. any inspection, test, or approval by others; or

8. any correction of defective Work by Owner.

D. If the Contract requires the Contractor to accept the assignment of a contract entered into by Owner, then the specific warranties, guarantees, and correction obligations contained in the assigned contract shall govern with respect to Contractor's performance obligations to Owner for the Work described in the assigned contract.

7.18 *Indemnification*

A. To the fullest extent permitted by Laws and Regulations, and in addition to any other obligations of Contractor under the Contract or otherwise, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the performance of the Work, provided that any such claim, cost, loss, or damage is attributable to bodily injury, sickness, disease, or death, or to injury to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom but only to the extent caused by any negligent act or omission of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work or anyone for whose acts any of them may be liable.

B. In any and all claims against Owner or Engineer or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors by any employee (or the survivor or personal representative of such employee) of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, the indemnification obligation under Paragraph 7.18.A shall not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for Contractor or any such Subcontractor, Supplier, or other individual or entity under workers' compensation acts, disability benefit acts, or other employee benefit acts.

C. The indemnification obligations of Contractor under Paragraph 7.18.A shall not extend to the liability of Engineer and Engineer's officers, directors, members, partners, employees, agents, consultants and subcontractors arising out of:

1. the preparation or approval of, or the failure to prepare or approve maps, Drawings, opinions, reports, surveys, Change Orders, designs, or Specifications; or

2. giving directions or instructions, or failing to give them, if that is the primary cause of the injury or damage.

7.19 *Delegation of Professional Design Services*

A. Contractor will not be required to provide professional design services unless such services are specifically required by the Contract Documents for a portion of the Work or unless such services are required to carry out Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. Contractor shall not be required to provide professional services in violation of applicable Laws and Regulations.

B. If professional design services or certifications by a design professional related to systems, materials, or equipment are specifically required of Contractor by the Contract Documents, Owner and Engineer will specify all performance and design criteria that such services must satisfy. Contractor shall cause such services or certifications to be provided by a properly licensed professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, and other submittals prepared by such professional. Shop

Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to Engineer.

C. Owner and Engineer shall be entitled to rely upon the adequacy, accuracy, and completeness of the services, certifications, or approvals performed by such design professionals, provided Owner and Engineer have specified to Contractor all performance and design criteria that such services must satisfy.

D. Pursuant to this paragraph, Engineer's review and approval of design calculations and design drawings will be only for the limited purpose of checking for conformance with performance and design criteria given and the design concept expressed in the Contract Documents. Engineer's review and approval of Shop Drawings and other submittals (except design calculations and design drawings) will be only for the purpose stated in Paragraph 7.16.D.1.

E. Contractor shall not be responsible for the adequacy of the performance or design criteria specified by Owner or Engineer.

ARTICLE 8 – OTHER WORK AT THE SITE

8.01 *Other Work*

A. In addition to and apart from the Work under the Contract Documents, the Owner may perform other work at or adjacent to the Site. Such other work may be performed by Owner's employees, or through contracts between the Owner and third parties. Owner may also arrange to have third-party utility owners perform work on their utilities and facilities at or adjacent to the Site.

B. If Owner performs other work at or adjacent to the Site with Owner's employees, or through contracts for such other work, then Owner shall give Contractor written notice thereof prior to starting any such other work. If Owner has advance information regarding the start of any utility work at or adjacent to the Site, Owner shall provide such information to Contractor.

C. Contractor shall afford each other contractor that performs such other work, each utility owner performing other work, and Owner, if Owner is performing other work with Owner's employees, proper and safe access to the Site, and provide a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work. Contractor shall do all cutting, fitting, and patching of the Work that may be required to properly connect or otherwise make its several parts come together and properly integrate with such other work. Contractor shall not endanger any work of others by cutting, excavating, or otherwise altering such work; provided, however, that Contractor may cut or alter others' work with the written consent of Engineer and the others whose work will be affected.

D. If the proper execution or results of any part of Contractor's Work depends upon work performed by others under this Article 8, Contractor shall inspect such other work and promptly report to Engineer in writing any delays, defects, or deficiencies in such other work that render it unavailable or unsuitable for the proper execution and results of Contractor's Work. Contractor's failure to so report will constitute an acceptance of such other work as fit and proper for integration with Contractor's Work except for latent defects and deficiencies in such other work.

8.02 *Coordination*

A. If Owner intends to contract with others for the performance of other work at or adjacent to the Site, to perform other work at or adjacent to the Site with Owner's employees, or to arrange to have utility owners perform work at or adjacent to the Site, the following will be set forth in the Supplementary Conditions or provided to Contractor prior to the start of any such other work:

1. the identity of the individual or entity that will have authority and responsibility for coordination of the activities among the various contractors;

2. an itemization of the specific matters to be covered by such authority and responsibility; and

3. the extent of such authority and responsibilities.

B. Unless otherwise provided in the Supplementary Conditions, Owner shall have sole authority and responsibility for such coordination.

8.03 *Legal Relationships*

A. If, in the course of performing other work at or adjacent to the Site for Owner, the Owner's employees, any other contractor working for Owner, or any utility owner for whom the Owner is responsible causes damage to the Work or to the property of Contractor or its Subcontractors, or delays, disrupts, interferes with, or increases the scope or cost of the performance of the Work, through actions or inaction, then Contractor shall be entitled to an equitable adjustment in the Contract Price or the Contract Times, or both. Contractor must submit any Change Proposal seeking an equitable adjustment in the Contract Price or the Contract Times under this paragraph within 30 days of the damaging, delaying, disrupting, or interfering event. The entitlement to, and extent of, any such equitable adjustment shall take into account information (if any) regarding such other work that was provided to Contractor in the Contract Documents prior to the submittal of the Bid or the final negotiation of the terms of the Contract. When applicable, any such equitable adjustment in Contract Price shall be conditioned on Contractor assigning to Owner all Contractor's rights against such other contractor or utility owner with respect to the damage, delay, disruption, or interference that is the subject of the adjustment. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.

B. Contractor shall take reasonable and customary measures to avoid damaging, delaying, disrupting, or interfering with the work of Owner, any other contractor, or any utility owner performing other work at or adjacent to the Site. If Contractor fails to take such measures and as a result damages, delays, disrupts, or interferes with the work of any such other contractor or utility owner, then Owner may impose a set-off against payments due to Contractor, and assign to such other contractor or utility owner the Owner's contractual rights against Contractor with respect to the breach of the obligations set forth in this paragraph.

C. When Owner is performing other work at or adjacent to the Site with Owner's employees, Contractor shall be liable to Owner for damage to such other work, and for the reasonable direct delay, disruption, and interference costs incurred by Owner as a result of Contractor's failure to take reasonable and customary measures with respect to Owner's other work. In response to such damage, delay, disruption, or interference, Owner may impose a set-off against payments due to Contractor.

D. If Contractor damages, delays, disrupts, or interferes with the work of any other contractor, or any utility owner performing other work at or adjacent to the Site, through Contractor's failure to take reasonable and customary measures to avoid such impacts, or if any claim arising out of Contractor's actions, inactions, or negligence in performance of the Work at or adjacent to the Site is made by any such other contractor or utility owner against Contractor, Owner, or Engineer, then Contractor shall (1) promptly attempt to settle the claim as to all parties through negotiations with such other contractor or utility owner, or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law, and (2) indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against any such claims, and against all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such damage, delay, disruption, or interference.

ARTICLE 9 – OWNER'S RESPONSIBILITIES

9.01 *Communications to Contractor*

A. Except as otherwise provided in these General Conditions, Owner shall issue all communications to Contractor through Engineer.

9.02 *Replacement of Engineer*

A. Owner may at its discretion appoint an engineer to replace Engineer, provided Contractor makes no reasonable objection to the replacement engineer. The replacement engineer's status under the Contract Documents shall be that of the former Engineer.

9.03 *Furnish Data*

A. Owner shall promptly furnish the data required of Owner under the Contract Documents.

9.04 *Pay When Due*

A. Owner shall make payments to Contractor when they are due as provided in the Agreement.

9.05 *Lands and Easements; Reports, Tests, and Drawings*

A. Owner's duties with respect to providing lands and easements are set forth in Paragraph 5.01.

B. Owner's duties with respect to providing engineering surveys to establish reference points are set forth in Paragraph 4.03.

C. Article 5 refers to Owner's identifying and making available to Contractor copies of reports of explorations and tests of conditions at the Site, and drawings of physical conditions relating to existing surface or subsurface structures at the Site.

9.06 *Insurance*

A. Owner's responsibilities, if any, with respect to purchasing and maintaining liability and property insurance are set forth in Article 6.

9.07 *Change Orders*

A. Owner's responsibilities with respect to Change Orders are set forth in Article 11.

9.08 *Inspections, Tests, and Approvals*

A. Owner's responsibility with respect to certain inspections, tests, and approvals is set forth in Paragraph 14.02.B.

9.09 *Limitations on Owner's Responsibilities*

A. The Owner shall not supervise, direct, or have control or authority over, nor be responsible for, Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Owner will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

9.10 *Undisclosed Hazardous Environmental Condition*

A. Owner's responsibility in respect to an undisclosed Hazardous Environmental Condition is set forth in Paragraph 5.06.

9.11 *Evidence of Financial Arrangements*

A. Upon request of Contractor, Owner shall furnish Contractor reasonable evidence that financial arrangements have been made to satisfy Owner's obligations under the Contract Documents (including obligations under proposed changes in the Work).

9.12 *Safety Programs*

A. While at the Site, Owner's employees and representatives shall comply with the specific applicable requirements of Contractor's safety programs of which Owner has been informed.

B. Owner shall furnish copies of any applicable Owner safety programs to Contractor.

ARTICLE 10 – ENGINEER'S STATUS DURING CONSTRUCTION

10.01 *Owner's Representative*

A. Engineer will be Owner's representative during the construction period. The duties and responsibilities and the limitations of authority of Engineer as Owner's representative during construction are set forth in the Contract.

10.02 *Visits to Site*

A. Engineer will make visits to the Site at intervals appropriate to the various stages of construction as Engineer deems necessary in order to observe as an experienced and qualified design professional the progress that has been made and the quality of the various aspects of Contractor's executed Work. Based on information obtained during such visits and observations, Engineer, for the benefit of Owner, will determine, in general, if the Work is proceeding in accordance with the Contract Documents. Engineer will not be required to make exhaustive or continuous inspections on the Site to check the quality or quantity of the Work. Engineer's efforts will be directed toward providing for Owner a greater degree of confidence that the completed Work will conform generally to the Contract Documents. On the basis of such visits and observations, Engineer will keep Owner informed of the progress of the Work and will endeavor to guard Owner against defective Work.

B. Engineer's visits and observations are subject to all the limitations on Engineer's authority and responsibility set forth in Paragraph 10.08. Particularly, but without limitation, during

or as a result of Engineer's visits or observations of Contractor's Work, Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work.

10.03 *Project Representative*

A. If Owner and Engineer have agreed that Engineer will furnish a Resident Project Representative to represent Engineer at the Site and assist Engineer in observing the progress and quality of the Work, then the authority and responsibilities of any such Resident Project Representative will be as provided in the Supplementary Conditions, and limitations on the responsibilities thereof will be as provided in Paragraph 10.08. If Owner designates another representative or agent to represent Owner at the Site who is not Engineer's consultant, agent, or employee, the responsibilities and authority and limitations thereon of such other individual or entity will be as provided in the Supplementary Conditions.

10.04 *Rejecting Defective Work*

A. Engineer has the authority to reject Work in accordance with Article 14.

10.05 *Shop Drawings, Change Orders and Payments*

A. Engineer's authority, and limitations thereof, as to Shop Drawings and Samples, are set forth in Paragraph 7.16.

B. Engineer's authority, and limitations thereof, as to design calculations and design drawings submitted in response to a delegation of professional design services, if any, are set forth in Paragraph 7.19.

C. Engineer's authority as to Change Orders is set forth in Article 11.

D. Engineer's authority as to Applications for Payment is set forth in Article 15.

10.06 *Determinations for Unit Price Work*

A. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor as set forth in Paragraph 13.03.

10.07 *Decisions on Requirements of Contract Documents and Acceptability of Work*

A. Engineer will render decisions regarding the requirements of the Contract Documents, and judge the acceptability of the Work, pursuant to the specific procedures set forth herein for initial interpretations, Change Proposals, and acceptance of the Work. In rendering such decisions and judgments, Engineer will not show partiality to Owner or Contractor, and will not be liable to Owner, Contractor, or others in connection with any proceedings, interpretations, decisions, or judgments conducted or rendered in good faith.

10.08 *Limitations on Engineer's Authority and Responsibilities*

A. Neither Engineer's authority or responsibility under this Article 10 or under any other provision of the Contract, nor any decision made by Engineer in good faith either to exercise or not exercise such authority or responsibility or the undertaking, exercise, or performance of any authority or responsibility by Engineer, shall create, impose, or give rise to any duty in contract, tort, or otherwise owed by Engineer to Contractor, any Subcontractor, any Supplier, any other individual or entity, or to any surety for or employee or agent of any of them.

B. Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Engineer will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

C. Engineer will not be responsible for the acts or omissions of Contractor or of any Subcontractor, any Supplier, or of any other individual or entity performing any of the Work.

D. Engineer's review of the final Application for Payment and accompanying documentation and all maintenance and operating instructions, schedules, guarantees, bonds, certificates of inspection, tests and approvals, and other documentation required to be delivered by Paragraph 15.06.A will only be to determine generally that their content complies with the requirements of, and in the case of certificates of inspections, tests, and approvals, that the results certified indicate compliance with the Contract Documents.

E. The limitations upon authority and responsibility set forth in this Paragraph 10.08 shall also apply to the Resident Project Representative, if any.

10.09 *Compliance with Safety Program*

A. While at the Site, Engineer's employees and representatives will comply with the specific applicable requirements of Owner's and Contractor's safety programs (if any) of which Engineer has been informed.

ARTICLE 11 – AMENDING THE CONTRACT DOCUMENTS; CHANGES IN THE WORK

11.01 *Amending and Supplementing Contract Documents*

A. The Contract Documents may be amended or supplemented by a Change Order, a Work Change Directive, or a Field Order.

1. *Change Orders*:

a. If an amendment or supplement to the Contract Documents includes a change in the Contract Price or the Contract Times, such amendment or supplement must be set forth in a Change Order. A Change Order also may be used to establish amendments and supplements of the Contract Documents that do not affect the Contract Price or Contract Times.

b. Owner and Contractor may amend those terms and conditions of the Contract Documents that do not involve (1) the performance or acceptability of the Work, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, without the recommendation of the Engineer. Such an amendment shall be set forth in a Change Order.

2. *Work Change Directives*: A Work Change Directive will not change the Contract Price or the Contract Times but is evidence that the parties expect that the modification ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order, following negotiations by the parties as to the Work Change Directive's effect, if any, on the Contract Price and Contract Times; or, if negotiations are unsuccessful, by a determination under the terms of the Contract Documents governing adjustments, expressly including Paragraph 11.04 regarding change of Contract Price. Contractor must submit any Change Proposal seeking an

adjustment of the Contract Price or the Contract Times, or both, no later than 30 days after the completion of the Work set out in the Work Change Directive. Owner must submit any Claim seeking an adjustment of the Contract Price or the Contract Times, or both, no later than 60 days after issuance of the Work Change Directive.

3. *Field Orders*: Engineer may authorize minor changes in the Work if the changes do not involve an adjustment in the Contract Price or the Contract Times and are compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. Such changes will be accomplished by a Field Order and will be binding on Owner and also on Contractor, which shall perform the Work involved promptly. If Contractor believes that a Field Order justifies an adjustment in the Contract Price or Contract Times, or both, then before proceeding with the Work at issue, Contractor shall submit a Change Proposal as provided herein.

11.02 *Owner-Authorized Changes in the Work*

A. Without invalidating the Contract and without notice to any surety, Owner may, at any time or from time to time, order additions, deletions, or revisions in the Work. Such changes shall be supported by Engineer's recommendation, to the extent the change involves the design (as set forth in the Drawings, Specifications, or otherwise), or other engineering or technical matters. Such changes may be accomplished by a Change Order, if Owner and Contractor have agreed as to the effect, if any, of the changes on Contract Times or Contract Price; or by a Work Change Directive. Upon receipt of any such document, Contractor shall promptly proceed with the Work involved; or, in the case of a deletion in the Work, promptly cease construction activities with respect to such deleted Work. Added or revised Work shall be performed under the applicable conditions of the Contract Documents. Nothing in this paragraph shall obligate Contractor to undertake work that Contractor reasonably concludes cannot be performed in a manner consistent with Contractor's safety obligations under the Contract Documents or Laws and Regulations.

11.03 *Unauthorized Changes in the Work*

A. Contractor shall not be entitled to an increase in the Contract Price or an extension of the Contract Times with respect to any work performed that is not required by the Contract Documents, as amended, modified, or supplemented, except in the case of an emergency as provided in Paragraph 7.15 or in the case of uncovering Work as provided in Paragraph 14.05.

11.04 *Change of Contract Price*

A. The Contract Price may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Price shall comply with the provisions of Paragraph 11.06. Any Claim for an adjustment of Contract Price shall comply with the provisions of Article 12.

B. An adjustment in the Contract Price will be determined as follows:

1. where the Work involved is covered by unit prices contained in the Contract Documents, then by application of such unit prices to the quantities of the items involved (subject to the provisions of Paragraph 13.03); or

2. where the Work involved is not covered by unit prices contained in the Contract Documents, then by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with Paragraph 11.04.C.2); or

3. where the Work involved is not covered by unit prices contained in the Contract Documents and the parties do not reach mutual agreement to a lump sum, then on

the basis of the Cost of the Work (determined as provided in Paragraph 13.01) plus a Contractor's fee for overhead and profit (determined as provided in Paragraph 11.04.C).

C. *Contractor's Fee*: When applicable, the Contractor's fee for overhead and profit shall be determined as follows:

1. a mutually acceptable fixed fee; or

2. if a fixed fee is not agreed upon, then a fee based on the following percentages of the various portions of the Cost of the Work:

a. for costs incurred under Paragraphs 13.01.B.1 and 13.01.B.2, the Contractor's fee shall be 15 percent;

b. for costs incurred under Paragraph 13.01.B.3, the Contractor's fee shall be five percent;

c. where one or more tiers of subcontracts are on the basis of Cost of the Work plus a fee and no fixed fee is agreed upon, the intent of Paragraphs 11.04.C.2.a and 11.04.C.2.b is that the Contractor's fee shall be based on: (1) a fee of 15 percent of the costs incurred under Paragraphs 13.01.A.1 and 13.01.A.2 by the Subcontractor that actually performs the Work, at whatever tier, and (2) with respect to Contractor itself and to any Subcontractors of a tier higher than that of the Subcontractor that actually performs the Work, a fee of five percent of the amount (fee plus underlying costs incurred) attributable to the next lower tier Subcontractor; provided, however, that for any such subcontracted work the maximum total fee to be paid by Owner shall be no greater than 27 percent of the costs incurred by the Subcontractor that actually performs the work;

d. no fee shall be payable on the basis of costs itemized under Paragraphs 13.01.B.4, 13.01.B.5, and 13.01.C;

e. the amount of credit to be allowed by Contractor to Owner for any change which results in a net decrease in cost will be the amount of the actual net decrease in cost plus a deduction in Contractor's fee by an amount equal to five percent of such net decrease; and

f. when both additions and credits are involved in any one change, the adjustment in Contractor's fee shall be computed on the basis of the net change in accordance with Paragraphs 11.04.C.2.a through 11.04.C.2.e, inclusive.

11.05 *Change of Contract Times*

A. The Contract Times may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Times shall comply with the provisions of Paragraph 11.06. Any Claim for an adjustment in the Contract Times shall comply with the provisions of Article 12.

B. An adjustment of the Contract Times shall be subject to the limitations set forth in Paragraph 4.05, concerning delays in Contractor's progress.

11.06 *Change Proposals*

A. Contractor shall submit a Change Proposal to Engineer to request an adjustment in the Contract Times or Contract Price; appeal an initial decision by Engineer concerning the requirements of the Contract Documents or relating to the acceptability of the Work under the Contract Documents; contest a set-off against payment due; or seek other relief under

the Contract. The Change Proposal shall specify any proposed change in Contract Times or Contract Price, or both, or other proposed relief, and explain the reason for the proposed change, with citations to any governing or applicable provisions of the Contract Documents.

1. *Procedures*: Contractor shall submit each Change Proposal to Engineer promptly (but in no event later than 30 days) after the start of the event giving rise thereto, or after such initial decision. The Contractor shall submit supporting data, including the proposed change in Contract Price or Contract Time (if any), to the Engineer and Owner within 15 days after the submittal of the Change Proposal. The supporting data shall be accompanied by a written statement that the supporting data are accurate and complete, and that any requested time or price adjustment is the entire adjustment to which Contractor believes it is entitled as a result of said event. Engineer will advise Owner regarding the Change Proposal, and consider any comments or response from Owner regarding the Change Proposal.

2. *Engineer's Action*: Engineer will review each Change Proposal and, within 30 days after receipt of the Contractor's supporting data, either deny the Change Proposal in whole, approve it in whole, or deny it in part and approve it in part. Such actions shall be in writing, with a copy provided to Owner and Contractor. If Engineer does not take action on the Change Proposal within 30 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of Engineer's inaction the Change Proposal is deemed denied, thereby commencing the time for appeal of the denial under Article 12.

3. *Binding Decision*: Engineer's decision will be final and binding upon Owner and Contractor, unless Owner or Contractor appeals the decision by filing a Claim under Article 12.

B. *Resolution of Certain Change Proposals*: If the Change Proposal does not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters, then Engineer will notify the parties that the Engineer is unable to resolve the Change Proposal. For purposes of further resolution of such a Change Proposal, such notice shall be deemed a denial, and Contractor may choose to seek resolution under the terms of Article 12.

11.07 *Execution of Change Orders*

A. Owner and Contractor shall execute appropriate Change Orders covering:

1. changes in the Contract Price or Contract Times which are agreed to by the parties, including any undisputed sum or amount of time for Work actually performed in accordance with a Work Change Directive;

2. changes in Contract Price resulting from an Owner set-off, unless Contractor has duly contested such set-off;

3. changes in the Work which are: (a) ordered by Owner pursuant to Paragraph 11.02, (b) required because of Owner's acceptance of defective Work under Paragraph 14.04 or Owner's correction of defective Work under Paragraph 14.07, or (c) agreed to by the parties, subject to the need for Engineer's recommendation if the change in the Work involves the design (as set forth in the Drawings, Specifications, or otherwise), or other engineering or technical matters; and

4. changes in the Contract Price or Contract Times, or other changes, which embody the substance of any final and binding results under Paragraph 11.06, or Article 12.

B. If Owner or Contractor refuses to execute a Change Order that is required to be executed under the terms of this Paragraph 11.07, it shall be deemed to be of full force and effect, as if fully executed.

11.08 *Notification to Surety*

A. If the provisions of any bond require notice to be given to a surety of any change affecting the general scope of the Work or the provisions of the Contract Documents (including, but not limited to, Contract Price or Contract Times), the giving of any such notice will be Contractor's responsibility. The amount of each applicable bond will be adjusted to reflect the effect of any such change.

ARTICLE 12 – CLAIMS

12.01 *Claims*

A. *Claims Process*: The following disputes between Owner and Contractor shall be submitted to the Claims process set forth in this Article:

1. Appeals by Owner or Contractor of Engineer's decisions regarding Change Proposals;

2. Owner demands for adjustments in the Contract Price or Contract Times, or other relief under the Contract Documents; and

3. Disputes that Engineer has been unable to address because they do not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters.

B. *Submittal of Claim*: The party submitting a Claim shall deliver it directly to the other party to the Contract promptly (but in no event later than 30 days) after the start of the event giving rise thereto; in the case of appeals regarding Change Proposals within 30 days of the decision under appeal. The party submitting the Claim shall also furnish a copy to the Engineer, for its information only. The responsibility to substantiate a Claim shall rest with the party making the Claim. In the case of a Claim by Contractor seeking an increase in the Contract Times or Contract Price, or both, Contractor shall certify that the Claim is made in good faith, that the supporting data are accurate and complete, and that to the best of Contractor's knowledge and belief the amount of time or money requested accurately reflects the full amount to which Contractor is entitled.

C. *Review and Resolution*: The party receiving a Claim shall review it thoroughly, giving full consideration to its merits. The two parties shall seek to resolve the Claim through the exchange of information and direct negotiations. The parties may extend the time for resolving the Claim by mutual agreement. All actions taken on a Claim shall be stated in writing and submitted to the other party, with a copy to Engineer.

D. *Mediation*:

1. At any time after initiation of a Claim, Owner and Contractor may mutually agree to mediation of the underlying dispute. The agreement to mediate shall stay the Claim submittal and response process.

2. If Owner and Contractor agree to mediation, then after 60 days from such agreement, either Owner or Contractor may unilaterally terminate the mediation process, and the Claim submittal and decision process shall resume as of the date of the termination. If the mediation proceeds but is unsuccessful in resolving the dispute, the Claim

submittal and decision process shall resume as of the date of the conclusion of the mediation, as determined by the mediator.

3. Owner and Contractor shall each pay one-half of the mediator's fees and costs.

E. *Partial Approval*: If the party receiving a Claim approves the Claim in part and denies it in part, such action shall be final and binding unless within 30 days of such action the other party invokes the procedure set forth in Article 17 for final resolution of disputes.

F. *Denial of Claim*: If efforts to resolve a Claim are not successful, the party receiving the Claim may deny it by giving written notice of denial to the other party. If the receiving party does not take action on the Claim within 90 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of the inaction, the Claim is deemed denied, thereby commencing the time for appeal of the denial. A denial of the Claim shall be final and binding unless within 30 days of the denial the other party invokes the procedure set forth in Article 17 for the final resolution of disputes.

G. *Final and Binding Results*: If the parties reach a mutual agreement regarding a Claim, whether through approval of the Claim, direct negotiations, mediation, or otherwise; or if a Claim is approved in part and denied in part, or denied in full, and such actions become final and binding; then the results of the agreement or action on the Claim shall be incorporated in a Change Order to the extent they affect the Contract, including the Work, the Contract Times, or the Contract Price.

ARTICLE 13 – COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK

13.01 *Cost of the Work*

A. *Purposes for Determination of Cost of the Work*: The term Cost of the Work means the sum of all costs necessary for the proper performance of the Work at issue, as further defined below. The provisions of this Paragraph 13.01 are used for two distinct purposes:

1. To determine Cost of the Work when Cost of the Work is a component of the Contract Price, under cost-plus-fee, time-and-materials, or other cost-based terms; or

2. To determine the value of a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price. When the value of any such adjustment is determined on the basis of Cost of the Work, Contractor is entitled only to those additional or incremental costs required because of the change in the Work or because of the event giving rise to the adjustment.

B. *Costs Included*: Except as otherwise may be agreed to in writing by Owner, costs included in the Cost of the Work shall be in amounts no higher than those prevailing in the locality of the Project, shall not include any of the costs itemized in Paragraph 13.01.C, and shall include only the following items:

1. Payroll costs for employees in the direct employ of Contractor in the performance of the Work under schedules of job classifications agreed upon by Owner and Contractor. Such employees shall include, without limitation, superintendents, foremen, and other personnel employed full time on the Work. Payroll costs for employees not employed full time on the Work shall be apportioned on the basis of their time spent on the Work. Payroll costs shall include, but not be limited to, salaries and wages plus the cost of fringe benefits, which shall include social security contributions, unemployment, excise, and payroll taxes, workers' compensation, health and retirement benefits, bonuses, sick leave, and vacation and holiday pay applicable

thereto. The expenses of performing Work outside of regular working hours, on Saturday, Sunday, or legal holidays, shall be included in the above to the extent authorized by Owner.

2. Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and Suppliers' field services required in connection therewith. All cash discounts shall accrue to Contractor unless Owner deposits funds with Contractor with which to make payments, in which case the cash discounts shall accrue to Owner. All trade discounts, rebates, and refunds and returns from sale of surplus materials and equipment shall accrue to Owner, and Contractor shall make provisions so that they may be obtained.

3. Payments made by Contractor to Subcontractors for Work performed by Subcontractors. If required by Owner, Contractor shall obtain competitive bids from subcontractors acceptable to Owner and Contractor and shall deliver such bids to Owner, who will then determine, with the advice of Engineer, which bids, if any, will be acceptable. If any subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work plus a fee, the Subcontractor's Cost of the Work and fee shall be determined in the same manner as Contractor's Cost of the Work and fee as provided in this Paragraph 13.01.

4. Costs of special consultants (including but not limited to engineers, architects, testing laboratories, surveyors, attorneys, and accountants) employed for services specifically related to the Work.

5. Supplemental costs including the following:

    a. The proportion of necessary transportation, travel, and subsistence expenses of Contractor's employees incurred in discharge of duties connected with the Work.

    b. Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office, and temporary facilities at the Site, and hand tools not owned by the workers, which are consumed in the performance of the Work, and cost, less market value, of such items used but not consumed which remain the property of Contractor.

    c. Rentals of all construction equipment and machinery, and the parts thereof, whether rented from Contractor or others in accordance with rental agreements approved by Owner with the advice of Engineer, and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs shall be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts shall cease when the use thereof is no longer necessary for the Work.

    d. Sales, consumer, use, and other similar taxes related to the Work, and for which Contractor is liable, as imposed by Laws and Regulations.

    e. Deposits lost for causes other than negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, and royalty payments and fees for permits and licenses.

    f. Losses and damages (and related expenses) caused by damage to the Work, not compensated by insurance or otherwise, sustained by Contractor in connection with the performance of the Work (except losses and damages within the deductible amounts of property insurance established in accordance with Paragraph 6.05), provided such losses and damages have resulted from causes

other than the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable. Such losses shall include settlements made with the written consent and approval of Owner. No such losses, damages, and expenses shall be included in the Cost of the Work for the purpose of determining Contractor's fee.

g. The cost of utilities, fuel, and sanitary facilities at the Site.

h. Minor expenses such as communication service at the Site, express and courier services, and similar petty cash items in connection with the Work.

i. The costs of premiums for all bonds and insurance that Contractor is required by the Contract Documents to purchase and maintain.

C. *Costs Excluded*: The term Cost of the Work shall not include any of the following items:

1. Payroll costs and other compensation of Contractor's officers, executives, principals (of partnerships and sole proprietorships), general managers, safety managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expediters, timekeepers, clerks, and other personnel employed by Contractor, whether at the Site or in Contractor's principal or branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in Paragraph 13.01.B.1 or specifically covered by Paragraph 13.01.B.4. The payroll costs and other compensation excluded here are to be considered administrative costs covered by the Contractor's fee.

2. Expenses of Contractor's principal and branch offices other than Contractor's office at the Site.

3. Any part of Contractor's capital expenses, including interest on Contractor's capital employed for the Work and charges against Contractor for delinquent payments.

4. Costs due to the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not limited to, the correction of defective Work, disposal of materials or equipment wrongly supplied, and making good any damage to property.

5. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in Paragraph 13.01.B.

D. *Contractor's Fee*: When the Work as a whole is performed on the basis of cost-plus, Contractor's fee shall be determined as set forth in the Agreement. When the value of any Work covered by a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price is determined on the basis of Cost of the Work, Contractor's fee shall be determined as set forth in Paragraph 11.04.C.

E. *Documentation*: Whenever the Cost of the Work for any purpose is to be determined pursuant to this Article 13, Contractor will establish and maintain records thereof in accordance with generally accepted accounting practices and submit in a form acceptable to Engineer an itemized cost breakdown together with supporting data.

13.02 *Allowances*

A. It is understood that Contractor has included in the Contract Price all allowances so named in the Contract Documents and shall cause the Work so covered to be performed for such sums and by such persons or entities as may be acceptable to Owner and Engineer.

B. *Cash Allowances*: Contractor agrees that:

1. the cash allowances include the cost to Contractor (less any applicable trade discounts) of materials and equipment required by the allowances to be delivered at the Site, and all applicable taxes; and

2. Contractor's costs for unloading and handling on the Site, labor, installation, overhead, profit, and other expenses contemplated for the cash allowances have been included in the Contract Price and not in the allowances, and no demand for additional payment on account of any of the foregoing will be valid.

C. *Contingency Allowance*: Contractor agrees that a contingency allowance, if any, is for the sole use of Owner to cover unanticipated costs.

D. Prior to final payment, an appropriate Change Order will be issued as recommended by Engineer to reflect actual amounts due Contractor on account of Work covered by allowances, and the Contract Price shall be correspondingly adjusted.

13.03 *Unit Price Work*

A. Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement.

B. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Payments to Contractor for Unit Price Work will be based on actual quantities.

C. Each unit price will be deemed to include an amount considered by Contractor to be adequate to cover Contractor's overhead and profit for each separately identified item.

D. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor. Engineer will review with Contractor the Engineer's preliminary determinations on such matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise). Engineer's written decision thereon will be final and binding (except as modified by Engineer to reflect changed factual conditions or more accurate data) upon Owner and Contractor, subject to the provisions of the following paragraph.

E. Within 30 days of Engineer's written decision under the preceding paragraph, Contractor may submit a Change Proposal, or Owner may file a Claim, seeking an adjustment in the Contract Price if:

1. the quantity of any item of Unit Price Work performed by Contractor differs materially and significantly from the estimated quantity of such item indicated in the Agreement;

2. there is no corresponding adjustment with respect to any other item of Work; and

3. Contractor believes that it is entitled to an increase in Contract Price as a result of having incurred additional expense or Owner believes that Owner is entitled to a decrease in Contract Price, and the parties are unable to agree as to the amount of any such increase or decrease.

ARTICLE 14 – TESTS AND INSPECTIONS; CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK

14.01 *Access to Work*

A. Owner, Engineer, their consultants and other representatives and personnel of Owner, independent testing laboratories, and authorities having jurisdiction will have access to the Site and the Work at reasonable times for their observation, inspection, and testing. Contractor shall provide them proper and safe conditions for such access and advise them of Contractor's safety procedures and programs so that they may comply therewith as applicable.

14.02 *Tests, Inspections, and Approvals*

A. Contractor shall give Engineer timely notice of readiness of the Work (or specific parts thereof) for all required inspections and tests, and shall cooperate with inspection and testing personnel to facilitate required inspections and tests.

B. Owner shall retain and pay for the services of an independent inspector, testing laboratory, or other qualified individual or entity to perform all inspections and tests expressly required by the Contract Documents to be furnished and paid for by Owner, except that costs incurred in connection with tests or inspections of covered Work shall be governed by the provisions of Paragraph 14.05.

C. If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested, or approved by an employee or other representative of such public body, Contractor shall assume full responsibility for arranging and obtaining such inspections, tests, or approvals, pay all costs in connection therewith, and furnish Engineer the required certificates of inspection or approval.

D. Contractor shall be responsible for arranging, obtaining, and paying for all inspections and tests required:

1. by the Contract Documents, unless the Contract Documents expressly allocate responsibility for a specific inspection or test to Owner;

2. to attain Owner's and Engineer's acceptance of materials or equipment to be incorporated in the Work;

3. by manufacturers of equipment furnished under the Contract Documents;

4. for testing, adjusting, and balancing of mechanical, electrical, and other equipment to be incorporated into the Work; and

5. for acceptance of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation in the Work.

Such inspections and tests shall be performed by independent inspectors, testing laboratories, or other qualified individuals or entities acceptable to Owner and Engineer.

E. If the Contract Documents require the Work (or part thereof) to be approved by Owner, Engineer, or another designated individual or entity, then Contractor shall assume full responsibility for arranging and obtaining such approvals.

F. If any Work (or the work of others) that is to be inspected, tested, or approved is covered by Contractor without written concurrence of Engineer, Contractor shall, if requested by Engineer, uncover such Work for observation. Such uncovering shall be at Contractor's expense unless Contractor had given Engineer timely notice of Contractor's intention to

cover the same and Engineer had not acted with reasonable promptness in response to such notice.

14.03 *Defective Work*

A. *Contractor's Obligation*: It is Contractor's obligation to assure that the Work is not defective.

B. *Engineer's Authority*: Engineer has the authority to determine whether Work is defective, and to reject defective Work.

C. *Notice of Defects*: Prompt notice of all defective Work of which Owner or Engineer has actual knowledge will be given to Contractor.

D. *Correction, or Removal and Replacement*: Promptly after receipt of written notice of defective Work, Contractor shall correct all such defective Work, whether or not fabricated, installed, or completed, or, if Engineer has rejected the defective Work, remove it from the Project and replace it with Work that is not defective.

E. *Preservation of Warranties*: When correcting defective Work, Contractor shall take no action that would void or otherwise impair Owner's special warranty and guarantee, if any, on said Work.

F. *Costs and Damages*: In addition to its correction, removal, and replacement obligations with respect to defective Work, Contractor shall pay all claims, costs, losses, and damages arising out of or relating to defective Work, including but not limited to the cost of the inspection, testing, correction, removal, replacement, or reconstruction of such defective Work, fines levied against Owner by governmental authorities because the Work is defective, and the costs of repair or replacement of work of others resulting from defective Work. Prior to final payment, if Owner and Contractor are unable to agree as to the measure of such claims, costs, losses, and damages resulting from defective Work, then Owner may impose a reasonable set-off against payments due under Article 15.

14.04 *Acceptance of Defective Work*

A. If, instead of requiring correction or removal and replacement of defective Work, Owner prefers to accept it, Owner may do so (subject, if such acceptance occurs prior to final payment, to Engineer's confirmation that such acceptance is in general accord with the design intent and applicable engineering principles, and will not endanger public safety). Contractor shall pay all claims, costs, losses, and damages attributable to Owner's evaluation of and determination to accept such defective Work (such costs to be approved by Engineer as to reasonableness), and for the diminished value of the Work to the extent not otherwise paid by Contractor. If any such acceptance occurs prior to final payment, the necessary revisions in the Contract Documents with respect to the Work shall be incorporated in a Change Order. If the parties are unable to agree as to the decrease in the Contract Price, reflecting the diminished value of Work so accepted, then Owner may impose a reasonable set-off against payments due under Article 15. If the acceptance of defective Work occurs after final payment, Contractor shall pay an appropriate amount to Owner.

14.05 *Uncovering Work*

A. Engineer has the authority to require additional inspection or testing of the Work, whether or not the Work is fabricated, installed, or completed.

B. If any Work is covered contrary to the written request of Engineer, then Contractor shall, if requested by Engineer, uncover such Work for Engineer's observation, and then replace the covering, all at Contractor's expense.

C. If Engineer considers it necessary or advisable that covered Work be observed by Engineer or inspected or tested by others, then Contractor, at Engineer's request, shall uncover, expose, or otherwise make available for observation, inspection, or testing as Engineer may require, that portion of the Work in question, and provide all necessary labor, material, and equipment.

1. If it is found that the uncovered Work is defective, Contractor shall be responsible for all claims, costs, losses, and damages arising out of or relating to such uncovering, exposure, observation, inspection, and testing, and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and pending Contractor's full discharge of this responsibility the Owner shall be entitled to impose a reasonable set-off against payments due under Article 15.

2. If the uncovered Work is not found to be defective, Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Times, or both, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement, and reconstruction. If the parties are unable to agree as to the amount or extent thereof, then Contractor may submit a Change Proposal within 30 days of the determination that the Work is not defective.

14.06 *Owner May Stop the Work*

A. If the Work is defective, or Contractor fails to supply sufficient skilled workers or suitable materials or equipment, or fails to perform the Work in such a way that the completed Work will conform to the Contract Documents, then Owner may order Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of Owner to stop the Work shall not give rise to any duty on the part of Owner to exercise this right for the benefit of Contractor, any Subcontractor, any Supplier, any other individual or entity, or any surety for, or employee or agent of any of them.

14.07 *Owner May Correct Defective Work*

A. If Contractor fails within a reasonable time after written notice from Engineer to correct defective Work, or to remove and replace rejected Work as required by Engineer, or if Contractor fails to perform the Work in accordance with the Contract Documents, or if Contractor fails to comply with any other provision of the Contract Documents, then Owner may, after seven days written notice to Contractor, correct or remedy any such deficiency.

B. In exercising the rights and remedies under this Paragraph 14.07, Owner shall proceed expeditiously. In connection with such corrective or remedial action, Owner may exclude Contractor from all or part of the Site, take possession of all or part of the Work and suspend Contractor's services related thereto, and incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere. Contractor shall allow Owner, Owner's representatives, agents and employees, Owner's other contractors, and Engineer and Engineer's consultants access to the Site to enable Owner to exercise the rights and remedies under this paragraph.

C. All claims, costs, losses, and damages incurred or sustained by Owner in exercising the rights and remedies under this Paragraph 14.07 will be charged against Contractor as set-offs against payments due under Article 15. Such claims, costs, losses and damages will

include but not be limited to all costs of repair, or replacement of work of others destroyed or damaged by correction, removal, or replacement of Contractor's defective Work.

D. Contractor shall not be allowed an extension of the Contract Times because of any delay in the performance of the Work attributable to the exercise by Owner of Owner's rights and remedies under this Paragraph 14.07.

ARTICLE 15 – PAYMENTS TO CONTRACTOR; SET-OFFS; COMPLETION; CORRECTION PERIOD

15.01 *Progress Payments*

A. *Basis for Progress Payments*: The Schedule of Values established as provided in Article 2 will serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to Engineer. Progress payments on account of Unit Price Work will be based on the number of units completed during the pay period, as determined under the provisions of Paragraph 13.03. Progress payments for cost-based Work will be based on Cost of the Work completed by Contractor during the pay period.

B. *Applications for Payments*:

1. At least 20 days before the date established in the Agreement for each progress payment (but not more often than once a month), Contractor shall submit to Engineer for review an Application for Payment filled out and signed by Contractor covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the Site or at another location agreed to in writing, the Application for Payment shall also be accompanied by a bill of sale, invoice, or other documentation warranting that Owner has received the materials and equipment free and clear of all Liens, and evidence that the materials and equipment are covered by appropriate property insurance, a warehouse bond, or other arrangements to protect Owner's interest therein, all of which must be satisfactory to Owner.

2. Beginning with the second Application for Payment, each Application shall include an affidavit of Contractor stating that all previous progress payments received on account of the Work have been applied on account to discharge Contractor's legitimate obligations associated with prior Applications for Payment.

3. The amount of retainage with respect to progress payments will be as stipulated in the Agreement.

C. *Review of Applications*:

1. Engineer will, within 10 days after receipt of each Application for Payment, including each resubmittal, either indicate in writing a recommendation of payment and present the Application to Owner, or return the Application to Contractor indicating in writing Engineer's reasons for refusing to recommend payment. In the latter case, Contractor may make the necessary corrections and resubmit the Application.

2. Engineer's recommendation of any payment requested in an Application for Payment will constitute a representation by Engineer to Owner, based on Engineer's observations of the executed Work as an experienced and qualified design professional, and on Engineer's review of the Application for Payment and the accompanying data and schedules, that to the best of Engineer's knowledge, information and belief:

a. the Work has progressed to the point indicated;

b. the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, the results of any subsequent tests called for in the Contract Documents, a final determination of quantities and classifications for Unit Price Work under Paragraph 13.03, and any other qualifications stated in the recommendation); and

c. the conditions precedent to Contractor's being entitled to such payment appear to have been fulfilled in so far as it is Engineer's responsibility to observe the Work.

3. By recommending any such payment Engineer will not thereby be deemed to have represented that:

a. inspections made to check the quality or the quantity of the Work as it has been performed have been exhaustive, extended to every aspect of the Work in progress, or involved detailed inspections of the Work beyond the responsibilities specifically assigned to Engineer in the Contract; or

b. there may not be other matters or issues between the parties that might entitle Contractor to be paid additionally by Owner or entitle Owner to withhold payment to Contractor.

4. Neither Engineer's review of Contractor's Work for the purposes of recommending payments nor Engineer's recommendation of any payment, including final payment, will impose responsibility on Engineer:

a. to supervise, direct, or control the Work, or

b. for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or

c. for Contractor's failure to comply with Laws and Regulations applicable to Contractor's performance of the Work, or

d. to make any examination to ascertain how or for what purposes Contractor has used the money paid on account of the Contract Price, or

e. to determine that title to any of the Work, materials, or equipment has passed to Owner free and clear of any Liens.

5. Engineer may refuse to recommend the whole or any part of any payment if, in Engineer's opinion, it would be incorrect to make the representations to Owner stated in Paragraph 15.01.C.2.

6. Engineer will recommend reductions in payment (set-offs) necessary in Engineer's opinion to protect Owner from loss because:

a. the Work is defective, requiring correction or replacement;

b. the Contract Price has been reduced by Change Orders;

c. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;

d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible; or

e. Engineer has actual knowledge of the occurrence of any of the events that would constitute a default by Contractor and therefore justify termination for cause under the Contract Documents.

D. *Payment Becomes Due*:

1. Ten days after presentation of the Application for Payment to Owner with Engineer's recommendation, the amount recommended (subject to any Owner set-offs) will become due, and when due will be paid by Owner to Contractor.

E. *Reductions in Payment by Owner*:

1. In addition to any reductions in payment (set-offs) recommended by Engineer, Owner is entitled to impose a set-off against payment based on any of the following:

a. claims have been made against Owner on account of Contractor's conduct in the performance or furnishing of the Work, or Owner has incurred costs, losses, or damages on account of Contractor's conduct in the performance or furnishing of the Work, including but not limited to claims, costs, losses, or damages from workplace injuries, adjacent property damage, non-compliance with Laws and Regulations, and patent infringement;

b. Contractor has failed to take reasonable and customary measures to avoid damage, delay, disruption, and interference with other work at or adjacent to the Site;

c. Contractor has failed to provide and maintain required bonds or insurance;

d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible;

e. Owner has incurred extra charges or engineering costs related to submittal reviews, evaluations of proposed substitutes, tests and inspections, or return visits to manufacturing or assembly facilities;

f. the Work is defective, requiring correction or replacement;

g. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;

h. the Contract Price has been reduced by Change Orders;

i. an event that would constitute a default by Contractor and therefore justify a termination for cause has occurred;

j. liquidated damages have accrued as a result of Contractor's failure to achieve Milestones, Substantial Completion, or final completion of the Work;

k. Liens have been filed in connection with the Work, except where Contractor has delivered a specific bond satisfactory to Owner to secure the satisfaction and discharge of such Liens;

l. there are other items entitling Owner to a set off against the amount recommended.

2. If Owner imposes any set-off against payment, whether based on its own knowledge or on the written recommendations of Engineer, Owner will give Contractor immediate written notice (with a copy to Engineer) stating the reasons for such action and the specific amount of the reduction, and promptly pay Contractor any amount

remaining after deduction of the amount so withheld. Owner shall promptly pay Contractor the amount so withheld, or any adjustment thereto agreed to by Owner and Contractor, if Contractor remedies the reasons for such action. The reduction imposed shall be binding on Contractor unless it duly submits a Change Proposal contesting the reduction.

3. Upon a subsequent determination that Owner's refusal of payment was not justified, the amount wrongfully withheld shall be treated as an amount due as determined by Paragraph 15.01.C.1 and subject to interest as provided in the Agreement.

15.02 *Contractor's Warranty of Title*

A. Contractor warrants and guarantees that title to all Work, materials, and equipment furnished under the Contract will pass to Owner free and clear of (1) all Liens and other title defects, and (2) all patent, licensing, copyright, or royalty obligations, no later than seven days after the time of payment by Owner.

15.03 *Substantial Completion*

A. When Contractor considers the entire Work ready for its intended use Contractor shall notify Owner and Engineer in writing that the entire Work is substantially complete and request that Engineer issue a certificate of Substantial Completion. Contractor shall at the same time submit to Owner and Engineer an initial draft of punch list items to be completed or corrected before final payment.

B. Promptly after Contractor's notification, Owner, Contractor, and Engineer shall make an inspection of the Work to determine the status of completion. If Engineer does not consider the Work substantially complete, Engineer will notify Contractor in writing giving the reasons therefor.

C. If Engineer considers the Work substantially complete, Engineer will deliver to Owner a preliminary certificate of Substantial Completion which shall fix the date of Substantial Completion. Engineer shall attach to the certificate a punch list of items to be completed or corrected before final payment. Owner shall have seven days after receipt of the preliminary certificate during which to make written objection to Engineer as to any provisions of the certificate or attached punch list. If, after considering the objections to the provisions of the preliminary certificate, Engineer concludes that the Work is not substantially complete, Engineer will, within 14 days after submission of the preliminary certificate to Owner, notify Contractor in writing that the Work is not substantially complete, stating the reasons therefor. If Owner does not object to the provisions of the certificate, or if despite consideration of Owner's objections Engineer concludes that the Work is substantially complete, then Engineer will, within said 14 days, execute and deliver to Owner and Contractor a final certificate of Substantial Completion (with a revised punch list of items to be completed or corrected) reflecting such changes from the preliminary certificate as Engineer believes justified after consideration of any objections from Owner.

D. At the time of receipt of the preliminary certificate of Substantial Completion, Owner and Contractor will confer regarding Owner's use or occupancy of the Work following Substantial Completion, review the builder's risk insurance policy with respect to the end of the builder's risk coverage, and confirm the transition to coverage of the Work under a permanent property insurance policy held by Owner. Unless Owner and Contractor agree otherwise in writing, Owner shall bear responsibility for security, operation, protection of the Work, property insurance, maintenance, heat, and utilities upon Owner's use or occupancy of the Work.

E. After Substantial Completion the Contractor shall promptly begin work on the punch list of items to be completed or corrected prior to final payment. In appropriate cases Contractor may submit monthly Applications for Payment for completed punch list items, following the progress payment procedures set forth above.

F. Owner shall have the right to exclude Contractor from the Site after the date of Substantial Completion subject to allowing Contractor reasonable access to remove its property and complete or correct items on the punch list.

15.04 *Partial Use or Occupancy*

A. Prior to Substantial Completion of all the Work, Owner may use or occupy any substantially completed part of the Work which has specifically been identified in the Contract Documents, or which Owner, Engineer, and Contractor agree constitutes a separately functioning and usable part of the Work that can be used by Owner for its intended purpose without significant interference with Contractor's performance of the remainder of the Work, subject to the following conditions:

1. At any time Owner may request in writing that Contractor permit Owner to use or occupy any such part of the Work that Owner believes to be substantially complete. If and when Contractor agrees that such part of the Work is substantially complete, Contractor, Owner, and Engineer will follow the procedures of Paragraph 15.03.A through E for that part of the Work.

2. At any time Contractor may notify Owner and Engineer in writing that Contractor considers any such part of the Work substantially complete and request Engineer to issue a certificate of Substantial Completion for that part of the Work.

3. Within a reasonable time after either such request, Owner, Contractor, and Engineer shall make an inspection of that part of the Work to determine its status of completion. If Engineer does not consider that part of the Work to be substantially complete, Engineer will notify Owner and Contractor in writing giving the reasons therefor. If Engineer considers that part of the Work to be substantially complete, the provisions of Paragraph 15.03 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.

4. No use or occupancy or separate operation of part of the Work may occur prior to compliance with the requirements of Paragraph 6.05 regarding builder's risk or other property insurance.

15.05 *Final Inspection*

A. Upon written notice from Contractor that the entire Work or an agreed portion thereof is complete, Engineer will promptly make a final inspection with Owner and Contractor and will notify Contractor in writing of all particulars in which this inspection reveals that the Work, or agreed portion thereof, is incomplete or defective. Contractor shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

15.06 *Final Payment*

A. *Application for Payment*:

1. After Contractor has, in the opinion of Engineer, satisfactorily completed all corrections identified during the final inspection and has delivered, in accordance with the Contract Documents, all maintenance and operating instructions, schedules, guarantees, bonds, certificates or other evidence of insurance, certificates of

inspection, annotated record documents (as provided in Paragraph 7.11), and other documents, Contractor may make application for final payment.

2. The final Application for Payment shall be accompanied (except as previously delivered) by:

   a. all documentation called for in the Contract Documents;

   b. consent of the surety, if any, to final payment;

   c. satisfactory evidence that all title issues have been resolved such that title to all Work, materials, and equipment has passed to Owner free and clear of any Liens or other title defects, or will so pass upon final payment.

   d. a list of all disputes that Contractor believes are unsettled; and

   e. complete and legally effective releases or waivers (satisfactory to Owner) of all Lien rights arising out of the Work, and of Liens filed in connection with the Work.

3. In lieu of the releases or waivers of Liens specified in Paragraph 15.06.A.2 and as approved by Owner, Contractor may furnish receipts or releases in full and an affidavit of Contractor that: (a) the releases and receipts include all labor, services, material, and equipment for which a Lien could be filed; and (b) all payrolls, material and equipment bills, and other indebtedness connected with the Work for which Owner might in any way be responsible, or which might in any way result in liens or other burdens on Owner's property, have been paid or otherwise satisfied. If any Subcontractor or Supplier fails to furnish such a release or receipt in full, Contractor may furnish a bond or other collateral satisfactory to Owner to indemnify Owner against any Lien, or Owner at its option may issue joint checks payable to Contractor and specified Subcontractors and Suppliers.

B. *Engineer's Review of Application and Acceptance*:

1. If, on the basis of Engineer's observation of the Work during construction and final inspection, and Engineer's review of the final Application for Payment and accompanying documentation as required by the Contract Documents, Engineer is satisfied that the Work has been completed and Contractor's other obligations under the Contract have been fulfilled, Engineer will, within ten days after receipt of the final Application for Payment, indicate in writing Engineer's recommendation of final payment and present the Application for Payment to Owner for payment. Such recommendation shall account for any set-offs against payment that are necessary in Engineer's opinion to protect Owner from loss for the reasons stated above with respect to progress payments. At the same time Engineer will also give written notice to Owner and Contractor that the Work is acceptable, subject to the provisions of Paragraph 15.07. Otherwise, Engineer will return the Application for Payment to Contractor, indicating in writing the reasons for refusing to recommend final payment, in which case Contractor shall make the necessary corrections and resubmit the Application for Payment.

C. *Completion of Work*: The Work is complete (subject to surviving obligations) when it is ready for final payment as established by the Engineer's written recommendation of final payment.

D. *Payment Becomes Due*: Thirty days after the presentation to Owner of the final Application for Payment and accompanying documentation, the amount recommended by Engineer (less any further sum Owner is entitled to set off against Engineer's recommendation,

including but not limited to set-offs for liquidated damages and set-offs allowed under the provisions above with respect to progress payments) will become due and shall be paid by Owner to Contractor.

15.07 *Waiver of Claims*

A. The making of final payment will not constitute a waiver by Owner of claims or rights against Contractor. Owner expressly reserves claims and rights arising from unsettled Liens, from defective Work appearing after final inspection pursuant to Paragraph 15.05, from Contractor's failure to comply with the Contract Documents or the terms of any special guarantees specified therein, from outstanding Claims by Owner, or from Contractor's continuing obligations under the Contract Documents.

B. The acceptance of final payment by Contractor will constitute a waiver by Contractor of all claims and rights against Owner other than those pending matters that have been duly submitted or appealed under the provisions of Article 17.

15.08 *Correction Period*

A. If within one year after the date of Substantial Completion (or such longer period of time as may be prescribed by the terms of any applicable special guarantee required by the Contract Documents, or by any specific provision of the Contract Documents), any Work is found to be defective, or if the repair of any damages to the Site, adjacent areas that Contractor has arranged to use through construction easements or otherwise, and other adjacent areas used by Contractor as permitted by Laws and Regulations, is found to be defective, then Contractor shall promptly, without cost to Owner and in accordance with Owner's written instructions:

1. correct the defective repairs to the Site or such other adjacent areas;

2. correct such defective Work;

3. if the defective Work has been rejected by Owner, remove it from the Project and replace it with Work that is not defective, and

4. satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others, or to other land or areas resulting therefrom.

B. If Contractor does not promptly comply with the terms of Owner's written instructions, or in an emergency where delay would cause serious risk of loss or damage, Owner may have the defective Work corrected or repaired or may have the rejected Work removed and replaced. Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others).

C. In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date if so provided in the Specifications.

D. Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and replaced under this paragraph, the correction period hereunder with respect to such Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.

E. Contractor's obligations under this paragraph are in addition to all other obligations and warranties. The provisions of this paragraph shall not be construed as a substitute for, or a waiver of, the provisions of any applicable statute of limitation or repose.

ARTICLE 16 – SUSPENSION OF WORK AND TERMINATION

16.01 *Owner May Suspend Work*

A. At any time and without cause, Owner may suspend the Work or any portion thereof for a period of not more than 90 consecutive days by written notice to Contractor and Engineer. Such notice will fix the date on which Work will be resumed. Contractor shall resume the Work on the date so fixed. Contractor shall be entitled to an adjustment in the Contract Price or an extension of the Contract Times, or both, directly attributable to any such suspension. Any Change Proposal seeking such adjustments shall be submitted no later than 30 days after the date fixed for resumption of Work.

16.02 *Owner May Terminate for Cause*

A. The occurrence of any one or more of the following events will constitute a default by Contractor and justify termination for cause:

1. Contractor's persistent failure to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment or failure to adhere to the Progress Schedule);

2. Failure of Contractor to perform or otherwise to comply with a material term of the Contract Documents;

3. Contractor's disregard of Laws or Regulations of any public body having jurisdiction; or

4. Contractor's repeated disregard of the authority of Owner or Engineer.

B. If one or more of the events identified in Paragraph 16.02.A occurs, then after giving Contractor (and any surety) ten days written notice that Owner is considering a declaration that Contractor is in default and termination of the contract, Owner may proceed to:

1. declare Contractor to be in default, and give Contractor (and any surety) notice that the Contract is terminated; and

2. enforce the rights available to Owner under any applicable performance bond.

C. Subject to the terms and operation of any applicable performance bond, if Owner has terminated the Contract for cause, Owner may exclude Contractor from the Site, take possession of the Work, incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere, and complete the Work as Owner may deem expedient.

D. Owner may not proceed with termination of the Contract under Paragraph 16.02.B if Contractor within seven days of receipt of notice of intent to terminate begins to correct its failure to perform and proceeds diligently to cure such failure.

E. If Owner proceeds as provided in Paragraph 16.02.B, Contractor shall not be entitled to receive any further payment until the Work is completed. If the unpaid balance of the Contract Price exceeds the cost to complete the Work, including all related claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals) sustained by Owner, such excess will be paid to Contractor. If the cost to complete the Work including such related claims, costs, losses,

and damages exceeds such unpaid balance, Contractor shall pay the difference to Owner. Such claims, costs, losses, and damages incurred by Owner will be reviewed by Engineer as to their reasonableness and, when so approved by Engineer, incorporated in a Change Order. When exercising any rights or remedies under this paragraph, Owner shall not be required to obtain the lowest price for the Work performed.

F. Where Contractor's services have been so terminated by Owner, the termination will not affect any rights or remedies of Owner against Contractor then existing or which may thereafter accrue, or any rights or remedies of Owner against Contractor or any surety under any payment bond or performance bond. Any retention or payment of money due Contractor by Owner will not release Contractor from liability.

G. If and to the extent that Contractor has provided a performance bond under the provisions of Paragraph 6.01.A, the provisions of that bond shall govern over any inconsistent provisions of Paragraphs 16.02.B and 16.02.D.

16.03 *Owner May Terminate For Convenience*

A. Upon seven days written notice to Contractor and Engineer, Owner may, without cause and without prejudice to any other right or remedy of Owner, terminate the Contract. In such case, Contractor shall be paid for (without duplication of any items):

1. completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such Work;

2. expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials, or equipment as required by the Contract Documents in connection with uncompleted Work, plus fair and reasonable sums for overhead and profit on such expenses; and

3. other reasonable expenses directly attributable to termination, including costs incurred to prepare a termination for convenience cost proposal.

B. Contractor shall not be paid on account of loss of anticipated overhead, profits, or revenue, or other economic loss arising out of or resulting from such termination.

16.04 *Contractor May Stop Work or Terminate*

A. If, through no act or fault of Contractor, (1) the Work is suspended for more than 90 consecutive days by Owner or under an order of court or other public authority, or (2) Engineer fails to act on any Application for Payment within 30 days after it is submitted, or (3) Owner fails for 30 days to pay Contractor any sum finally determined to be due, then Contractor may, upon seven days written notice to Owner and Engineer, and provided Owner or Engineer do not remedy such suspension or failure within that time, terminate the contract and recover from Owner payment on the same terms as provided in Paragraph 16.03.

B. In lieu of terminating the Contract and without prejudice to any other right or remedy, if Engineer has failed to act on an Application for Payment within 30 days after it is submitted, or Owner has failed for 30 days to pay Contractor any sum finally determined to be due, Contractor may, seven days after written notice to Owner and Engineer, stop the Work until payment is made of all such amounts due Contractor, including interest thereon. The provisions of this paragraph are not intended to preclude Contractor from submitting a Change Proposal for an adjustment in Contract Price or Contract Times or otherwise for

expenses or damage directly attributable to Contractor's stopping the Work as permitted by this paragraph.

ARTICLE 17 – FINAL RESOLUTION OF DISPUTES

17.01 *Methods and Procedures*

A. *Disputes Subject to Final Resolution*: The following disputed matters are subject to final resolution under the provisions of this Article:

1. A timely appeal of an approval in part and denial in part of a Claim, or of a denial in full; and

2. Disputes between Owner and Contractor concerning the Work or obligations under the Contract Documents, and arising after final payment has been made.

B. *Final Resolution of Disputes*: For any dispute subject to resolution under this Article, Owner or Contractor may:

1. elect in writing to invoke the dispute resolution process provided for in the Supplementary Conditions; or

2. agree with the other party to submit the dispute to another dispute resolution process; or

3. if no dispute resolution process is provided for in the Supplementary Conditions or mutually agreed to, give written notice to the other party of the intent to submit the dispute to a court of competent jurisdiction.

ARTICLE 18 – MISCELLANEOUS

18.01 *Giving Notice*

A. Whenever any provision of the Contract Documents requires the giving of written notice, it will be deemed to have been validly given if:

1. delivered in person, by a commercial courier service or otherwise, to the individual or to a member of the firm or to an officer of the corporation for which it is intended; or

2. delivered at or sent by registered or certified mail, postage prepaid, to the last business address known to the sender of the notice.

18.02 *Computation of Times*

A. When any period of time is referred to in the Contract by days, it will be computed to exclude the first and include the last day of such period. If the last day of any such period falls on a Saturday or Sunday or on a day made a legal holiday by the law of the applicable jurisdiction, such day will be omitted from the computation.

18.03 *Cumulative Remedies*

A. The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder to the parties hereto are in addition to, and are not to be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by Laws or Regulations, by special warranty or guarantee, or by other provisions of the Contract. The provisions of this paragraph will be as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right, and remedy to which they apply.

18.04 *Limitation of Damages*

A. With respect to any and all Change Proposals, Claims, disputes subject to final resolution, and other matters at issue, neither Owner nor Engineer, nor any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, shall be liable to Contractor for any claims, costs, losses, or damages sustained by Contractor on or in connection with any other project or anticipated project.

18.05 *No Waiver*

A. A party's non-enforcement of any provision shall not constitute a waiver of that provision, nor shall it affect the enforceability of that provision or of the remainder of this Contract.

18.06 *Survival of Obligations*

A. All representations, indemnifications, warranties, and guarantees made in, required by, or given in accordance with the Contract, as well as all continuing obligations indicated in the Contract, will survive final payment, completion, and acceptance of the Work or termination or completion of the Contract or termination of the services of Contractor.

18.07 *Controlling Law*

A. This Contract is to be governed by the law of the state in which the Project is located.

18.08 *Headings*

A. Article and paragraph headings are inserted for convenience only and do not constitute parts of these General Conditions.

SUPPLEMENTARY CONDITIONS

These Supplementary Conditions amend or supplement the Standard General Conditions of the Construction Contract, EJCDC C-700 (2013 Edition, Rev. 1). All provisions which are not so amended or supplemented remain in full force and effect.

The terms used in these Supplementary Conditions have the meanings stated in the General Conditions. Additional terms used in these Supplementary Conditions have the meanings stated below, which are applicable to both the singular and plural thereof.

The address system used in these Supplementary Conditions is the same as the address system used in the General Conditions, with the prefix "SC" added thereto.

The terms "Field Order and Work Directive Change" listed throughout these Supplementary Conditions are to be replaced by "Field Transmittal Memo".

ARTICLE 1 – DEFINITIONS AND TERMINOLOGY

SC-1.01 Defined Terms

DELETE and REPLACE definitions 2, 20, and 28 in Paragraph 1.01 A. of the General Conditions with the following:

2. *Agreement* - The written instrument, executed by the Owner and Contractor, which identifies the parties and the Engineer and sets forth the scope of the Work, Contract Price, Contract Times, and designates the specific items that are Contract Documents. The term “Agreement” shall be interchangeable and have the same meaning in the Contract Documents with the terms “Contract” and “Construction Contract”.

20. Engineer – The individual or entity named as such in the Agreement. The term “Engineer” and “Owner” shall be interchangeable and have the same meaning in the Contract Documents.

28. Owner – The individual or entity with whom Contractor has entered into the Agreement and for whom the Work is to be performed. The terms “Owner” and “Engineer” are interchangeable and shall have the same meaning in the Contract Documents.

ADD the following term and definition to Paragraph 1.01.A:

49. Field Transmittal Memorandum (FTM) – A written communication issued by the Engineer during the Construction period.

ARTICLE 2 – PRELIMINARY MATTERS

SC-2.02 Copies of Documents

AMEND the first sentence of Paragraph 2.02.A. to read as follows:

A. Owner shall furnish to Contractor 1 (one) printed copies of the Drawings and Project Manual (including one fully executed counterpart of the Agreement), and one copy

in electronic portable document format (PDF). Additional printed copies will be furnished upon request at the cost of reproduction.

SC-2.03 Before Starting Construction

ADD the following new subparagraph after 2.03 A.3.

4. A minimum list of items to be included in the Schedule of Values is provided in Section 01990 – Schedule of Values. In the event the Schedule of Values appears to be front-loaded or unbalanced, in the opinion of the Owner or the Engineer, Contractor shall provide detailed documentation to support the values in question, or revise the Schedule of Values to address Owner and Engineer's concerns.

ADD the following new paragraph after 2.03.A:

B. E-Verify Reporting: Contractor shall be solely responsible for complying with the E-Verify Reporting requirements in IC 5-16-13-11 throughout the contract time. Before starting construction. Contractor shall collect and submit the E-Verify case verification numbers for each individual who will be working on the project and who is required to be verified under IC 22-5-1.7 (effective July 1, 2011), from all contractors of any tier (as defined in IC 5-16-13-4).

ARTICLE 4 – COMMENCEMENT AND PROGRESS OF THE WORK

SC-4.01 Commencement of Contract Times; Notice to Proceed

DELETE Paragraph GC-4.01 in its entirety and INSERT the following:

The Contract Times will commence on the day indicated in the Notice to Proceed. A Notice to Proceed may be given at any time within __30__ days after the Effective Date of the Agreement.

Computation of Contract Time shall commence on the start date given in the Notice to Proceed, and every calendar day following, except as herein provided, shall be counted as Contract Time, in accordance with Article 18.02.

SC-4.05 Delays in the Contractor's Progress

REPLACE subparagraph 4.05.C.2 in its entirety with the following:

2. abnormal weather conditions: abnormal weather conditions shall be defined as inclement weather which prevents Contractor from making progress on the critical path Work for more days each month than listed in the table below. It is the Contractor's responsibility to document the weather conditions from an approved weather service and to document the impacts to the critical path. If the number of days in which inclement weather delays Contractor's critical path progress exceeds the days in table 4.05.C.2. in any given month, then Contractor shall be given a no cost time extension to the contract duration

equal to the number of documented inclement weather days that exceed the amount in table 4.05.C.2.

Table 4.05.C.2	
Contractor shall plan for the following number of inclement weather days:	
January	7
February	6
March	6
April	8
May	5
June	3
July	3
August	3
September	3
October	4
November	5
December	6

ARTICLE 5 – AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS

SC-5.02 Use of Site and Other Areas

ADD the following paragraphs immediately following Paragraph 5.02.D:

E. *Operations Within Right-of-Way*: In public thoroughfares, all operations of the Contractor, including those of a temporary nature, must be confined within the applicable right-of-way limits. The Contractor shall be solely responsible for any encroachment on private property beyond the right-of-way limits.

F. *Operations Within Private Easement*: On private property in a private easement, all operations of the Contractor, including those of a temporary nature, must be confined within the applicable easement limits. The Contractor shall be solely responsible for any encroachment on private property beyond the easement limits. Contractor shall notify the property owner(s) at least two (2) working days prior to the start of construction on any portion of Work on private property.

SC-5.03 Subsurface and Physical Conditions

DELETE Paragraphs 5.03.A and 5.03.B in their entirety and INSERT the following:

A. No reports of explorations or tests of subsurface conditions at or adjacent to the Site, or drawings of physical conditions relating to existing surface or subsurface structures at the Site, are known to Owner.

SC-5.06 Hazardous Environmental Conditions at Site

DELETE Paragraphs 5.06.A and 5.06.B in their entirety and INSERT the following:

A. No reports or drawings related to Hazardous Environmental Conditions at the Site are known to Owner.

B. Not Used.

ARTICLE 7 – CONTRACTOR'S RESPONSIBILITIES

SC-7.01 Concerning Supervision and Superintendence

ADD the following to Paragraph 7.01.B:

The superintendent will be Contractor's representative at the Site and shall have authority to act on behalf of Contractor. All communications given to or received from the superintendent shall be binding on Contractor.

SC-7.02. Labor; Working Hours

ADD the following to Paragraph 7.02.A:

Owner and Engineer reserve the right to require the Contractor to remove from the Project labor personnel (including subcontractors) who the Owner or Engineer determine to not be competent, suitably qualified, or reasonably disciplined in the performance of the Work.

ADD the following new subparagraphs immediately after Paragraph 7.02.B:

1. Regular working hours will be 7:30 am to 4:30 pm Monday through Friday.
2. Owner's legal holidays are:

New Year's Day	January 1
Martin Luther King, Jr. Day	January 20
President's Day	February 17
Spring Holiday	April 18
Memorial Day	May 26
Juneteenth	June 19
Independence Day	July 4
Labor Day	September 1
Indigenous Peoples' Day	October 13
Veterans Day	November 11
Thanksgiving Holiday	November 27 & 28
Winter Holiday	December 25 & 26

SC-7.08 Permits

AMEND the first sentence of Paragraph 7.08.A to read as follows:

Contractor shall obtain and pay for all construction permits and licenses except those listed in Section 01010 – Summary of Work.

SC-7.09 Taxes

ADD a new paragraph immediately after Paragraph 7.09.A:

B. Owner is exempt from payment of sales and compensating use taxes of the State of Indiana and of cities and counties thereof on all materials to be incorporated into the Work.

1. Owner will furnish the required certificates of tax exemption to Contractor for use in the purchase of supplies and materials to be incorporated into the Work.
2. Owner's exemption does not apply to construction tools, machinery, equipment, or other property purchased by or leased by Contractor, or to supplies or materials not incorporated into the Work.

SC-7.16 Shop Drawings, Samples, and Other Submittals

DELETE subparagraphs 7.16.E.2 and 7.16.E.3 and REPLACE them with the following:

2. Contractor will furnish required submittals with sufficient information and accuracy in order to obtain required approval of an item with no more than two submittals. Engineer will record Engineer's time for reviewing subsequent submittals of Shop Drawings, samples, or other items requiring approval and Contractor shall reimburse Owner for Engineer's charges for such time.

3. In the event Contractor request a change of a previously approved item, Contractor shall reimburse Owner for Engineer's charges for review of the item unless the need for such change is beyond the control of the Contractor.

ARTICLE 9 – OWNER'S RESPONSIBILITIES

ADD the following new paragraph immediately after Paragraph 9.12 of the General Conditions:

SC-9.13 Owner's Site Representative

A. Owner may furnish an "Owner's Site Representative" to represent Owner at the Site and assist Owner in observing the progress and quality of the Work.

ARTICLE 10 – ENGINEER'S STATUS DURING CONSTRUCTION

SC-10.03 Project Representative

ADD a new paragraph immediately following Paragraph 10.03.A:

B. The duties, responsibilities and limitations of the authority of the Resident Project Representative shall be as follows:

Make visits to site at intervals appropriate to the various stages of construction, as ENGINEER deems necessary, to observe as an experienced and qualified design professional the progress and quality of Contractor's executed work (assumed 6 visits).

ARTICLE 11 – AMENDING THE CONTRACT DOCUMENTS; CHANGES IN THE WORK

SC-11.01 Amending and Supplementing Contract Documents

DELETE Paragraph 11.01.A in its entirety and INSERT the following in its place:

A. The Contract Documents may be amended or supplemented by a Change Order, a Work Change Directive, a Field Order, or a Field Transmittal Memo.

ARTICLE 13 – COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK

SC-13.01 Cost of the Work

DELETE subparagraph 13.01.B.5.c in its entirety and INSERT the following in its place:

c. Construction Equipment and Machinery:
   1) Rentals of all construction equipment and machinery, and the parts thereof, in accordance with rental agreements approved by Owner with the advice of Engineer, and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs shall be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts shall cease when the use thereof is no longer necessary for the Work.
   2) Costs for equipment and machinery owned by Contractor will be paid at a rate no greater than the rate shown for such equipment in the Rental Rate Blue Book for Construction Equipment. An hourly rate will be computed by dividing the monthly rates by 176. These computed rates will include all operating costs. Costs will include the time the equipment or machinery is in use on the changed Work and the costs of transportation, loading, unloading, assembly, dismantling, and removal when directly attributable to the changed Work. The cost of any such equipment or machinery, or parts thereof, shall cease to accrue when the use thereof is no longer necessary for the changed

Work. Equipment or machinery with a value of less than $1,000 will be considered small tools.

DELETE subparagraph 13.01.C.1. in its entirety and INSERT the following in its place:

1. Payroll costs and other compensation of Contractor's officers, executives, principals (of partnerships and sole proprietorships), general managers, project managers, safety managers, engineers (including project engineers and field engineers), interns, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expediters, timekeepers, clerks, and other personnel employed by Contractor, whether at the Site or in Contractor's principal or branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in Paragraph 13.01.B.1 or specifically covered by Paragraph 13.01.B.4. The payroll costs and other compensation excluded here are to be considered administrative costs covered by the Contractor's fee.

ARTICLE 15 – PAYMENTS TO CONTRACTOR; SET-OFFS; COMPLETION; CORRECTION PERIOD

SC-15.01 Progress Payments

DELETE Paragraph 15.01.A in its entirety and INSERT the following:

A. Basis for Progress Payments

1. The Schedule of Values established as provided in Article 2 will serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to Engineer. The Contractor shall, within 10 days of receipt of Notice to Proceed, submit a complete and detailed Schedule of Values. A minimum list of items to be included in the Schedule of Values is provided in Section 01990. The Schedule of Values shall be approved by the Engineer. In the event the Schedule of Values appears to be front-loaded or unbalanced, in the opinion of the Engineer, Contractor shall provide detailed documentation to support the values in question, or revise the Schedule of Values to address Engineer's concerns.
2. The value assigned to each item of the Work in the Schedule of Values may be considered in evaluating additions and deletions in the Scope of Work.
3. Progress payments on account of Unit Price Work will be based on the number of units completed during the pay period, as determined under the provisions of Paragraph 13.03.
4. Progress payments for cost-based Work will be based on Cost of the Work completed by Contractor during the pay period.

SC-15.01.B Application for Payments

REPLACE the first sentence of Paragraph 15.01.B with the following:

At the date established for each progress payment (but not more often than once a month), Contractor shall submit to Engineer for review an Application for

Payment filled out and signed by Contractor covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents.

ADD the following sentence at the end of Paragraph 15.01.B:

Contractor shall submit to the Engineer one copy of all supplier invoices for stored materials and equipment as they are claimed for payment. The invoices shall be submitted with the monthly Application for Payment. The total amount to be paid for claimed stored materials will not exceed 90% of the Schedule of Values amount of the respective item.

SC 15.01.D Payment Becomes Due

DELETE Paragraph 15.01.D in its entirety and INSERT the following:

Forty-five (45) days after presentation of the Application for Payment to Owner with Engineer's recommendation, the amount recommended will (subject to the provisions of Paragraph 15.01.E) become due, and when due will be paid by Owner to Contractor.

SC-15.03 Substantial Completion

ADD the following new subparagraph to Paragraph 15.03.B:

1. If some or all of the Work has been determined not to be at a point of Substantial Completion and will require re-inspection or re-testing by Engineer, the cost of such re-inspection or re-testing, including the cost of time, travel and living expenses, shall be paid by Contractor to Owner. If Contractor does not pay, or the parties are unable to agree as to the amount owed, then Owner may impose a reasonable set-off against payments due under Article 15.

ADD the following new subparagraph to Paragraph 15.03.C:

1. Upon Substantial Completion, Owner shall pay an amount sufficient to increase total payments to Contractor to 100 percent (100%) of the Work completed, less such amounts as Engineer shall determine in accordance with Paragraph 15.01.C.6 of the General Conditions, less 200 percent (200%) of Engineer's estimate of the value of Work to be completed or corrected as shown on the tentative list of items to be completed or corrected attached to the certificate of Substantial Completion, and less any applicable liquidated damages.

ARTICLE 17 – FINAL RESOLUTION OF DISPUTES

ADD the following new paragraphs immediately after Paragraph 17.01:

SC-17.02 Arbitration

A. All matters subject to final resolution under this Article will be decided by arbitration in accordance with the rules of an arbitration agency selected by Owner, subject

to the conditions and limitations of this paragraph. This agreement to arbitrate and any other agreement or consent to arbitrate entered into will be specifically enforceable under the prevailing law of any court having jurisdiction.

B. The demand for arbitration will be filed in writing with the other party to the Contract and with the selected arbitrator or arbitration provider, and a copy will be sent to Engineer for information. The demand for arbitration will be made within the specific time required in this Article, or if no specified time is applicable within a reasonable time after the matter in question has arisen, and in no event shall any such demand be made after the date when institution of legal or equitable proceedings based on such matter in question would be barred by the applicable statute of limitations. The demand for arbitration should include specific reference to Paragraph SC-17.02.D below.

C. No arbitration arising out of or relating to the Contract shall include by consolidation, joinder, or in any other manner any other individual or entity (including Engineer, and Engineer's consultants and the officers, directors, partners, agents, employees or consultants of any of them) who is not a party to this Contract unless:

1. the inclusion of such other individual or entity is necessary if complete relief is to be afforded among those who are already parties to the arbitration; and
2. such other individual or entity is substantially involved in a question of law or fact which is common to those who are already parties to the arbitration and which will arise in such proceedings.

D. The award rendered by the arbitrator(s) shall be consistent with the agreement of the parties, in writing, and include a concise breakdown of the award, and a written explanation of the award specifically citing the Contract provisions deemed applicable and relied on in making the award.

E. The award will be final. Judgment may be entered upon it in any court having jurisdiction thereof, and it will not be subject to modification or appeal, subject to provisions of the Laws and Regulations relating to vacating or modifying an arbitral award.

F. The fees and expenses of the arbitrators and any arbitration service shall be shared equally by Owner and Contractor.

SC-17.03 Attorneys' Fees

ADD the following new paragraph immediately after Paragraph 17.02.

Attorneys' Fees: For any matter subject to final resolution under this Article, the prevailing party shall be entitled to an award of its attorneys' fees incurred in the final resolution proceedings, in an equitable amount to be determined in the discretion of the court, arbitrator, arbitration panel, or other arbiter of the matter subject to final resolution, taking into account the parties' initial demand or defense positions in comparison with the final result.

SC-17.04 Court of Jurisdiction

Any action in court related to the Project shall be filed in Monroe County Court, Indiana.

ARTICLE 18 – MISCELLANEOUS

ADD the following new paragraphs immediately after Paragraph 18.08:

SC-18.09 Occupational Safety and Health Act of 1970

A. These construction documents and the joint and several phases of construction hereby contemplated are to be governed, at all times, by applicable provisions of the federal laws, including but not limited to, the latest amendments of the following:

Williams - Steiger Occupational Safety and Health Act of 1980, Public Law 91-596.

Part 1910 - Occupational Safety and Health Standards, Chapter XVII of Title 29, code of Federal Regulations.

Indiana Occupational Safety and Health Administration (IOSHA) OSHA Safety and Health Standards for the Construction Industry (29 CFR Part 1926) with Amendments as of August 1, 1991, including 29 CFR Part 1910 General Industry Safety and health Standards Applicable to Construction.

SC-18.14 Drug Testing Requirements

A. Contractor shall implement their Drug Testing Plan as submitted with the bid. Contractor of any tier must comply with the INDOA drug testing requirements set forth in IC 4-13-18. The Owner may cancel the contract for noncompliance if the Contractor fails to meet the conditions set forth in IC 4-13-18-7.

SC-18.15 Public Works Qualification Requirements

A. For contracts over $300,000.00, Contractor must be qualified under either IC 4-13.6-4 or IC 8-23-10 (Indiana Department of Administration or Indiana Department of Transportation) before doing any Work on a public works project.

SC-18.16 Liquidated Damages

A. In the event the Contractor fails to complete satisfactorily the entire Work contemplated and provided for under this contract on or before the dates of completion determined as described elsewhere herein, the Owner shall, in the form of a Change Order, deduct from the monies due the Contractor the sums as outlined in the Agreement Between Owner and Contractor. If the monies due the Contractor are less than the amount of such liquidated damages, then the Contractor or his surety shall pay the balance to the Owner.

-END-

EXHIBIT "A"

DUTIES, RESPONSIBILITIES AND LIMITATIONS OF AUTHORITY OF RESIDENT PROJECT REPRESENTATIVE

Prepared by

ENGINEERS' JOINT CONTRACT DOCUMENTS COMMITTEE

and

Issued and Published Jointly by

PROFESSIONAL ENGINEERS IN PRIVATE PRACTICE
A practice division of the
NATIONAL SOCIETY OF PROFESSIONAL ENGINEERS

and by

AMERICAN CONSULTING ENGINEERS COUNCIL

and by

AMERICAN SOCIETY OF CIVIL ENGINEERS

A LISTING OF THE DUTIES, RESPONSIBILITIES AND LIMITATIONS OF AUTHORITY OF THE RESIDENT PROJECT REPRESENTATIVE**

**unless otherwise noted

ENGINEER shall furnish a Resident Project Representative (RPR), assistants and other field staff to assist ENGINEER in observing performance of the Work of the CONTRACTOR.

Through more extensive on-site observations of the Work in progress and field checks of materials and equipment by the RPR and assistants, ENGINEER shall endeavor to provide further protection for OWNER against defects and deficiencies in the Work; but, the furnishing of such services will not make ENGINEER responsible for or give ENGINEER control over construction means, methods, techniques, sequences or procedures or for safety precautions or programs, or responsibility for CONTRACTOR's failure to perform the Work in accordance with the Contract Documents.

The duties and responsibilities of the RPR are limited to those of ENGINEER in ENGINEER's agreement with the OWNER and in the construction Contract Documents, and are further limited and described as follows:

A. General

RPR will be ENGINEER's employee or agent at the Site, will act as directed by and under the supervision of ENGINEER, and will confer with ENGINEER regarding RPR's actions. RPR's dealings in matters pertaining to the Work in general shall be with ENGINEER and CONTRACTOR. RPR's dealings with Subcontractors shall be through or with the full knowledge and approval of CONTRACTOR.

B. Duties and Responsibilities of RPR

1. *Schedules* – Review the Progress Schedule, Schedule of Shop Drawing and Sample submittals, and Schedule of Values prepared by CONTRACTOR and consult with ENGINEER concerning acceptability.

2. *Conferences and Meetings* – Attend meetings with CONTRACTOR, such as preconstruction conferences, progress meetings, job conferences and other project related meetings and prepare and circulate copies of minutes thereof.

3. *Liaison* –
   a. Serve as ENGINEER's liaison with CONTRACTOR; working principally through CONTRACTOR's authorized representative and assist in providing information regarding the intent of the Contract Documents.
   b. Assist ENGINEER in serving as OWNER's liaison with CONTRACTOR when CONTRACTOR's operations affect OWNER's on-Site operations.
   c. Assist in obtaining from OWNER additional details or information, when required for proper execution of the Work.

4. *Interpretation of Contract Documents* –
   Report to ENGINEER when clarifications and interpretations of the Contract Documents are needed and transmit to CONTRACTOR clarifications and interpretations as issued by ENGINEER.

5. *Shop Drawings and Samples* –
   a. Record date of receipt of Samples and approved Shop Drawings.
   b. Receive samples, which are furnished at the Site by CONTRACTOR, and notify ENGINEER of availability of Samples for examination.

6. *Modifications* –
   Consider and evaluate CONTRACTOR'S suggestions for modifications in Drawings or Specifications and report such suggestions, together with RPR's recommendations, to ENGINEER. Transmit to CONTRACTOR in writing decisions as issued by ENGINEER.

7. *Review of Work, Rejection of Defective Work* –
   a. Conduct on-site observations of CONTRACTOR's Work in progress to assist ENGINEER in determining if the Work is in general proceeding in accordance with the Contract Documents.
   b. Report to ENGINEER whenever RPR believes that any part of CONRACTOR's work in progress will not produce a completed Project that conforms generally to the Contract Documents or will imperil the integrity of the design concept of the completed Project as a functioning whole as indicated in the Contract Documents, or has been damaged, or does not meet the requirements of any inspection, test or approval required to be made; and advise ENGINEER of that part of work in progress that RPR believes should be corrected or rejected or should be uncovered for observation, or requires special testing, inspection or approval.

8. *Inspections, Tests, and System Startups*-
   a. Verify that tests, equipment and systems startups and operating and maintenance training are conducted in the presence of appropriate OWNER's personnel, and that CONTRACTOR maintains adequate records thereof.

b. Observe, record and report to ENGINEER appropriate details relative to the test procedures and systems startups.

9. *Records* –
   a. Record names, addresses, fax numbers, e-mail addresses, web site locations, and telephone numbers of all CONTRACTORS, Subcontractors and major Suppliers of materials and equipment.
   b. Maintain records for use in preparing Project documentation.

10. *Reports* -
   a. Furnish to ENGINEER periodic reports as required of progress of the Work and of CONTRACTOR's compliance with the progress schedule and schedule of Shop Drawings and Sample submittals.
   b. Draft and recommend to ENGINEER proposed Change Orders, Work Change Directives, and Field Orders. Obtain backup material from CONTRACTOR.
   c. Immediately notify ENGINEER of the occurrence of any Site accidents, emergencies, acts of God endangering the Work, damage to property by fire or other causes, or the discovery of any Hazardous Environmental Condition.

11. *Payment Requests* –
   Review Applications for Payment with CONTRACTOR for compliance with the established procedure for their submission and forward with recommendations to ENGINEER, noting particularly the relationship of the payment requested to the Schedule of Values, Work completed, and materials and equipment delivered at the Site but not incorporated in the Work.

12. *Certificates, Maintenance and Operation Manuals* –
   During the course of the Work, verify that certificates, maintenance and operation manuals and other data required by the Specifications to be assembled and furnished by CONTRACTOR are applicable to the items actually installed and in accordance with Contract Documents, and have these documents delivered to ENGINEER for review and forwarding to OWNER prior to payment for that part of the Work.

13. *Completion* –
   a. Participate in a Substantial Completion inspection, assist in the determination of Substantial Completion and the preparation of lists of items to be completed or corrected.
   b. Participate in a final inspection in the company of ENGINEER, OWNER, and CONTRACTOR and prepare a final list of items to be completed and deficiencies to be remedied.

c. Observe whether all items on final list have been completed or corrected and make recommendations to ENGINEER concerning acceptance and issuance of the Notice of Acceptability of the Work.

C. Limitations of Authority

Resident Project Representative shall not:

1. Authorize any deviation from the Contract Documents or substitution of materials or equipment (including "or-equal" items).
2. Exceed limitations of ENGINEER's authority as set forth in the Contract Documents.
3. Undertake any of the responsibilities of CONTRACTOR, Subcontractors, Suppliers, or CONTRACTOR's superintendent.
4. Advise on, issue directions relative to, or assume control over any aspect of the means, methods, techniques, sequences or procedures of CONTRACTOR's work unless such advice or directions are specifically required by the Contract Documents.
5. Advise on, issue directions regarding, or assume control over safety practices, precautions, and programs in connection with the activites or operations of OWNER or CONTRACTOR.
6. Participate in specialized field or laboratory tests or inspections conducted off-site by others except as specifically authorized by ENGINEER.
7. Accept Shop Drawing or Sample submittals from anyone other than CONTRACTOR.
8. Authorize OWNER to occupy the Project in whole or in part.

DIVISION 1 - GENERAL REQUIREMENTS

SECTION 01010 - SUMMARY OF WORK

PART 1 - GENERAL

1.1 Summary

A. The Work shall be as described in the Advertisement for Bids.

1.2 Contract

A. Work shall be constructed under a Lump Sum Contract.

B. The Contractor shall not be allowed extra compensation by reason of any matter or thing concerning which the Contractor might have fully informed himself prior to the bidding. No verbal agreement, understandings or conversations with a representative or employee of the Owner or Engineer, either before or after the execution of this Contract, shall affect or modify the terms of obligations herein contained.

1.3 Completion

A. Commence Work required by the Contract Documents within 10 days after the date of the Notice to Proceed, and fully complete the Work within the Contract Times stated in the Bid Attachment and Agreement unless the Contract Times are extended otherwise by the Contract Documents.

B. The Project will not be ready for substantial completion review until test and performance evaluations are completed, all Work is complete and ready for service and occupancy, interior of all rooms requiring Work have been broom cleaned and mopped and the site is clear of construction rubbish and debris.

1.4 Work by Others

A. The Owner reserves the right to let other Contracts in connection with other portions of the project.

1.5 Items to be Provided by Owner

A. Those items shown on the Drawings and/or specified herein.

1.6 Coordination

A. Select order of Work and establish schedule or working hours for construction, subject to approval of Engineer which will assure orderly and expeditious progress of Work.

B. Maintain existing service affected by Contractors' operations under the contract. Schedule construction to minimize interruptions to existing services, and inconveniences to others.

1.7 Rights of Access

A. The Contractor agrees that representatives of the Engineer, Owner and regulatory agencies will have access to the Work wherever it is in preparation or progress and that the Contractor will provide facilities for such access and inspection.

1.8 Safety and Health Regulations for Construction

A. Obligations prescribed as employer obligations under Chapter XVII of Title 29, Code of Federal Regulations, Part 1926, otherwise known as "Safety and Health Regulations for Construction and CFR Part 1910.46 Permit Required for Confined Space" are the sole responsibility of the Contractor. Provide Engineer the name of the Contractor's Safety Officer, plus the on-site Safety Representative, if other than the Superintendent, as indicated under Article 6.21 of the General Conditions of the Construction Contract.

1.9 Discovery of Hazardous Material

A. If, during the course of this Work, the existence of hazardous material, including asbestos containing material, is observed in the Work area, immediately notify the Engineer in writing. Do not perform any Work pertinent to the hazardous material prior to receipt of special instructions from the Engineer.

1.10 Easements

A. The Owner will obtain right-of-way easements over and through certain private lands for construction. The width or limits of such easements will be defined by the Owner before the Work begins. If the methods of construction employed by the Contractor require the use of land beyond these limits, make agreements with the property owners affected for the use of such additional land. Such additional agreements will not include any liability for the Owner or Engineer and shall have no direct effect on the completion of the project, project cost, or the time of completion.

B. Place backfill to the grade of the existing ground level or as otherwise shown on the Drawings.

C. Include the cost of all restoration of property in the Contractor's bid. No additional payment will be allowed for restoration Work.

1.11 Operations Within Right-of-Way

A. If the methods of the construction employed are such as to require the use of land beyond the public right-of-way limits, make arrangements with the property owners affected for the use of such additional land. Such additional agreements will not include any liability for the Owner or Engineer and shall have no direct effect on the completion of the project, project cost, or the time of completion.

1.12 Permits

A. No permits are required for the Owner to obtain.

B. Obtain permits related to construction activities as specified in the General Conditions.

1. All necessary permits or licenses from the city, state or county in connection with construction procedures will be obtained by the Contractor. The construction shall be performed in full accordance with all requirements of the State of Indiana as well as county and local requirements.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.

-END-

SECTION 01050 - CONSTRUCTION ENGINEERING

PART 1 - GENERAL

1.01 Summary

A. Section Includes: Providing all equipment, personnel and materials necessary for performing Construction Engineering, including layout and verification of existing conditions and infrastructure, to complete the Work as described in these Specifications.

1.02 Project/Site Conditions

A. Field Measurements

1. Make all measurements and check all dimensions and elevations necessary for the proper construction of the Work called for by the Drawings and Specifications.
2. Make all necessary measurements to prevent misfitting in said Work, and be responsible for the accuracy of the layout, staking and construction of the Work.

PART 2 - MATERIALS

Not Used.

PART 3 - EXECUTION

3.01 Examination

A. Verification of Conditions

1. Check and verify elevations and locations of existing infrastructure and conditions shown on the Drawings, or otherwise present at the site, that may affect the Work. Allow adequate time for modifications to be made to the Work to account for conditions which may differ from those shown on the Drawings.
2. Verify conditions and accessible existing infrastructure prior to the preparation of shop drawings associated with, or that may be impacted by, existing conditions and infrastructure.
3. Obtain and verify elevations of inaccessible infrastructure immediately after exposure by excavation.
4. No additional compensation will be made to the Contractor for failure to obtain this information in a timely manner which would have permitted modifications to the Work that would have avoided additional work, delays, and cost.

3.02 Preparation

A. Perform all necessary Construction Engineering, including layout and staking, to ensure that the Work conforms to the lines, grades, and elevations shown on the Drawings or otherwise specified or required.

1. Establish all necessary lines, points, and corners with references for recovery of said items during construction.
2. Conduct a level circuit to establish additional benchmarks for use during construction.
3. Set stakes for structures.
4. Set any other reference points as required for control lines and grades.

B. When staking utilities, perform the necessary checking to establish location and grade to best fit the conditions.

-END-

SECTION 01090 - REFERENCE STANDARDS

PART 1 - GENERAL

1.01 Summary

A. Section Includes

1. General reference standards, rules and regulations that govern construction work, alterations, repairs, mechanical installations and appliances connected therewith
2. Abbreviations used in these Specifications

1.02 Quality Assurance

A. Regulatory Requirements: Work shall comply with the following:

1. Occupational Safety and Health Act
2. Indiana State Construction Industry Safety Code
3. State Building rules and regulations of the Indiana Department of Homeland Security Fire and Building Safety Division
4. Indiana State Fire Marshal
5. Indiana Department of Environmental Management
6. Indiana Department of Natural Resources
7. Army Corps of Engineers
8. National Electric Code
9. National Electric Safety Code
10. Uniform Building Code
11. Life Safety Code
12. Utility regulations
13. Local ordinances, state, and federal rules and regulations pertaining to the Work

B. Such rules, regulations and ordinances are to be considered part of these Specifications.

C. Fees for licenses shall be paid by the Contractor.

1.03 Reference Abbreviations

A. Reference to a technical society, trade association or standards setting organization may be made in the Specifications by abbreviations in accordance with the following list:

AABC	Associated Air Balance Council
AAR	Association of American Railroads
AAMA	American Architectural Manufacturers Association
AASHTO	American Association of State Highway and Transportation Officials
AATCC	American Association of Textile Chemists and Colorists
ACI	American Concrete Institute

ADC	Air Diffusion Council
AFBMA	Anti-Friction Bearing Manufacturers Association
A-E	Architect/Engineer
AGA	American Gas Association
AHAM	Association of Home Appliance Manufacturers
AIA	American Institute of Architects
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AMCA	Air Movement and Control Association International, Inc.
ANSI	American National Standards Institute
APA	The Engineered Wood Association
ARI	American Refrigeration Institute
ASCE	American Society of Civil Engineers
ASLA	American Society of Landscape Architects
ASME	American Society of Mechanical Engineers
ASSE	American Society of Safety Engineers
ASTM	American Society for Testing and Materials
AWI	Architectural Woodwork Institute
AWPA	American Wood Protection Association
AWS	American Welding Society
AWWA	American Water Works Association
BHMA	Builders Hardware Manufacturers Association
BIA	Brick Industry Association
CABO	Council of American Building Officials
CAGI	Compressed Air and Gas Institute
CISPI	Cast Iron Soil Pipe Institute
CTI	Cooling Tower Institute
DHI	Door and Hardware Institute
DOH	Department of Health
DOT	Department of Transportation
FS	Federal Specifications
FHWA	Federal Highway Administration, Department of Transportation
FM	Associated Factory Mutual Laboratories
GANA	Glass Association of North America
HPVA	Hardwood Plywood and Veneer Association
ICEA	Insulated Cable Engineers Association
IDEM	Indiana Department of Environmental Management
IEEE	Institute of Electrical and Electronics Engineers
IFI	Industrial Fasteners Institute
IGCC	Insulating Glass Certification Council
INDOT	Indiana Department of Transportation
IPCEA	Insulated Power Cable Engineers Association
ISPC	Indiana State Plumbing Code
MIL	Military Specifications
MSS	Manufacturer’s Standardization Society
NAAMM	National Association of Architectural Metal Manufacturers
NACM	National Association of Chain Manufacturers
NAIMA	North American Insulation Manufacturers Association
NAVFAC	U.S. Naval Facilities Engineering Command
NEBB	National Environmental Balancing Bureau

NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NETA	InterNational Electrical Testing Association
NFPA	National Fire Protection Association
NFPA	National Forest Products Association
NIST	National Institute of Standards and Technology
NSF	National Sanitation Foundation
OSHA	Occupational Safety and Health Administration
PCI	Precast Prestressed Concrete Institute
PDI	Plumbing and Drainage Institute
PFI	Pipe Fabricators Institute
SAE	Society of Automotive Engineers
SPECS	Specifications
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association
SPI	Society of the Plastics Industry
SSPC	The Society for Protective Coatings
STI	Steel Tank Institute
TCNA	Tile Council of North America
UL	Underwriter's Laboratories, Inc.
USBR	US Bureau of Reclamation
WWPA	Western Wood Products Association

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.

-END-

SECTION 01200 - PROJECT MEETINGS

PART 1 - GENERAL

1.01 Preconstruction Conference

A. A Preconstruction Conference will be scheduled within 20 days after delivery of the Owner-executed Agreement to the Contractor, but before starting the Work. The Engineer will make arrangements for the meeting at the site or other location and notify participants in advance of the meeting date, time and location. Required attendees include the Engineer, Contractor, Subcontractors, and the Owner or his representative. Significant proceedings of this meeting will be recorded by the Engineer and copies distributed to the participants.

B. At the meeting, submit a preliminary Construction Progress Schedule, Schedule of Submittals (including name, type and specification section), Schedule of Values (per Section 01990) and a list of subcontractors and suppliers if a list was not previously submitted with the Contractor’s bid, or if subcontractors and suppliers have changed.

1.02 Monthly Progress Meetings

A. A monthly Progress Meeting will be conducted on a specific day of every month at the job site. A supervisory representative, able to make management decisions, from the Contractor shall attend the meeting. The date, time and location of said meeting will be determined at the Preconstruction Conference.

B. Present a written status report, neatly prepared, at each meeting. The status report shall include at least the following information: Construction progress, update of schedule, delays, changes, status of RFIs, RFPs, problems, differing conditions, anticipated payment requests, personnel changes, and regulatory compliance updates. The status report shall cover all subcontractors.

C. Require the attendance of subcontractors' supervisory personnel, as necessary, to assist in the presentation of the status report.

D. Prepare 5 copies of the status report for distribution to the Engineer's representatives.

E. If the Contractor fails to have a supervisory representative attend the Progress Meeting or if the Contractor fails to distribute a written status report as specified above, approval of a Partial Payment Application may be withheld until such time as the Progress Meeting can be rescheduled.

F. Significant proceedings of this meeting will be recorded by the Engineer and copies distributed to the participants.

1.03 Special Meetings

A. Special Meetings may be called by the Engineer or Contractor as progress of the Work dictates.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.

-END-

SECTION 01300 - SUBMITTALS

PART 1 - GENERAL

1.01 Summary

A. Section Includes

1. Administrative and procedural requirements for submittals and construction documentation, including Construction Progress Schedules, Shop Drawings, Product Data, requests for information (RFIs), field transmittal memos (FTMs), samples, tests, O&M manuals, and Partial Pay Claims.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

3.01 Construction Schedules

A. Submit Progress Schedules (Bar Charts or CPM/PERT Charts) at the monthly Progress Meetings during the contract period.

1. Provide complete sequence of construction by activity showing dates for beginning and completion of each element of construction.
2. Identify Work in separate phases, or other logically grouped activity.
3. Identify first work day of each week on a horizontal time scale. Sheet size shall be 24” x 36” maximum and 8 ½” x 11” minimum, but of sufficient size to allow space for updating.

B. Engineer will review Progress Schedules for conformance to the contract completion dates. If required, resubmit within 7 days after return of reviewed copy addressing Engineer’s review comments.

C. Show all changes occurring since previous submission of updated schedule. Indicate progress of each activity and show completion dates. Include major changes in scope, activities modified since previous updating, revised projections due to changes and other identifiable changes.

D. If the Progress Schedule reflects completion date(s) different than the Contract Times, the Contract Times are not thereby voided, nullified, or affected. The Contract Times govern. Where the Progress Schedule reflects completion date(s) that are earlier than the Contract Times, the Engineer may accept such Progress Schedule with the Contractor to specifically understand that no Change Request or Claim for additional Contract Time or Contract Price shall be brought resulting from the Contractor’s inability to complete the Work by the earlier date(s) indicated on the accepted Progress Schedule.

E. Distribute copies of monthly Progress Schedule to Engineer, the job site file, subcontractors, and other concerned parties.

F. Instruct recipients to report any inability to comply, and provide detailed explanation, with suggested remedies.

3.02 Alternate or "or equal" items

A. A Specification followed by one or more manufacturers and "or approved equal" is open to equal products or materials as determined to be "equal" solely by the Engineer. The Engineer's decision shall be final in this regard.

B. Where specific manufacturers and/or model numbers for materials or equipment are listed in the detailed Specifications, these items have served as the basis for the design of the new facilities and/or improvements in this project. Materials and equipment submitted as an alternate or "or equal" item must be certified by the Contractor as:

1. Meeting or exceeding the requirements of the detailed Specifications,
2. Being of equal or better quality, and
3. Being of equal function to the specific manufacturer and/or model listed.

C. If the submitted alternate or "or equal" item requires any modification or deviation from the Drawings, prepare and submit detailed drawings to the Engineer showing all modifications in structures, piping, electrical, mechanical, or other Work required to adapt the Work to the submitted alternate or "or equal" item. The Engineer will review the submitted detailed drawings of the modifications and indicate whether changes are necessary to comply with the project requirements. Detailed drawings which do not comply with the project requirements shall be revised and resubmitted.

D. The Contractor’s listed "add" or "deduct" associated with alternate equipment items shall be based upon an "installed price" and shall take into consideration and include any cost of the design or construction changes that may be required as a result of an alternate or "or equal" material or equipment.

E. Voluntary alternate and/or "or equal" equipment that is installed by Contractor but fails to meet the specified requirements as determined by the Engineer shall be replaced with the specified item at the Contractor's expense.

3.03 Shop Drawings

A. General

1. References to Shop Drawings in this Section 01300 shall by definition include Product Data and other descriptive data.
2. Submit Shop Drawings to the Engineer within 30 days after Notice-to-Proceed.
3. The Engineer shall have 21 calendar days from the date of receipt of a complete submittal to review and return the submittal. The Contractor shall not

be allowed any claims for Shop Drawing review that is completed within the 21-day review period.

a. The Engineer may agree to expedite his Shop Drawing review on an item by item basis, but it is imperative that all Shop Drawing submittals be complete and properly marked as indicated in this Section 01300.
b. Completion of the project within the contracted time is critical. Engineer cannot review incomplete or poor quality Shop Drawings and will not accept responsibility for any delays caused by incomplete or poor quality Shop Drawing submittals.
c. It is the Contractor's responsibility to submit legible Shop Drawings. Faxed copies of the Shop Drawings are unacceptable and will be returned without review.

4. Contractor agrees that Shop Drawing submittals processed by the Engineer are not Change Orders; that the purpose of Shop Drawing submittals by the Contractor is to demonstrate to the Engineer that the Contractor understands the design concept, that he demonstrates his understanding by indicating which equipment and materials he intends to furnish and install, and by detailing the fabrication and installation methods he intends to use.
5. Review of Shop Drawings does not relieve Contractor of responsibility for correct ordering of material and equipment. Contractor's review should ensure that equipment will fit in available space.
6. Contractor further agrees that if deviations, discrepancies or conflicts between Shop Drawings and Specifications are discovered either prior to or after Shop Drawing submittals are processed by the Engineer, the design Drawings and Specifications shall control and shall be followed.

B. Contractor Submittal Procedure

1. Submit Shop Drawings to the Engineer for every manufactured piece of equipment and all components to be used in the Work in accordance with the General Conditions, individual Sections, and this Section 01300.
2. Shop Drawings shall be submitted and processed electronically.
   a. The Engineer reserves the right to request up to two (2) hard copies of all submittals.
   b. Full-size drawings may be requested by the Engineer for review.
3. Provide a letter of transmittal to the Engineer for each submittal. The letter of transmittal shall contain the name of the project, workmanship and materials Section number, the name of the Contractor, the list of drawings submitted including numbers and titles, and any other pertinent information for the items being submitted.
4. If any part of a Shop Drawing lists data or information which is in conflict or differs from the Specification or Drawings, clearly note the difference or conflict on the submittal and include in the cover letter a description of the differences entitled "Exceptions to the Specifications and/or Drawings".
   a. Information on submittals which contain differences or discrepancies which are not clearly noted shall be considered "not reviewed" with any of the Shop Drawing action codes and may be rejected.
5. Coordinate and submit complete sets of Shop Drawings in brochure form and include all related items in one brochure.

6. Do not markup Shop Drawings in red font. Engineer will make all his review comments in red font.
7. Submit Shop Drawings, including wiring diagrams, to the Engineer for review before equipment is fabricated or sent to the project.
8. Complete submittals shall include all significant data and a response to each requirement listed in the Specifications. Submittals which do not comply with these requirements may be returned as incomplete and without review.
9. Shop Drawings shall be of sufficient detail to assure the items comply with the Specifications, and shall provide the necessary data for installation, operation, and maintenance.
10. Submittals shall be applicable to this project and not a "cover-all", “general”, or “typical” drawing or catalog cut-sheet unless it is made to indicate the items or equipment being provided specifically for this project using the following methods:
    a. Include project name, item or equipment name, and other items or equipment identifiers and descriptions on the drawings and cut sheets.
    b. All sizes, special features, options, modifications, etc., that are provided specific to this project are noted in some fashion.
    c. All options or features not provided specific to this project or pertinent to this Work are deleted, crossed out, or otherwise removed from consideration.
11. Information to Include
    a. Manufacturer's model number or catalog number, size and performance curves and data. Indicate the operating point on curves and tabular data for each piece of equipment the curves or data represents.
    b. Indication of all performance data, construction materials, finishes and modifications to manufacturer's standard design called for in the Specifications
    c. Location of connections for all piping
    d. Rough-in foundation and support point dimensions
    e. Wiring diagrams or connection diagrams pertaining to this project only
12. Affix Contractor’s company name and date in form of a stamp, to all Shop Drawings submittals before submitting. The signature of Contractor's Representative is required.
13. Contractor's Certification: Material data and Shop Drawings shall be submitted by the Contractor with a cover letter, and the Contractor's stamp of approval, indicating that he has reviewed, checked, and approved the data submitted; that submittal is in compliance with the requirements of the project and with the provisions of the Contract Documents; that any exceptions to the Specifications or Drawings are specifically noted or pointed out as such; and that he has verified all field measurements and construction criteria, materials, catalog numbers, and similar data.
14. Failure to provide required information and certification with or on the submittals shall be cause for the return of Shop Drawings without review or other action.

C. Engineer’s Review

1. Engineer’s action codes shall have the following meanings:
   a. If a Shop Drawing is stamped "No Exceptions Taken" or "Make Corrections Noted", then no further submittals by the Contractor will be required and a letter of transmittal will be returned to the Contractor.
   b. If a Shop Drawing is stamped "Make Corrections Noted", make the corrections indicated and proceed as noted.
   c. If a Shop Drawing is stamped "Rejected-Resubmit" or "Revise and Resubmit", the Contractor will receive marked copies with a letter of transmittal noting the Engineer’s review comments.
2. If the first Shop Drawing submittal is rejected by the Engineer, and the second Shop Drawing submittal for the same item is also rejected by the Engineer, then the review fees and expenses that the Engineer incurs in conjunction with the review of the third and subsequent Shop Drawing submittals shall be charged to the Contractor, and the Contractor shall reimburse the Owner.
   a. Engineer's review fees and expenses shall be based upon the current "Hourly Rate and Reimbursable Expense Schedule" of the Engineer and this compensation shall be paid within 30 days of being invoiced. As an option, Engineer’s review fees and expenses may be withheld from payment to Contractor.
3. Resubmitted Shop Drawings
   a. Make the necessary corrections and resubmit the documents. The letter transmitting corrected Shop Drawings shall note that the documents comprise a resubmittal.
   b. All information, which is correct on the original submittal, will <u>not</u> be changed in any way on the resubmitted Shop Drawings.
      1) If information on a Shop Drawing must be changed due to a Change Order, cloud all the changes on the resubmitted Shop Drawing and state such changes in the resubmittal transmittal letter.
      2) If any corrections to the original Shop Drawing, other than those noted by the Engineer, are made on a resubmittal due to discovery by Contractor that original information was incorrect, cloud all the changes on the resubmitted Shop Drawing and state such changes in the resubmittal transmittal letter.
   c. Revise and resubmit the Shop Drawings as required, until the submittal is marked “No Exceptions Taken” or “Make Corrections Noted”.

3.04 Equipment Manuals

A. Submit Manufacturer Operation and Maintenance (O&M) Manuals to the Engineer for review a minimum of 60 days prior to system start up for each respective system or piece of equipment. System or equipment start up and substantial completion may be delayed at the discretion of the Engineer if O&M Manuals are not received in the time frame specified herein.

B. The status of an O&M Manual must be marked as "No Exceptions Taken" or "Make Corrections Noted", by Engineer before equipment can be placed into service for operation.

C. Furnish two (2) printed sets and one (1) electronic copy in searchable, bookmarked PDF (Adobe or other) format, of the equipment manufacturer's O&M materials and manuals to the Engineer. The electronic PDF shall use Optical Character Recognition (OCR) for alphanumeric recognition of all printed characters.

D. All O&M Manuals submitted shall be specific for the items and models furnished under this contract and reflect as-approved and as-installed information.

1. Standard manuals from equipment suppliers which reflect all sizes and options of equipment available from the supplier shall be clearly marked to indicate the applicable sizes and options specific to this project.
2. All non-applicable information shall be marked as such by crossing out.
3. Indicate actual model numbers and equipment options.
4. Manuals not marked as indicated above will be returned to the Contractor without review.

E. Manual Organization

1. Organize O&M Manuals into suitable sets of manageable size.
2. Bind data into individual binders for each manual, properly identified on front and spine. For large manuals, provide an index sheet and thumb tabs for separate information categories.
3. Provide heavy-duty, three-ring, vinyl-covered binders, 1/2 to 3 inches thick as required to contain information, sized for 8½" x 11" or 11" x 17" paper with inside pockets or pocket folders for folded sheets.
4. O&M Data shall be arranged in a Technical Manual in the following format:
    a. Category 1 - Equipment Summary
        1) Summary: A summary table shall indicate the equipment name, equipment number, and process area in which the equipment is installed.
    b. Category 2 - Operational Procedures
        1) Procedures: Manufacturer's instructions on the following shall be included in Category 2.
            a) Installation
            b) Adjustment
            c) Startup
            d) Location of controls, special tools, equipment required, or related instrumentation as needed for operation
            e) Operation procedures
            f) Waste disposal
            g) Load changes
            h) Calibration
            i) Shutdown
            j) Troubleshooting
            k) Disassembly
            l) Reassembly
            m) Realignment
            n) Clearances and tolerances
            o) Testing to determine performance efficiency

p) Tabulation of proper settings for all pressure relief valves, low- and high-pressure switches, and other protection devices
q) List of all electrical relay settings including alarm and contact settings

c. Category 3 - Preventive Maintenance Procedures
1) Procedures: Preventive maintenance procedures shall include all manufacturer's instructions of maintenance to be performed on a periodic basis, both by removing and replacing the equipment or component, and by leaving the equipment in place. This includes, but is not limited to,
a) A written explanation with illustrations as required for each preventive maintenance task, including finishes
b) Recommended intervals for execution of preventive maintenance tasks
c) Lubrication and other consumables charts
d) Table of alternative lubricants
e) Troubleshooting instructions to aid in the diagnosis of common equipment problems
f) List of required maintenance tools and equipment
(1) Contractor shall provide all maintenance tools and equipment specified by the manufacturer as necessary for the proper operation, calibration and maintenance of the item provided.
2) Schedules
a) Recommended frequency of preventive maintenance procedures
b) Lubrication schedules, including lubricant SAE grade, type, and temperature ranges
3) Interaction: Descriptions of any interactions while operating major subsystems or components.

d. Category 4 - Parts List
1) Parts List: Furnish a complete parts list, including a generic description and manufacturer's identification number for each part. Include addresses and telephone numbers of the nearest supplier and parts warehouse.
2) Drawings: Cross-sectional or exploded view drawings shall accompany the parts list.

e. Category 5 - Wiring Diagrams
1) Diagrams: Part 5 shall include complete internal and connection wiring diagrams for electrical equipment items.

f. Category 6 - Shop Drawings
1) Drawings: This part shall include approved shop or fabrication drawings, complete with dimensions.

g. Category 7 - Safety
1) Procedures: This part describes the safety precautions to be taken when operating and maintaining the equipment or working near it.

h. Category 8 - Documentation
1) All equipment warranties, affidavits, and certifications required by the Technical Specifications shall be placed in this part.

5. The Technical Manual shall be subdivided first by specification section number; second, by equipment item; and last, by category.

F. Information to be Included

1. Include in each O&M Manual information specified in individual Specification Sections and the following:
   a. Project title, equipment manufacturer, local equipment supplier, subcontractor, and prime contractor, including contact information (address, phone number, and e-mail) for each
   b. Term, name, or identifier used in the Contract Documents for the item listed
   c. Detailed description of the item
   d. Full nameplate information for each item provided including serial numbers, model number, horsepower, voltage, etc.
   e. Assigned equipment or valve number
   f. Copy of manufacturer warranties specific to this project
   g. Copies of factory tests or certified tests and reports, if required by the Specification Section or by referenced standards
   h. Equipment installation instructions
   i. Troubleshooting guide and emergency instructions
   j. Recommended maintenance materials, instructions, and procedures, including schedules, drawings, and diagrams
   k. Precautions against improper maintenance and exposure
   l. Inspection and system test procedures
   m. Complete, detailed written operating instructions for each product or piece of equipment including but not limited to:
      1) operating characteristics,
      2) limiting conditions,
      3) operating instructions for start-up, normal, and emergency conditions,
      4) regulation and control, and
      5) shutdown.
   n. Complete, detailed written preventive maintenance instructions as defined in this Section.
   o. A manufacturer's recommended spare parts lists including a listing of those spare parts and/or consumables which are to be provided for each equipment item and local sources of supply for parts as applicable.
   p. A written explanation of all safety considerations relating to operation or maintenance procedures.
   q. Complete parts lists showing parts, catalog numbers and generic description, along with assembly drawing, exploded view or sectional drawing with all parts identified. Parts listing shall include part name and original equipment manufacturer's parts numbers.
   r. Copy of all approved Shop Drawings and copy of warranty bond and service contract as applicable.
   s. Copies of revised Shop Drawings and Product Data showing as-installed information, including:
      1) Detailed drawings and descriptions of equipment showing all dimensions, elevations, parts, constructed details, materials of construction, performance data, descriptive literature, weights, and other physical characteristics, including performance curves, motor starting and full-load amps, motor horsepower, and motor data.
      2) Project name, equipment name, tag numbers, location, and/or other identifying description included on the drawings and cut sheets.

3) All sizes, special features, options, modifications, etc., that are provided specific to this project.
4) All options or features not provided specific to this project are deleted, crossed out, or otherwise removed.

t. Electrical & Controls Information:
1) Detailed drawings and descriptions of electrical and controls equipment, including main and auxiliary control panels, showing all dimensions, parts, constructed details, and materials of construction.
2) Complete electrical system drawings and description including, but not limited to, the following:
a) Complete system interconnection diagrams between power supply, control panels, drive motors, secondary drive motors, and all ancillary equipment connected to control system, including terminal number connection points.
b) Control panel overall dimensions and layout of external and internal mounted components.
c) Complete electrical schematics with power wiring and control wiring in accordance with current standards. Schematics shall include all component ratings.
3) Complete motor rating including all nameplate data, guaranteed minimum rated efficiency, and speed torque curves
4) Description of control system in written form including functions monitored, controlled, and alarmed. Include sequence of operation and interface requirements.

G. Each prime contractor is responsible for O&M manuals for its own Work. Where a manual includes information on installations by more than one contract, the Contractor who is the principal source of information, as designated by the Engineer, is responsible to receive information from other contractors, coordinate and collate information for a unified manual, and provide binders and submittal as specified.

3.05 Partial Payment Claims

A. These claims are described in the General Conditions. One (1) pdf copy of the fully executed claims shall be submitted to the Engineer monthly as determined at the Preconstruction Conference.

B. Submit to the Engineer one copy of all purchase orders, invoices and delivery tickets for materials claimed as stored materials, or for pay items based on a unit of weight or volume of material installed, on partial payment claims. Prices must be shown on the invoices or delivery tickets if the Contractor is claiming reimbursement for materials stored onsite, in the possession of the Owner. Amounts claimed for stored materials cannot exceed the amounts indicated in the invoice for the applicable items. Amounts claimed for a stored material shall not exceed the value of that Work item listed on the approved Schedule of Values.

-END-

SECTION 01400 – QUALITY ASSURANCE AND QUALITY CONTROL

PART 1 - GENERAL

1.01 Summary

A. Section Includes: Administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspection services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Documents.

1. Specific quality-control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
2. Specified tests, inspections, and related actions do not limit Contractor's quality-control procedures that facilitate compliance with the Contract Documents.
3. Requirements for Contractor to provide quality-control services required by Engineer, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

1.02 Definitions

A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and ensure construction complies with requirements.

B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that completed construction complies with requirements. Services do not include contract enforcement activities performed by Engineer.

C. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratories shall mean the same as testing agency.

1.03 Delegated Design

A. Where professional design services or certifications by a design professional are specifically required of the Contractor by the Contract Documents, provide these services and certifications in compliance with specific performance and design criteria indicated. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Engineer.

B. Submit a statement, signed and sealed by the responsible design professional, for each product or system specifically assigned to Contractor to be designed or certified by a design professional, indicating the products or systems comply with

performance and design criteria indicated. Include list of codes, loads, and other design factors used in performing these services.

1.04 Tests and Inspections

A. All materials and each part or detail of the Work shall be subject to inspection by the Engineer at all times. Allow access to all parts of the Work and furnish such information and assistance required to make a complete and detailed inspection.

B. Shop inspections may be required including observations of the preparation, manufacture and coating of materials and products at the plant.

C. The inspection of the Work shall not relieve the Contractor of any obligation to fulfill his contract as prescribed. Defective Work shall be made good and unsuitable materials shall be rejected, not withstanding that such defective Work and materials have been previously overlooked and accepted on estimates for payments.

D. All Work shall be tested to the satisfaction of the Engineer before acceptance. The cost of all tests is to be borne by the Contractor.

E. Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents within 30 days of Notice to Proceed. Include the following information in the schedule:

1. Specification Section number and title
2. Description of test and inspection
3. Identification of applicable standards
4. Identification of test and inspection methods
5. Number of tests and inspections required
6. Time schedule or time span for tests and inspections
7. Entity responsible for performing tests and inspections
8. Requirements for obtaining samples
9. Unique characteristics of each quality-control service

F. Distribute schedule to Engineer, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

G. Prepare and submit certified written reports that include the following:

1. Date of issue
2. Project title and number
3. Name, address, and telephone number of testing agency
4. Dates and locations of samples and tests or inspections
5. Names of individuals making tests and inspections
6. Chain of Custody Record (where applicable)
7. Description of the Work and test and inspection method
8. Identification of product and Specification Section
9. Complete test or inspection data
10. Test and inspection results and an interpretation of test results

11. Ambient conditions at time of sample taking and testing and inspection
12. Comments or professional opinion on whether tested or inspected Work complies with the Contract Documents requirements
13. Name and signature of laboratory inspector
14. Recommendations on retesting and reinspection

1.05 Submittals

A. Submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.06 Quality Assurance

A. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance.

C. Testing Agency Qualifications: An agency specializing in, and with proven experience and capability in, conducting the types of tests and inspections to be performed. Provide proof of agency's capabilities and experience upon Owner's request.

1.07 Quality Control

A. Contractor Responsibilities: Provide quality-control services specified in the Contract Documents and required by authorities having jurisdiction.

1. Engage a qualified testing agency to perform quality-control services.
2. Do not employ the same entity engaged by Owner, unless agreed to in writing by Owner.
3. Notify testing and inspection agencies in ample time before performing Work that requires testing or inspection. Abide by notification requirements of authority having jurisdiction.
4. Submit a certified written report of each quality-control service performed to Owner, Engineer, and authority having jurisdiction.

B. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation. Report results in writing.

C. Retesting/Reinspection: Regardless of whether original tests or inspections were Contractor's responsibility, provide retesting and reinspection for construction that

revised or replaced Work that failed to comply with requirements of the Contract Documents.

D. Testing Agency Responsibilities: Provide qualified personnel to perform required tests and inspections.

1. Notify Engineer and Contractor promptly of irregularities or deficiencies observed in the Work during performance of services.
2. Interpret tests and inspections and state in each report whether tested and inspected Work complies with or deviates from requirements.
3. Submit a certified written report, in duplicate, of each test and inspection service through Contractor.
4. Do not release, revoke, alter, or increase requirements of the Contract Documents or approve or accept any portion of the Work.

E. Associated Services: Cooperate with agencies performing tests and inspections, and provide reasonable auxiliary services requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

1. Access to the Work
2. Incidental labor and facilities necessary to facilitate tests and inspections
3. Adequate quantities of representative samples of materials that require testing and inspection. Assist agency in obtaining samples.
4. Facilities for storage and field-curing of test samples
5. Delivery of samples to testing agencies
6. Preliminary design mix proposed for use for material mixes that require control by testing agency
7. Security and protection for samples and for testing and inspection equipment at Project site

F. Schedule time for tests, inspections, obtaining samples, and similar activities. Coordinate sequence of activities to accommodate quality-assurance and quality-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspection.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

3.01 Repair and Protection

A. On completion of testing, inspection, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

-END-

SECTION 01500 - CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 - GENERAL

1.01 Summary

A. Section Includes: Providing and coordinating temporary facilities, utilities and controls.

B. Related Sections

1. Section 01010 – Summary of Work
2. Section 01090 – Reference Standards

1.02 References

A. Federal Highway Administration's Manual on Uniform Traffic Control Devices (MUTCD) and Indiana Supplement, latest editions

1.03 Submittals

A. Quality Assurance/Control Submittals

1. Before beginning Work adjacent to any street, provide the Engineer with a proposed signing schedule, which shall include location, size, and messages of all signs to be used.

1.04 Quality Assurance

A. Regulatory Requirements

1. Obtain permits as specified in Section 01010.
2. Comply with the latest applicable Federal, State, and local codes, including but not limited to, the agencies and codes specified in Section 01090.
3. Maintain lights and barricades on all obstructions and hazards during contract period in conformance with federal, state, and local laws and codes.

PART 2 - PRODUCTS

2.01 Temporary Facilities, Utilities, and Services

A. Storage Sheds and Enclosures

1. Storage sheds or trailers shall be provided by each Subcontractor as required. Coordinate location and removal with General Contractor.
2. Provide temporary weather-tight enclosures for all exterior openings.
3. Equip exterior doors with locks and closers.

B. Sanitary Facilities

1. Provide sanitary facilities for use of all construction personnel including personnel of other contractors for the duration of the project as follows:
   a. Chemical units complete with weather-tight enclosure adequately ventilated and equipped with latching door.
   b. Maintain chemical units weekly or at lesser periods if determined necessary. Chemical units shall be in accordance with the rules and regulations of the locality of the project (State, county, or city).
   c. Furnish toilet paper and hand sanitizer for the chemical units and replenish supply as needed.

C. Water and Electric Service

1. Install and maintain all extensions from the service sources to Work areas as required providing adequate water supply and electric power for all aspects of the Work and in accordance with all relevant codes and regulations.

D. Heat and Ventilation

1. Provide heat and ventilation as required to maintain specified conditions for construction operations, to provide for a safe working environment in accordance with health regulations, and to protect materials and finishes from damage due to temperature or humidity. Follow requirements set forth elsewhere in these Specifications.
2. Whenever fixtures, water services or items subject to damage from cold have been installed, maintain the temperature above 50 degrees Fahrenheit.
3. Prior to operation of permanent facilities for temporary purposes, verify that installation is approved for operation, and that filters are in place. Provide and pay for operation, maintenance, and utilities and fully service all equipment, including cleaning filters, until the time the Work is turned over to the Owner.
4. Provide ventilation of enclosed areas to cure materials, to disperse humidity, and to prevent accumulations of dust, fumes, vapors, or gases.
5. No open fires will be permitted.

E. Trash Containers

1. Provide a trash container for the disposal of packaging materials, pieces of broken pipe, rubbish, trash and all other debris. Empty trash containers weekly or as container is filled.

F. Fire Extinguishers

1. Provide multipurpose dry chemical fire extinguishers as required. Mount units in protective red enclosures plainly marked and readily accessible.

G. Bulletin Board

1. Provide a bulletin board or display area to post required notices in an appropriate weather-protected manner.

H. Construction Signs and Equipment

1. Provide and erect construction signs, lights, channelizing devices, and other traffic control equipment in accordance with the MUTCD and the Indiana Supplement requirements.

PART 3 - EXECUTION

3.01 Installation

A. Locate temporary facilities herein specified, and facilities required by the Contractor and his Subcontractors for storage or other purposes in the performance of their contracts, to avoid interference with Work. Relocate as required and/or directed by Engineer.

B. Construct temporary structures on stable foundation with code approved service connections.

C. Install temporary electrical service and distribution overhead. Do not run branch circuits on floor.

3.02 Protection

A. Piping Rough-ins: Keep foreign materials out of piping by capping or other protection. Trades responsible for stoppage will be charged for cleaning.

B. Safety: Maintain signs, lights, and barricades on all obstructions and hazards during construction period in conformance with local, state, and federal laws and codes.

3.03 Access Roads and Parking Areas

A. Provide and maintain vehicular access to the site and within the site for use by persons and equipment involved in the construction of the project. Maintain access roads and driveways with sufficient compacted aggregate to provide a suitable support for vehicular traffic and anticipated loads.

B. Provide and maintain temporary parking facilities for use by construction personnel, the Owner, and the Engineer. Maintain parking facilities free of construction materials, mud, snow, ice, and debris.

C. Restore areas to original or to specified conditions shown on the Drawings at completion of the Work.

3.04 Maintenance of Traffic

A. General

1. Comply with the requirements of the State, City, or County Highway and Street Departments for all traffic maintenance.

2. Maintain all construction signs, lights, channelizing devices, and other traffic control equipment in proper working order.
3. During construction, maintain and protect the pedestrian and vehicular traffic at all times on all streets involved and provide access to all residential and commercial establishments adjacent to the construction area.

B. Notification Requirements

1. Before closing any thoroughfare, notify and, if necessary, obtain a permit or permits from the duly constituted public authority having jurisdiction (state, county, or city).
2. Notify the Engineer of intended road or drive closures 72 hours in advance of the proposed closing. Place all proper detour signs and barricades prior to the actual street closing.
3. Notify each resident or property owner of Work which will impact access to his property a minimum of 2 business days in advance of restricting access to the property.

C. Lane/Road Restriction Requirements

1. Do not unduly or unnecessarily restrict or impede normal traffic through the streets of the community. Keep the traveled way of all streets, roads, and alleys clear and unobstructed. Do not use streets, roads, or alleys for the storage of construction materials, equipment supplies, or excavated earth, except when and where necessary.
2. Adjacent street segments shall not be closed at the same time to reduce delays for emergency responders. For this requirement, an "adjacent street segment" shall include the next block of the same street in either direction, the same block of a parallel street in either direction, and the nearest blocks of perpendicular (connecting) streets in all directions.
3. The Contractor may limit or prohibit public parking within the limits of the project.
4. If required by duly constituted public authority, construct bridges or other temporary crossing structures over trenches at no additional cost to Owner. Such structures shall be of adequate strength and proper construction and shall be maintained in such manner as not to constitute an undue traffic hazard.

D. Access to Private Property

1. Private driveways shall not be closed, except when and where necessary, and then only upon advance notice to the Engineer and for the shortest practicable period of time, consistent with efficient and expeditious construction. When a residential driveway is closed due to construction activity, designate safe parking areas, and provide access to adjacent properties. The Contractor shall be liable for any damage to persons or property resulting from his Work.
2. Maintain a clean pedestrian access to all establishments within the project limits during construction by use of temporary bridging or other means.

E. Walks and Passageways

1. Make provisions at cross streets for the free passage of vehicles and foot passengers, either by bridging or otherwise.
2. Do not unnecessarily obstruct the sidewalks, gutters, or streets, or prevent in any manner the flow of water in streets. Use all proper and necessary means to permit the free passage of surface water along the gutters.
3. Immediately remove and dispose of excavated materials and offensive matter to avoid inconveniencing the public and adjacent tenants. Erect suitable barriers to prevent such inconveniences and to prevent injury to trees, sidewalks, fences, and adjacent properties.
4. At any time during construction, when there is not a curb adjacent to the roadway, place barricades as shown on the Drawings or as directed. Protect any gaps adjacent to an open sidewalk with orange snow fencing.

F. Pavement Restoration

1. Streets in which excavation has occurred shall be temporarily restored to receive traffic as soon as possible. Permission to close additional streets shall be denied the Contractor if, in the opinion of the Owner or Engineer, the restoration on streets where excavation has occurred has not progressed satisfactorily.
2. Maintain the road surfaces during the construction, take precautions to prevent unnecessary damage to partially completed surfaces, and repair any portions which do become damaged. Bear all costs involved in such maintenance, precautions, and repairs, including the cost of all necessary materials.

3.05 Barricades, Warning Lights and Arrow Boards

A. Provide, erect and maintain all necessary barricades, suitable and sufficient danger signals and signs. Take all necessary precautions for the protection and safety of the public, workmen, structures, and equipment. Roads closed to traffic shall be protected by effective barricades. Obstructions shall be illuminated during hours of darkness.

B. Erect warning signs in advance of any location on the project where operations may interfere with the use of the road by traffic and at all intermediate points where the new Work crosses or coincides with an existing road.

C. Place sufficient warning lights and arrow boards on or near the Work and keep them illuminated during periods of construction and reduced visibility (from twilight in the evening until sunrise). The Contractor is responsible for all damages that Owner or any other party may sustain in consequences of neglecting the necessary precautions in prosecuting this Work.

3.06 Removal and Clean-Up

A. Remove all temporary facilities, utilities, services and materials upon completion of construction. Remove debris and clean area. Repair all damage and restore area to finish condition.

-END-

SECTION 01550 – PLANT OPERATIONS DURING CONSTRUCTION

PART 1 - GENERAL

1.01 Summary

A. Section Includes

1. Furnishing and installing temporary facilities and services, scheduling and sequencing of construction, and utilizing construction procedures necessary to maintain wastewater treatment during construction.
2. Requirements for developing a plan for construction activities, scheduling, and sequencing construction to maintain wastewater treatment or pumping operations during construction.
3. Specific requirements which may influence the Contractor's Bid Price and scheduling are included in this Section. However, specific procedures are not limited to the ones included in this Section, and additional and more detailed procedures may be required during construction. If requested by the Engineer, provide a written plan describing how these requirements will be met. Include all costs in Bid Price for meeting the requirements described in this Section.

1.02 System Description

A. The Blucher Poole WWTP Supervisory Control and Data Acquisition (SCADA) system is outdated and needs some of the critical infrastructure replaced. This project identifies key instruments, Programmable Logic Controllers (PLCs), Variable Frequency Drives (VFDs), and Human Machine Interfaces (HMIs) that shall be replaced to modernize the SCADA operations for the facility.

1.03 Submittals

A. At least thirty days before the migration of the new hardware, provide a written plan detailing how the requirements for maintaining production, treatment, electrical, and other utility operations will be met. Indicate the sequence and scope for the migration of each major plant control panel, including the requirements for the removal of existing equipment. It is anticipated that each plant panel will take one (1) day for cutover to the new PLC and HMI equipment installed in that panel.

B. The Engineer will review the plan only for compliance with the intent of maintaining operation of the water facilities during construction.

C. Make revisions to the written plan submitted based on the Engineer’s review and incorporate those revisions into the Project.

1.04 Maintaining Operations

A. It is essential that treatment in the existing wastewater treatment facilities is not interrupted during construction or diminished in quality/quantity by construction procedures or methods.

B. All efforts shall be made to utilize existing control panel capacity to reduce the amount of time that the control equipment is without power or is inoperable for the migration. All mounting and wiring that can be completed prior to the cutover day shall be completed and tested prior to the start of decommissioning of the existing SCADA equipment.

C. Should temporary facilities be required, have on site, or at immediate accessibility, back-up facilities in the event of failure of the primary temporary units.

D. Procedures as set forth herein are included as a guide only and do not relieve the Contractor from any costs to provide and maintain any or all temporary facilities and equipment that may be required to maintain full plant operation during the construction period. The Contractor may use procedures other than those set forth herein with prior approval of the Engineer. The approval of the Engineer shall be only for compliance with the intent of maintaining full operation of the treatment facilities.

1.05 Construction Schedule

A. Notify the Owner and Engineer one week in advance of any interruptions or access to existing treatment facilities. Such interruptions shall be strictly coordinated with the Plant Superintendent.

1.06 Plant Operations and Maintenance

A. Existing facilities: Existing facilities which are required to be in service during their modification will be operated by the Owner.

B. Temporary facilities: Furnish and install temporary facilities and equipment, such as pumps, piping, flumes, valves, gates, etc. required to maintain full wastewater treatment in the existing facilities.

1. Operate temporary facilities and equipment 24 hours a day if needed to maintain the treatment process.
2. Coordinate, and provide instructions for, the operation of temporary facilities in writing to the Engineer.
3. Provide, and pay energy costs for, temporary utilities.

C. New Facilities: Operate and maintain new facilities prior to completion of construction whether utilized or not in the treatment process.

1. New equipment required to be in service before acceptance by the Owner will be operated by and maintained by the Contractor.

D. Operation of new or modified equipment by the Owner before tested and accepted does not imply acceptance of the equipment by the Owner.

E. New or modified equipment which have been completed, tested, and accepted by the Owner per Specification Section 01650, Article 1.05 will be operated and maintained by the Owner.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

3.01 General Procedures

A. Schedule and coordinate the Work so that:

1. Minimal interruptions are made to facility operations,
2. The number of process shutdowns are minimized, and
3. Portions of the facility which are shut down or taken out of service are minimized.

B. As a general rule, a shutdown for a specific process will be provided only once, and the Contractor is responsible for completing all Work necessary for that item during that time and within the time frame specified.

C. Prior to the start of modifications to any existing facility, assemble labor, materials, and equipment required to complete the modifications without interruption and/or inordinate delays.

D. Complete modification to one existing facility before starting another modification to existing facilities. Avoid modification to more than one of the existing facilities simultaneously, unless approved by the Engineer.

3.02 Timing

A. Coordinate construction which requires any portion of the treatment facilities to be taken out of service with the Engineer. Be prepared to undertake these procedures at times of low flow, if necessary.

3.03 Specific Procedures

A. Prepare each existing control panel prior to cut over by identifying all mounting and electrical connection options to reduce the amount of time that the control panel is powered off during the conversion. It is recommended that the new PLCs are mounted in place (if possible) prior to cut over.

B. Install, wire and test new plant HMIs prior to PLC cut over

C. All instrumentation shall be wired and terminated prior to conversion of the connected PLC.

D. All variable frequency drives (VFDs) shall be converted on days where no other migration activities are taking place at the plant. Operations staff will provide the appropriate bypass procedures to allow for the VFDs to be powered off during the conversion.

3.04 Site Access

A. The project site is fenced and gated. Normal operating hours by the Owner are 7:30 am to 4:30 pm. Coordinate access to the site, including access to gated drives and locked facilities, with the Owner during normal operating hours.

B. Schedule the construction of the new drives and demolition of existing drives and/or construct temporary drives as necessary to provide uninterrupted access to existing facilities.

C. Provide access at all times when the Contractor is not working on the site.

D. Interruptions to access when the Contractor is working on the site shall only occur when connections between new or temporary drives and existing drives are being constructed or removed. Coordinate this Work with the Engineer and Owner.

E. Sufficiently stabilize and maintain temporary drives to permit passage of fully loaded semi-trailer trucks without assistance from other vehicles or construction equipment.

-END-

SECTION 01600 - MATERIAL AND EQUIPMENT

PART 1 - GENERAL

1.01 Delivery, Storage and Handling

A. The delivery, receipt, storage and handling of all fixtures, equipment, materials, components and appurtenances (collectively “products”) shall be the responsibility of the Contractor.

B. Load and unload all products by lifting with hoists and skidding to avoid shock or damage. Under no circumstances shall products be dropped.

C. Do not skid or roll products on or against other products. Use padded slings, hooks, pipe tongs, etc, to handle all products in a manner to prevent damage.

D. Pack, transport and store all equipment components and motors in protective enclosures such that they are not subjected to forces or elements that may result in damage. Promptly remove damaged products from the job site and replace with undamaged products.

E. Do not stack equipment components or motors. Adequately support equipment during transport and storage to prevent undue stress.

F. Obtain storage space for all products used on this project. The Owner will not receive, store or house products being delivered to the site for Contractor or his Subcontractor.

G. Store products to prevent dirt and debris from entering and accumulating. Protect products from heat, cold, sunlight, contamination and other adverse conditions.

H. Deliver, store, protect, and handle products in accordance with the manufacturer’s instructions. Products not properly stored or protected may be subject to rejection as determined by the Engineer.

1.02 Local Labor and Materials

A. Whenever possible, the Contractor, his subcontractors, material men, or others who employ labor, shall employ labor locally.

B. Purchase materials such as sand, cement, gravel, pipe, steel, and lumber from local dealers when such local dealers' prices meet competition’s and where such materials meet the Specifications.

1.03 Domestic Product Requirements

A. All steel and foundry products provided for public works projects, including ferrous and non-ferrous metals, piping, fittings, and piping-related products, shall be manufactured in the United States in accordance with Indiana Code 5-16-8-2 –

Public agency contract provisions; rules for determining reasonable pricing; and Consolidated Appropriations Act (2014) Section 436.

1.04 Unavailability of Materials and Equipment

A. Bids must be based on use of the products specified, subject to the provisions of any addenda issued. If the Contractor is unable to furnish or use any of the products specified because of any order by a governmental agency limiting the manufacture or use, or because of the lack of availability in the market for such products, the Contractor shall offer substitutes suitable for the purpose, considering the factors of quality, serviceability, appearance, and maintenance. No substitute shall be used until it has been approved by the Engineer.

B. No consideration will be given to the use of substitutes on account of market conditions unless the Contractor demonstrates that, for the item in question, he placed his order and submitted shop drawings without delay, that he has shown due diligence in attempting to locate the item as specified, and that the unavailability is due to market conditions in general throughout the particular industry.

C. If substitutes are used in the Work, the compensation to be paid to the Contractor shall be subject to review and adjustment. The basis upon which the amount of price and adjustments will be founded shall be the cost of the appropriate items at the time the bids were opened.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.

-END-

SECTION 01650 – STARTING OF SYSTEMS

PART 1 - GENERAL

1.01 Summary

A. Section Includes

1. Starting of equipment and systems
2. Demonstration, training and instructions
3. Acceptance of Equipment

1.02 Submittals

A. Submit O&M Manuals to the Engineer for review prior to system start up for each respective system or piece of equipment in accordance with Section 01300.

B. Provide an abstract or outline of the start-up, testing and training procedures to the Engineer at least five (5) days prior to the scheduled start-up.

C. Following start-up, a typed, bound Start-Up Certification Report covering the manufacturer's representative's findings shall be submitted to the Engineer for review and approval. The report shall certify that the equipment is properly installed and functioning for the purpose intended. The report shall include the following:

1. Type of inspections performed
2. A description of the start-up procedures taken
3. Detailed description of any deficiencies observed along with the corrective measures taken
4. The results of all field tests, including necessary graphs, charts, tables, etc., specified in the detailed Specification or required by the referenced standards

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

3.01 Examination

A. Verification of Conditions

1. Verify that each piece of equipment for system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions which may cause damage.
2. Verify that tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.

3. Verify that wiring and support components for equipment are complete and tested.

3.02 Preparation

A. Coordinate schedule for start-up of various equipment and systems.

B. Notify Engineer seven days prior to start-up of each item. Coordinate system or equipment start-up with Plant Superintendent and Engineer.

3.03 Field Quality Control

A. Manufacturers Field Service

1. Execute start-up under supervision of applicable manufacturer's representative and Contractor’s personnel and in accordance with manufacturer’s instructions. When indicated in individual Specification sections, require manufacturer to provide an authorized representative to be present at the site.
2. Manufacturer’s services shall be furnished at the Contractor's expense.
3. The services provided shall be by a qualified representative for the specified period of time and for the specified number of trips. A working day is defined as a normal 8-hour working day on the job and does not include travel time.
4. Manufacturer’s services shall include:
   a. Inspect the complete installation of the equipment.
   b. Place the equipment in operation and make any necessary adjustments.
   c. Perform tests specified in the detailed Specification and as recommended by the equipment manufacturer.
   d. Instruct Owner's personnel in the proper operation and maintenance of the equipment (training) as described in Article 3.04.
5. The purpose of these services is to demonstrate to the Owner and Engineer's complete satisfaction that the equipment has been properly installed and will satisfactorily perform the functions for which it is intended.

B. If equipment or systems are not completed for proper start-up and training procedures, the representative shall schedule another visit at no additional cost to the Owner. The Contractor shall bear all expenses associated with the start-up, testing and training procedures, and required reporting, including labor, transportation, lodging and material costs.

3.04 Demonstration, Training and Instructions

A. Training will not be permitted without prior start-up and operation of the equipment. Training shall be performed separate and distinct from start-up and testing tasks. Manufacturer's O&M Manuals and materials shall be incorporated in the training procedures, with emphasis on items or materials of greatest importance.

B. Demonstrate project equipment and instruct in a classroom environment located at the plant site. Instruction shall be by a manufacturer's representative who is knowledgeable about the equipment and its application to the project.

C. Utilize O&M Manuals as basis for instruction. Review contents of manual with Owner's personnel in detail to explain all aspects of operation and maintenance.

D. Demonstrate start-up, operation, control, adjustments, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at agreed time at equipment location.

E. Prepare and insert additional data in O&M Manuals when need for additional data becomes apparent during instruction.

F. The amount of time required for instruction on each item of equipment and system is that specified in individual sections.

G. Provide demonstration such that the Owner may video the training if so desired.

3.05 Acceptance of Equipment

A. Acceptance of equipment shall be defined as that point in time when the following requirements have been fulfilled and the equipment is placed in operation:

1. All required submittals and documentation have been submitted, and are acceptable to the Engineer.
2. All start-up and training procedures have been satisfactorily performed and the Start-Up Certification Report has been submitted, and is acceptable, to the Engineer.
3. All equipment O&M Manuals and materials have been submitted, and are acceptable to the Engineer.
4. All spare parts have been provided to the Owner.

B. The date of formal acceptance by the Owner for a particular item of equipment, or Date of Acceptance, shall be the date of Substantial Completion as described in the General Conditions, unless specifically approved otherwise by the Engineer.

C. Equipment which is absolutely necessary to be placed into operation prior to Substantial Completion may be accepted by the Owner as described in the General Conditions, provided that all the above requirements have been met. Once the Start-Up Certification Report has been submitted and is acceptable to the Engineer, an Acceptance Agreement for Partial Work Completed may be issued, which indicates the Date of Acceptance. The Contractor shall maintain ownership and have total responsibility for the equipment until the Date of Acceptance Agreement for Partial Work Completed is agreed to by all parties. The Owner shall provide regular operation and maintenance of the equipment after acceptance. Only equipment which must be placed into operation prior to Substantial Completion in order to maintain adequate treatment through the facility will be considered for acceptance prior to Substantial Completion, as determined by the Engineer.

D. The manufacturer's and Contractor's warranty for each item of equipment shall not begin until the equipment is placed into permanent operation, as determined by the Date of Acceptance established for each piece of equipment.

-END-

SECTION 01710 - CLEANING

PART 1 - GENERAL

1.01 Summary

A. Section Includes

1. Intermediate Cleaning During Construction
2. Final Cleaning
3. Final Inspection

1.02 Quality Assurance

A. Requirements of Regulatory Agencies

1. Maintain project in accordance with Occupational Safety and Health Act of 1970 as amended, in terms of cleanup.

1.03 Project/Site Conditions

A. Environmental Requirements

1. Conduct cleaning and disposal operations in accordance with local ordinances, state and federal regulations and anti-pollution laws.
2. Do not burn or bury rubbish and waste materials on project site. Do not dispose of volatile wastes such as, mineral spirits, oil or paint thinner in storm or sanitary drains.

PART 2 - PRODUCTS

2.01 Cleaning Materials

A. Use only cleaning materials recommended by manufacturer of surface to be cleaned.

B. Use cleaning materials only on surfaces recommended by cleaning material manufacturer.

PART 3 - EXECUTION

3.01 General

A. All cleaning shall be the responsibility of the Contractor unless specifically noted otherwise. If rubbish and debris are not removed from the Work areas as specified, or cleaning of the buildings, structures and site are not completed as specified, the Owner reserves the right to have the cleaning done at the expense of the Contractor.

B. Schedule cleaning operations so that dust and other contaminants resulting from cleaning process will not fall on wet or newly painted surfaces.

C. Provide on-site containers for collection of waste materials, debris and rubbish.

3.02 Intermediate Cleaning During Construction

A. Execute cleaning to ensure that all structures and buildings, grounds, roadways and property are maintained free from accumulations of waste materials, debris and rubbish caused by construction activities. Remove all surplus materials from the job site on a daily basis.

B. Prior to placing equipment and Work areas into service, perform intermediate cleaning as follows:

1. Remove and dispose of all temporary structures and debris, including dirt, sand, gravel, rubbish, and waste material from the tanks, filters, and Work areas.
2. Thoroughly clean, sweep, and wash down all tanks, filters, and Work areas.
3. Thoroughly clean, and when so directed, disinfect all materials and equipment being modified, rehabilitated, and or replaced.
4. Direct all Subcontractors to similarly clean all tanks, filters, and areas in which they have worked, and to thoroughly clean all materials and equipment provided under their contracts.

3.03 Final Cleaning

A. General: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit of Work to the condition expected from a commercial building cleaning and maintenance program. Comply with manufacturer's cleaning instructions.

B. At the completion of Work and immediately prior to final inspection, clean the entire Project as follows:

1. Clean the project site, yard and grounds, in areas disturbed by construction activities, including landscape development areas, of waste materials, debris, rubbish and foreign substances.
2. Sweep paved areas broom clean. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
3. Remove tools, construction equipment, machinery, and surplus material from the site.
4. Thoroughly clean, sweep, wash, and polish all Work and equipment under the Contract, including finishes.
5. Remove all dirt, sand, gravel, and other material.
6. Remove grease, dust, dirt, stains, labels, fingerprints, and other foreign materials from sight-exposed interior and exterior finished surfaces; polish surfaces so designated to shine finish.
7. Remove labels that are not permanent labels.

8. Repair, patch and touch-up marred surfaces to specified finish, to match adjacent surfaces.
9. Remove snow and ice from access to all buildings and structures, new or existing, affected by the Work.
10. Replace air-handling filters, new and existing, if units were operated during construction.
11. Clean new and existing ducts, blowers, and coils, if air-handling units were operated without filters during construction.
12. Vacuum clean all interior spaces, including inside cabinets.
13. Clean transparent materials, including mirrors and glass in doors and windows.
14. Clean interior of all panels, cabinets, pull boxes, and other equipment enclosures.
15. Wash and wipe clean all lighting fixtures, lamps, and other electrical equipment which may have become soiled during construction.
16. Perform touch-up painting.

C. Leave the structures and site in a complete and finished condition to the satisfaction of the Engineer.

D. At completion of Work, remove tools, equipment, machinery and surplus materials, and clean all sight-exposed surfaces; leave project clean and ready for occupancy or operation as applicable.

3.04 Final Inspection

A. In preparation for substantial completion or occupancy, conduct inspection of sight-exposed interior and exterior finished surfaces, and of concealed spaces.

B. After cleaning is complete the final inspection may be scheduled. The inspection will be done with the Owner and Engineer.

-END-

SECTION 01720 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.01 Summary

A. Section Includes: Administrative and procedural requirements for Project Record Documents.

B. Project Record Documents required include the following as applicable:

1. Marked-up copies of Contract Drawings
2. Marked-up copies of Shop Drawings
3. Newly prepared drawings
4. Marked-up copies of Addenda, and Change Orders
5. Marked-up Product Data submittals
6. Field Orders
7. Record Samples
8. Field records for variable and concealed conditions
9. Record information on Work that is recorded only schematically
10. Field Test Reports
11. Equipment Test Reports

C. Related Sections

1. Section 01300 – Submittals

1.02 Submittals

A. Record Drawings

1. For substantial completion to be established, deliver one (1) set of "Contractor's Record Drawings" to Engineer. The Engineer will review the Record Drawings prior to acceptance.
2. Contractor may complete Record Drawings in electronic format using Owner-approved CAD-based software.
3. Organize into sets and bind and label sets for the Owner's continued use.
4. If the Engineer determines the Record Drawings are not in conformance with the specifications, the Engineer will return the Record Drawings to the Contractor. Revise the Record Drawings and resubmit to the Engineer prior to final completion. The Engineer will review the revised Record Drawings for conformance to specifications. If the revised Record Drawings are not in conformance with the specifications the Engineer or a third party as determined by the Owner will then perform all necessary field survey and measurements, field excavations and locations, engineering calculations, and drafting to complete the Record Drawings in conformance with the specifications.
5. The Contractor shall be responsible for payment to the Owner for Work to make the corrections and revisions to the incomplete Record Drawings submitted by the Contractor.

6. The Engineer will not recommend Final Completion until Record Drawings are submitted and approved.

B. Markup Procedures

1. During construction, maintain one (1) set of Contract Drawings and Shop Drawings for Project Record Document purposes. Label each drawing "Contractor's Record Drawing" in 2-inch high printed letters. Keep Record Drawings current. Do not permanently conceal any Work until required information has been recorded.
   a. Legibly and accurately mark these Drawings in an understandable drawing technique to show the actual installations where the installation varies from the installation shown originally. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
   b. Items required to be marked include as applicable, but are not limited to, the following:
      1) Dimensional changes to the Drawings
      2) Revisions to details shown on the Drawings
      3) Depths of foundations below the first floor
      4) Locations and depths of underground utilities
         a) All valves (gate, plug, air release, combination sewage, etc.) shall be located and referenced to three (3) permanent surface improvements.
         b) All fittings (tees, wyes, bends, crosses, plugs, caps, etc.) shall be located and referenced to three (3) permanent surface improvements.
         c) All force mains shall be located and referenced to the centerline of the road or street at 500 foot minimum intervals.
         d) All structures (manholes, vaults, etc.) shall be located and referenced to three (3) permanent surface improvements.
         e) All sewer laterals shall be located and referenced to the downstream manhole (stationing in feet) and depth of lateral at property line.
      5) Revisions to routing of piping and conduits
      6) Revisions to electrical circuitry
      7) Actual equipment locations
      8) Duct size and routing
      9) Locations of concealed internal utilities
      10) Changes made by Change Order or Field Transmittal Memo
      11) Changes made following the Engineer's written orders
      12) Details not on original Contract Drawings
   c. Mark record prints of Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. Where Shop Drawings are marked, show cross-reference on Contract Drawings location.
   d. Mark record sets with red erasable colored pencil. Use other colors to distinguish between changes for different categories of the Work at the same location.

e. Mark important additional information that was either shown schematically or omitted from original Drawings.
f. Note Field Transmittal Memo numbers, alternate numbers, Change Order numbers, and similar identification.

2. Responsibility for Markup: Contractor shall be solely responsible for the measurement and recording of the Record Drawings. The presence of the Engineer or Owner shall not relieve the Contractor in any way of his/her obligation in this regard.
   a. The individual or entity who obtained record data, whether the installer, subcontractor or similar entity, should provide their Record Drawings to the Contractor. The Contractor shall be responsible for collecting and recording subcontractor's and other's information on the Record Drawings.

C. Record Specifications

1. During the construction period, maintain **one (1) copy** of the Project Specifications, including addenda and modifications issued, for Project Record Document purposes.
   a. Mark the Specifications to indicate the actual installation where the installation varies from that indicated in Specifications and modifications issued. Note related project Record Drawing information, where applicable. Give particular attention to substitutions, selection of product options, and information on concealed installations that would be difficult to identify or measure and record later.
      1) In each Specification Section where products, materials, or units of equipment are specified or scheduled, mark the copy with the proprietary name and model number of the product furnished.
      2) Record the name of the manufacturer, supplier, installer, and other information necessary to provide a record of selections made and to document coordination with record Product Data submittals and maintenance manuals.
      3) Note related record Product Data, where applicable. For each principal product specified, indicate whether record Product Data has been submitted in maintenance manual instead of submitted as record Product Data.
   b. Upon completion of markup, submit record Specifications to the Engineer for the Owner's records.
   c. The Contractor is responsible for collecting marked-up record Specifications from each of his subcontractors. The Contractor is also responsible for collating these Sections in proper numeric order with its own Sections to form a complete set of record Specifications.

D. Record Product Data

1. During the construction period, maintain one (1) copy of each Product Data submittal for Project Record Document purposes.
   a. Mark Product Data to indicate the actual product installation where the installation varies substantially from that indicated in Product Data submitted. Include significant changes in the product delivered to the site and changes in manufacturer's instructions for installation.

b. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
c. Note related Change Orders and markup of Record Drawings, where applicable.
d. Upon completion of markup, submit a complete set of Product Data to the Engineer for the Owner's records.
e. Where Record Product Data is required as part of maintenance manuals, submit marked-up Product Data as an insert in the manual instead of submittal as record Product Data.
f. Each subcontractor is responsible for marking up and submitting record Product Data for its own Work. Contractor is responsible for collecting and submitting Record Product Data.

E. Record Sample Submittal

1. Immediately prior to date of Substantial Completion meet with the Engineer and the Owner's personnel at the site to determine which of the samples maintained during the construction period shall be transmitted to the Owner for record purposes. Comply with the Engineer's instructions for packaging, identification marking, and delivery to the Owner's sample storage space.
2. Dispose of other samples in a manner specified for disposing of surplus and waste materials.

F. Miscellaneous Records

1. Refer to other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities and equipment.
2. Immediately prior to Substantial Completion, complete miscellaneous records and place in good order, properly identified and bound or filed, ready for use and reference. Submit to the Engineer for the Owner's records.
3. Miscellaneous records include, but are not limited to, the following categories as applicable:
   a. Field records on excavations and foundations
   b. Field records on underground construction and similar Work
   c. Survey showing locations and elevations of underground lines
   d. Invert elevations of drainage piping
   e. Surveys establishing building lines and levels
   f. Authorized measurements utilizing unit prices or allowances
   g. Records of landscaping and plant treatments
   h. Ambient and substrate condition tests
   i. Certification received in lieu of labels on bulk products
   j. Batch mixing and bulk delivery records
   k. Testing and qualification of tradesmen
   l. Documented qualification of installation firms
   m. Load and performance testing
   n. Inspections and certifications by governing authorities
   o. Leakage and water-penetration tests
   p. Fire-resistance and flame-spread test results
   q. Equipment Manuals

r. Final inspection and correction procedures

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

3.01 Recording

A. Post changes and modifications to the Documents as they occur. Do not wait until the end of the Project.

B. The Documents shall be available for review by the Engineer at all times. Have Documents readily available for review at the monthly progress meetings. Partial pay claims may be withheld if record documents are not kept updated in a satisfactory manner.

-END-

SECTION 01731 - CUTTING AND PATCHING

PART 1 - GENERAL

1.01 Summary

A. Section Includes

1. Procedural requirements for cutting and patching as applicable to mechanical, structural, electrical and related installations.

1.02 Definitions

A. Cutting: Removal of existing construction necessary to permit installation or performance of other Work.

B. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.

1.03 Submittals

A. Submit a plan describing cutting and patching procedures at least 10 days before cutting and patching will be performed. Include the following information:

1. Describe cutting and patching extent; show how the work will be performed.
2. Describe changes to existing structural elements and operating components as well as changes in building's appearance and other significant visual elements.
3. List products to be used and firms or entities that will perform the work.
4. Indicate the dates cutting and patching will be performed.
5. List utilities that will be disturbed, affected, relocated or temporarily out of service. Indicate how long service will be disrupted.
6. Where cutting and patching involve adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with original structure.
7. Obtain approval of cutting and patching plan from Engineer before commencing cutting and patching work. Approval does not waive right to later require removal and replacement of unsatisfactory work.

1.04 Quality Assurance

A. Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time and complete without delay.

B. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.

C. Operational Elements: Do not cut and patch the following operating elements and related components in a manner that results in reducing their capacity to perform

as intended or that result in increased maintenance or decreased operational life or safety.

1. Primary operational systems and equipment
2. Air or smoke barriers
3. Fire-protection systems
4. Control systems
5. Communication systems
6. Conveying systems
7. Electrical wiring systems
8. Operating systems of special construction in Division 13 Sections
9. Piping systems
10. Ventilation systems

D. Miscellaneous Elements: Do not cut and patch the following elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that result in increased maintenance or decreased operational life or safety.

1. Water, moisture, or vapor barriers
2. Membranes and flashings
3. Exterior curtain-wall construction
4. Equipment supports
5. Piping, ductwork, vessels, and equipment
6. Noise- and vibration-control elements and systems

E. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Engineer's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

PART 2 - PRODUCTS

2.01 Materials

A. Use materials identical to existing materials unless otherwise specified or approved. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of existing materials.

B. For exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.

PART 3 - EXECUTION

3.01 Examination

A. Verification of Conditions

1. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.
2. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers before beginning work.
3. Plan the work to avoid interference of use of adjoining areas or interruption of free passage to adjoining areas.

3.02 Preparation

A. Protection

1. Protect existing construction prior to and during cutting and patching to prevent damage.
2. Provide temporary support of work to be cut.
3. Correct any unsafe or unsatisfactory conditions prior to proceeding with installation.
4. Provide protection from adverse weather conditions for portions of project that might be exposed during cutting and patching operations.

B. Provisions for Existing Services

1. Where existing services are required to be removed, relocated, or abandoned, bypass such services before cutting to minimize or avoid interruption of services to occupied areas.

3.03 Installation

A. Cutting: Interface with Existing Construction

1. Cut existing construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original or specified condition.
2. Cut existing construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original installer; comply with original installer's written recommendations.
3. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
4. Existing Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.

5. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
6. Excavating and Backfilling: Comply with requirements in applicable Division 2 Sections where required by cutting and patching operations.
7. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.

B. Proceed with patching after construction operations requiring cutting are complete.

C. Patching

1. Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections of these Specifications.
2. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
3. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
4. Floors and Walls: Where walls or partitions that are removed extend from one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
5. Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
6. Ceilings: Patch, repair, or re-hang existing ceilings as necessary to provide an even-plane surface of uniform appearance.
7. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weather-tight condition.
8. For watertight structures, patch and seal leaks using approved, compatible materials per the manufacturer’s recommendations.

-END-

SECTION 01990 – SCHEDULE OF VALUES

PART 1 - GENERAL

1.01 Summary

A. Submit a Schedule of Values for the various items of Work to be completed on the project for review by the Engineer. The Schedule shall include prices which when added together equal the Contract Price. The Schedule will be used in processing Monthly Partial Pay Claims. The following is a minimum list of items to be included in the Schedule.

B. General Conditions

1. Field Superintendent

C. Plant Improvements

1. Replace Primary Sludge Blanket Level Elements & Transmitters
2. New Final Clarifier Sludge Blanket Level Elements & Transmitters
   a. Mounting to structure
   b. Electrical Wiring and Terminations
3. New CP-BS1 and Installation
   a. Structure Assembly and Mounting
   b. Electrical Wiring and Terminations
4. New redundant level transmitters
   a. Mounting to structure
   b. Electrical Wiring and Terminations
5. New Variable Frequency Drives
   a. Drive Installation
   b. Electrical Wiring and Terminations
6. New Plant SCADA PLCs and associated equipment
   a. Mounting and Wiring of all equipment inside existing enclosure
7. New Plant SCADA HMIs and associated equipment
   a. Field mounting to existing enclosure door
   b. Wiring and Terminations

1.02 20% of the Contract Price can be claimed upon Engineer's approved shop drawings for the project.

1.03 60% of the Contract Price can be claimed upon delivery of equipment to project site.

1.04 10% of the Contract Price can be claimed upon completed and verified I/O validation sheets.

1.05 The final 10% of the Contract Price can be claimed upon final completion of the project.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

-END-

DIVISION 2 – SITE WORK

SECTION 02102 – MATERIAL HANDLING AND SPILL PREVENTION PLAN

PART 1 - GENERAL

1.01 Summary

A. Section Includes: providing a plan outlining procedures to:

1. Help protect the health and safety of those working at the project site as well as the environment
2. Prevent the contamination of stormwater runoff by onsite pollutants
3. Help prevent fuel and chemical spills
4. Provide a response procedure should a spill occur

1.02 References

A. 327 IAC 2-6.1 – Spills; Reporting, Containment, and Response

B. 327 IAC 2-10 – Secondary Containment of Aboveground Storage Tanks Containing Hazardous Materials

1.03 Definitions

A. Minor Spill: Approximately 10 gallons or less of pollutant with no contamination of ground or surface waters. Minor spills can generally be controlled by the first responder with help from other site personnel.

B. Major or Hazardous Spill: More than 10 gallons with the potential for death, injury, or illness to humans or animals or has the potential for surface or groundwater pollution.

C. Pollutants generated onsite may include gasoline, diesel fuel, oils, grease, paints, pesticides, nutrients, concrete and cementitious washout, soil, solvents, paper, plastic, Styrofoam, metals, glass, and other forms of liquid or solid wastes.

1.04 Quality Assurance

A. Regulatory Requirements

1. Ensure material handling and storage associated with construction activity complies with the spill prevention and spill response requirements in Indiana Administrative Code 327 IAC 2-6.1.
2. Ensure aboveground storage tanks containing hazardous materials are stored appropriately according to the requirements in Indiana Administrative Code 327 IAC 2-10.
3. Dispose of contaminated soils, absorbents, and spill cleanup materials in accordance with all Federal, State, and local regulations.

4. Do not use water to flush spilled material unless authorized by a Federal, State, or local agency.
5. Additional regulation or requirements may be required. Consult a spill response professional to ensure all appropriate and required steps have been taken.
6. Do not remove contaminated material from the site until approval is given by Indiana Department of Environmental Management (IDEM), Office of Emergency Response (when emergency response is required).
7. Construction waste must be managed to prevent the discharge of pollutants and windblown materials. Waste containers (trash receptacles), when selected to manage waste, must be managed to reduce the discharge of pollutants and windblown debris.
8. Comply with CSGP requirements and conditions until a Notice of Termination is submitted to terminate the permit.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

3.01 Preparedness

A. Prepare a contact list of First Responders and the chain of command in the event of a spill on the site. Include names, contact numbers, local agency contact numbers, and information on circumstances requiring the initiation of the contact list and chain of command. Include IDEM Emergency Spill Line (888) 233-7745 or (317) 233-7745.

B. Maintain a list of qualified contractors, vacuum trucks, tank pumpers, and other equipment and businesses qualified to perform cleanup operations.

C. Provide a list and quantity of absorbent materials and supplies the Contractor will make available onsite in sufficient quantities to address minor spills.

D. Train construction personnel, equipment operators, subcontractors, and other employees on proper fueling procedures, prevention of spills, spill response procedures, and communication procedures.

3.02 Spill Response

A. Minor Spills

1. Contain the spill to prevent material from entering the waterways and the storm or groundwater systems. Immediately clean up the spill with absorbent materials.
2. Do not flush with water, bury, or allow soaking into the ground.
3. Tarps can be used to cover spilled material during rain events on land.
4. Use absorbent material to cleanup spills on land.
   a. Contain spills on impervious surfaces with a dry absorbent.

b. Contain spills on clayey soils by constructing an earthen dike and dispose of spilled material as soon as possible to prevent migration deeper into the soil and groundwater. Remove contaminated soils.

5. Use containment booms to prevent the migration of spills on water.
   a. Contain spills on water with a containment boom and absorb with an oil-only boom, mechanical skimmer, or other similar device.
   b. Outside agencies will determine additional cleanup measures.
   c. Report oil spills that cause a sheen upon the waters.
6. Gather contaminated materials and/or soils. Place contaminated absorbents and soils into a container for later disposal. Ensure the lid is closed and mark or label the container for identification purposes.
7. Contact 911 if the spill could be a safety issue.
8. Contact supervisors and designated inspectors immediately.
9. Dispose of waste appropriately.

B. Major or Hazardous Spills

1. Control or contain the spill without risking bodily harm.
2. Temporarily plug or cover storm drains if possible, to prevent migration of the spill into the stormwater system.
3. Use containment booms to prevent the migration of spills on water.
   a. Contain spills on water with a containment boom and absorb with an oil-only boom, mechanical skimmer, or other similar device.
   b. Outside agencies will determine additional cleanup measures.
   c. Report oil spills that cause a sheen upon the waters.
4. Immediately contact the local Fire Department at 911 to report any hazardous material spill.
5. Contact supervisors and designated inspectors immediately. Contact county or municipal officials responsible for stormwater facilities. The Contractor is responsible for having these contact numbers available at the job site. Submit a written report to the Owner as soon as possible.
6. Contact IDEM, Office of Emergency Response as soon as possible, but within 2 hours of discovery at 1-888-233-7745. Note the following information for future reports to the IDEM or the National Response Center (1-800-424-8802):
   a. Name, address, and phone number of person making the spill report
   b. The location of the spill
   c. The date and time of the spill
   d. Identification of the spilled substance
   e. Cause of the spill
   f. Approximate quantity of the substance that has been spilled or may be further spilled and the amount recovered
   g. The duration and source of the spill
   h. Name and location of the damaged waters
   i. Name of spill response organization
   j. Measures taken in the spill response
   k. Other pertinent information

3.03 Spill Prevention and Material Handling Practices

A. Vehicle and Equipment Fueling

1. Purpose: To prevent fuel spills and leaks and to reduce or eliminate contamination of stormwater and waterways.
2. Implementation
   a. Use offsite commercial fueling stations when possible. Use onsite vehicle and equipment fueling only where it is impractical to send vehicles and equipment offsite to a commercial fueling station.
   b. When performing fueling onsite, provide a designated fueling area.
   c. Do not “top-off” fuel tanks.
   d. Keep available absorbent spill cleanup materials and spill kits in fueling areas and on fueling trucks.
   e. Inspect vehicles and equipment daily for leaks. Repair leaks immediately or remove them from the project site.
   f. Use drip pans or absorbent pads during vehicle and equipment fueling, unless the fueling is performed over an impermeable surface in a dedicated fueling area.
   g. Protect dedicated fueling areas from stormwater run-on and runoff and locate them at least 50 feet away from the downstream drainage facilities, stormwater conveyances or waterways.
   h. Perform fueling on level-grade areas.
   i. Protect fueling areas with berms and dikes to contain spills.
   j. Equip nozzles used in vehicle and equipment fueling with an automatic shut off.
   k. Do not leave fueling operations unattended.
   l. Avoid mobile refueling of construction equipment; rather transport the equipment to the designated fueling area.
   m. Store all petroleum products in tightly sealed containers which are clearly labeled.
   n. Observe Federal, State, and local regulations for any stationary above ground storage tanks.

B. Vehicle Maintenance Areas

1. Purpose: To prevent stormwater exposure and spills during the normal maintenance of construction machinery.
2. Implementation:
   a. As feasible, perform maintenance offsite in a covered facility with an impervious floor.
   b. Use a dedicated site for machinery maintenance.
   c. Locate maintenance areas at least 50 feet from stormwater inlets or water bodies.
   d. Maintain spill kits and absorbent materials in close proximity to maintenance areas. Utilize drip pans and absorbent pads to prevent oils or other maintenance fluids from reaching the soil surfaces.
   e. Inspect equipment daily for leaks or worn hoses. Repair or replace as needed to prevent onsite spills.
   f. Properly dispose of all spilled fluids and fluids removed from machinery.

C. Equipment and Vehicle Washing

1. Purpose: To prevent or reduce the discharge of pollutants to waterways or stormwater from construction equipment and vehicle washing.
2. Implementation:
   a. As feasible, perform washing offsite in a covered facility with an impervious floor and drains connected to the sanitary sewer.
   b. Use a dedicated site for washing.
   c. Locate wash areas at least 50 feet from stormwater inlets or water bodies.
   d. Do not discharge wash water if using soaps, solvents, or detergents. Only non-contaminated wash water may be discharged to stormwater.
   e. Inspect equipment and vehicles for leaks or worn hoses prior to washing.
   f. Properly dispose of contaminated wash water.

D. Solid Waste Management

1. Purpose: To prevent or reduce the discharge of pollutants to waterways or stormwater from construction waste by providing designated waste collection areas and containers, arranging for regular disposal, and training employees and subcontractors.
2. Suitable Applications: Suitable for construction sites where the following wastes are generated or stored:
   a. Solid waste generated from trees and shrubs removed during land clearing, demolition of existing structures (rubble), and building construction.
   b. Packaging materials including wood, paper, and plastic.
   c. Scrap or surplus building materials including scrap metals, rubber, plastic, glass pieces, and masonry products.
   d. Domestic wastes including food containers such as beverage cans, coffee cups, paper bags, plastic wrappers, and cigarettes.
   e. Construction waste including brick, mortar, timber, steel and metal scraps, pipe and electrical cuttings, non-hazardous equipment parts, Styrofoam, plastic, and other packaging for construction materials.
   f. Sediments and other materials collected in erosion and sediment control measures (silt fence, inlet protection, catch basin sumps, etc.).
   g. Natural debris such as excess soil, stone, sand, leaves, branches, brush, or wood.
3. Implementation
   a. Develop a plan for proper waste disposal including the disposal of excess soil and excavated material. If a commercial disposal facility will not be utilized for soil disposal, then develop a Stormwater Pollution Prevention Plan for the selected disposal area.
   b. Select designated waste collection areas onsite.
   c. Inform trash-hauling contractors that only watertight dumpsters are acceptable for onsite use.
   d. Inspect dumpsters for leaks, and repair dumpsters that are not watertight.
   e. Provide an adequate number of containers with lids or covers to prevent loss of wastes from wind and to prevent the collection of rainwater.
   f. Waste that is not disposed of in trash receptacles must be protected from exposure to the weather and/or removed at the end of the day from the site and disposed of properly.

g. Collect site trash daily or more frequent if needed during demolition Work. Do not allow containers to overflow. Clean up immediately if a container spills, leaks, or overflows.
h. Remove solid waste promptly from erosion and sediment control devices.
i. Ensure that toxic liquid wastes (used oils, solvents, and paints) and chemicals (acid, pesticides, additives, curing compounds) are not disposed of in dumpsters designed for construction debris.
j. Do not hose out dumpsters on the construction site. Ensure that dumpster cleaning is conducted by the trash hauling contractor off site.
k. Make sure that construction waste is collected, removed, and disposed of only at authorized disposal areas. Do not locate solid waste storage areas in areas prone to flooding or ponding.
l. Locate solid waste dumpsters a minimum of 50 feet away from waterways, stormwater inlets or other drainage facilities.
m. Minimize the potential for spills or leaks to drain immediately into a waterway or drainage facility.
n. Do not bury construction waste onsite.
o. Cover construction material hauled from the site in dump trucks with a tarpaulin.
p. Inspect construction waste areas regularly.

E. Fluids, Paints, Solvents and Other Chemicals Storage and Use

1. Purpose: To prevent stormwater exposure and spills during the use and storage of the materials.
2. Implementation
   a. Store materials in manufacturer's containers.
   b. Maintain Safety Data Sheets (SDS) on all products.
   c. Store materials in a weatherproof/vandal resistant locker or building.
   d. Keep materials away from flammable sources.
   e. Follow manufacturer's instructions for the proper use and storage of all materials.
   f. Do not perform washing of applicators or containers of solvent, paint, grout, stucco, or other materials near or into a waterway or stormwater inlet. Wash water is to be disposed offsite as wastewater.
   g. Tightly seal and store paint containers and curing compounds when not required for use.
   h. Do not discharge excess paint to a waterway or storm system. Properly dispose of excess paint according to the manufacturer’s instructions and in accordance with all Federal, State, and local regulations.

F. Secondary Containment

1. Provide secondary containment for aboveground storage tanks or storage areas containing hazardous materials that are located outside.
2. Provide secondary containment consistent with good engineering standards.
3. Provide secondary containment that is compatible with the hazardous materials being stored.
4. Provide secondary containment that will prevent a release from entering waters for a 72-hour period.

5. Secondary containment must meet one of the following:
   a. Double-walled tank,
   b. Dikes, berms, retaining walls, trenches, or
   c. Diversionary system
6. Provide secondary containment with a capacity to contain at least 110% of the volume of the largest aboveground tank or the volume of the largest aboveground tank plus enough freeboard to contain precipitation generated by a 25 year/24-hour rain event.
7. Provide secondary containment with a minimum 120-gallon capacity for storage area holding only drums.
8. Maintain the secondary containment to protect the integrity and capacity of the area.
9. Remove collected liquid in the secondary containment area within 72 hours of its discovery to maintain the capacity. Remove ice as soon as weather permits. Liquid that collects within the secondary containment area must meet all applicable requirements of the Water Quality Standards if discharged to waters of the state.

G. Disposal of Sediment-Laden Water

1. Purpose: To prevent the purposeful discharge of sediment-laden water from the project site.
2. Implementation
   a. Do not discharge sediment-laden water from pumping operations into or near stormwater conveyances, wetlands, rivers, streams, waterways, and impoundments or into natural or manmade channels leading thereto.
   b. Discharge sediment-laden water from dewatering of trenches, or other excavations by means of a pump or similar means into a manufactured pumping bag for filtering in accordance with the manufacturer's instructions unless the pumped water is routed through another erosion control measure such as a sediment trap or outlets onto a well-established vegetated area without eroding.
   c. Pumping operations moving clean water through a site are not required to have a pumping bag or similar device at the outlet.
   d. Protect the point of discharge to prevent soil erosion.
   e. Do not discharge water with a visible sheen and/or pollutants at a level that requires additional or alternate treatment.

H. Concrete Washout Area

1. Discuss the concrete management techniques (such as handling of concrete waste and washout) with the ready-mix concrete supplier before any deliveries are made.
2. Incorporate requirements for concrete waste management into material supplier and subcontractors' agreements. Inspect construction activities on a regular basis to ensure suppliers, contractors, and others are utilizing designated washout areas. If concrete waste is being disposed of improperly, identify the violators and take appropriate action.

3. Perform washout of concrete trucks either offsite or in designated areas only. Never dispose of washout from concrete trucks in a ditch, stream, wetland, waterway, or stormwater conveyance.
4. Provide a designated concrete washout area for use of washing out concrete trucks to contain potential stormwater pollutants. Use one of the following methods:
    a. Construct a minimum 10-feet by 10-feet by 3-feet deep area (or larger as required to contain liquid and solid waste from concrete washout operations) with a polyethylene lining. Construct and prepare the base of the system so that it is free of rocks and other debris that may cause tears or punctures in the polyethylene lining.
    b. Install and maintain a pre-fabricated containment system in accordance with the manufacturer's instructions.
    c. Use a polyethylene-lined roll-off dumpster when other methods are not practicable.
    d. Subcontract with a concrete supplier that collects all washout water and pumps it back into the mixer drum for proper disposal off-site. In this instance, a concrete washout area would not be required.
5. Install orange safety fencing around concrete washout area perimeter. Post signage directing contractors and suppliers to the designated concrete washout location.
6. Locate washout areas at least 50 feet from storm drains, open ditches, or water bodies.
7. Inspect concrete washout area daily and after each storm event.
    a. Check to ensure that the washout has not reached or exceeded maximum capacity.
    b. Inspect the integrity of the overall structure.
    c. Inspect the polyethylene liner for failure. The liner may need to be replaced after every cleaning if removal of material has damaged the liner.
    d. Repair the concrete washout structure, as needed, or construct a new system.
8. Concrete wastewater liquid shall be fully evaporated prior to the planned capacity of the washout structure capacity being exceeded. Liquid that collects in the washout area could be high in alkalinity and could contain pollutants. Liquid must be disposed of offsite as wastewater.
    a. Concrete wastewater liquid that has not solidified may be pumped out into a secondary lined container or into a tanker and taken to an approved disposal facility.
    b. Concrete wastewater shall not be allowed to leak onto the ground, run into storm drains, or into any body of water. Where washout wastewater leaks onto the ground, all contaminated soils shall be excavated and disposed of properly.
9. Allow concrete wastes to set. Break up and properly dispose of hardened wastes. Upon removal of waste, inspect the structure.
10. Do not wash sweepings from exposed aggregate concrete into the street or storm drain. Collect and return sweepings to aggregate base stockpile or dispose of in the trash.
11. Do not dump excess concrete onsite, except in designated areas.

12. Provide a secondary concrete washout system onsite to be used in an emergency and that is of sufficient size to hand concrete washout wastewater from a minimum of one truck.
13. When concrete washout areas are no longer required, close the concrete washout systems. Dispose of all hardened concrete and other materials used to construct the system. Backfill, grade, and stabilize any holes, depressions, and other land disturbances associated with the system.

I. Fertilizers

1. Apply fertilizers only in the minimum amounts recommended by the manufacturer, as indicated from a soil test, or per the Indiana Stormwater Quality Manual.
2. Work fertilizers into the soil to limit exposure to stormwater.
3. Do not apply immediately prior to precipitation events.
4. Store fertilizers in a covered area and transfer partially used bags to a sealable container to avoid spills.

-END-

SECTION 02111 – RECORDING OF CONSTRUCTION AREAS

PART 1 - GENERAL

1.01 Summary

A. Section Includes

1. Providing all labor, materials, equipment, services, and operations necessary to produce color, audio-visual, digital recording of the existing surface features and conditions within the construction area prior to beginning construction.
2. Providing corresponding runsheet logs.

1.02 Submittals

A. Submit still frame capable, color videos on a digital media storage device compatible for playback on a personal computer (USB flash drives acceptable).

PART 2 - PRODUCTS

2.01 Equipment

A. Use a high-quality color camcorder with 1/4-inch, 1/3-inch, or 1/2-inch charged coupled device-imaging system. Camera must:

1. Utilize optical stabilization (Electronic stabilization is not acceptable.)
2. Be capable of 20x minimum optical magnification
3. Be capable of producing NTSC 525 lines resolution/60 fields/30 frames per second
4. Have minimum illumination capabilities of at least 3-lux

PART 3 - EXECUTION

3.01 General

A. Prior to beginning construction, walk each Work site and record existing site conditions. Provide audio-visual recordings of all existing surface features and site conditions located within the construction zone of influence.

B. The purpose of this coverage is to accurately document the pre-construction conditions of the surface features.

3.02 Information to be Included

A. The construction zone of influence shall be defined as an area located within the permanent and temporary construction easement, an area 30 feet beyond either side of the centerline of the construction area, the road right-of-way, and shall

include those areas adjacent to these areas which may be affected by routine construction operations, or as requested by the Engineer.

B. The surface features within the construction zone of influence shall include, but not be limited to, all visible roadways, pavements, curbs, driveways, sidewalks, culverts, headwalls, retaining walls, buildings, landscaping, trees, shrubbery and fences.

C. Provide a runsheet log that accurately catalogs the contents of each video. Information in the runsheet must include:

1. Street name, easement, or address
2. Drawing sheet number(s) relative to the line entry of a particular area of coverage
3. Media storage device numbers
4. Real time code indexing for each segment of the project. Real time code indexing will indicate hours, minutes, and seconds to cross reference with playback equipment to locate specific points of interest on the project.
5. Direction of travel for each specific segment
6. Viewing side for each specific segment
7. Starting point for each specific segment
8. Ending point for each specific segment
9. Project information, i.e., project title, owner, date

D. All media storage devices must be tagged/labeled with appropriate project information and be able to be cross-referenced with runsheets. Information on media storage device labels shall include:

1. Video number
2. Project Title
3. Location of project
4. Month and year of coverage
5. If multiple copies of each video is to be made available, media storage devices must be marked as sets, i.e., Engineer’s set, Owner's set, Contractor's set.
6. Quick reference list of contents of a particular video

3.03 Miscellaneous Details

A. Conduct recording of the project prior to the placement of equipment and materials on the jobsite. Log and present all videos to the Engineer before the actual construction is started for their review. Give particular and detailed attention to any defects noted, such as cracks, disturbed areas, damaged items, or as may be required by Engineer. It is the intent of this coverage to document pre-existing conditions accurately and clearly, especially any items that may result in construction claims.

B. To prevent tampering or editing of videos, all recordings must digitally display continuous and simultaneously generated information including the date and time of recordings, as well as the corresponding engineering stationing numbers. The date information will contain the month, day and year.

C. Accompanying the recording shall be a corresponding and simultaneously recorded audio track containing the commentary of the camera operator. Each video shall begin with the current date, project name, municipality, and the general location, i.e., name of street, viewing side, and direction of progress. The commentary shall assist in the maintenance of viewer orientation, identification of surface features, and objective description of the points of interest being shown on the video portion of the recording.

3.04 Recording

A. Perform recordings during times of good visibility. Do not record during periods of visible precipitation, or when more than 10 percent of the ground area is covered with snow, unless authorized by the Engineer.

B. Identify houses and buildings visually by house number, when visible, in such a manner that structures of the proposed system, i.e., manholes on a sewer system, gate valves and hydrants on a water system can be located by reference. In all instances, locations shall be identified by audio or visual means at intervals not to exceed 100 linear feet.

C. To produce the proper detail and perspective, provide adequate lighting to fill in shadow areas caused by trees, utility poles, road signs, and other such objects.

D. The rate of speed in the general direction of travel of the conveyance used during taping shall be directly proportional to the number, size, and value of the surface features within that construction area's zone of influence. The rate of speed shall not exceed 48 feet per minute in residential areas, or 100 feet per minute in non-residential areas. The rate of travel for haul routes, rainfall studies, and road surface view shall be approximately five (5) miles per hour. Panning rates and zoom-in, zoom-out rates shall be electronically or manually controlled sufficiently such that during playback will produce clarity of the object viewed. The playback picture shall be in focus and be of extreme clarity at all times.

E. Where conventional wheeled vehicles are used, mount the camera securely to produce steady viewing. Camera lens is to be a minimum of eight (8) feet from ground of viewing area, or at a level to facilitate best perspective and line of sight. Vehicles used while performing documentation must be plainly marked with Company name and phone number. Use caution signs, flags, and strobes on vehicle as necessary.

F. Televise and tape areas with paved roads, along co-owned easements through parks, lawns, and open fields. If recording on private property, give the Owner sufficient prior notice of such entry so that property owners may be advised of and their permission obtained for the Work. If permission is denied, runsheet log shall be duly noted.

G. The Engineer shall have the authority to designate what area may be omitted or added for recording.

H. The Engineer shall have the authority to reject all or any portion of the recording not conforming to Specifications.

-END-

DIVISION 13 – SPECIAL CONTRUCTION

SECTION 13400 – MEASUREMENT AND CONTROL INSTRUMENTATION

PART 1 - GENERAL

1.01 Summary

A. Section Includes

1. Requirements for the integration of process and other instruments and equipment into a functioning control system.
2. Descriptions of unit process system functions and operations.
3. Requirements for integrated controls between individual unit process systems.
4. Requirements for planning, implementation, adjustment, testing, start-up, commissioning, and training for the instrumentation and control (I&C) systems required for the Project.

B. Related Sections

1. Section 13431 – Control Panel Design and Construction
2. Section 13441 – Miscellaneous Control Panel Components
3. Section 13450 – Modular Programmable Logic Controllers
4. Section 13452 – Computer Equipment
5. Section 13455 – SCADA Local Area Network (LAN) Equipment
6. Section 13456 – Uninterruptable Power Supply (UPS)
7. Section 13482 – SCADA and Control Systems - IO List

1.02 Definitions

A. General Definitions

1. I/O – Inputs/Outputs
2. HMI – Human Machine Interface
3. PLC – Programmable Logic Controller
4. SCADA – Supervisory Control and Data Acquisition System
5. SCADA CSS – SCADA Control System Supplier – Entity that plans, coordinates, provides and installs all control system hardware components for the project.
6. SCADA CSP – SCADA Control System Programmer – Entity that provides the programming for the following:
   a. PLC-ILS – Influent Lift Station PLC
   b. PLC-GRT – Grit Removal Facility PLC
   c. PLC-RPS – Return Sludge Pump Station PLC
   d. PLC-SHF – Solids Handling Facility PLC
   e. PLC-BS1 – Blower Structure No. 1 PLC
   f. HMI-ILS – Influent Lift Station HMI
   g. HMI-GRT – Grit Removal Facility HMI

h. HMI-RPS – Return Sludge Pump Station HMI
i. HMI- SHF – Solids Handling Facility HMI

7. VFD – Variable Frequency Drive

B. Location Definitions

1. LOCAL - A location at the respective equipment local panel.
2. REMOTE - A location somewhere other than the equipment local panel. This may be a remote-control station, switch, PLC, or the SCADA System.

C. Mode Definitions

1. LOCAL - In LOCAL mode, the equipment shall be controlled locally regardless of a REMOTE signal.
2. HAND – In HAND mode, the equipment shall be controlled locally at the equipment regardless of a REMOTE signal.
   a. Equipment with a local ON/OFF control in addition to HAND will RUN based on the ON/OFF control.
   b. Equipment without a local ON/OFF control in addition to HAND will RUN when in HAND.
3. OFF – In OFF mode, the equipment shall remain OFF regardless of a REMOTE signal
4. REMOTE – In REMOTE mode, the equipment shall be controlled remotely, either by a REMOTE HOA selector switch, PLC, or by SCADA.
5. AUTO – In AUTO mode, the equipment shall be controlled by SCADA.
6. MANUAL – In MANUAL mode, the equipment shall be controlled by the Operator.
7. SCADA – In SCADA mode, the equipment shall be controlled by SCADA.
8. SCADA AUTO – In SCADA AUTO mode, SCADA will control the ON/OFF and RATE setting of the equipment automatically.
9. SCADA MANUAL – In SCADA MANUAL mode, the Operator will control the ON/OFF and RATE setting of the equipment manually through SCADA.

1.03 System Description

A. The services of the SCADA Control System Programmer (SCADA CSP) shall be provided by the OWNER.

B. The core components of the new SCADA System are the new fully assembled Blower Structure No. 1 control panel, as well as new PLCs and HMIs mounted in the existing control panels in the following locations:

1. Influent Lift Station
2. Solids Handling Facility
3. Grit Facility
4. Return Pump Station

C. Refer to the Control One-line Diagram for an overview of the system components.

1. Requirements for the control panels are detailed in Section 13431 – Control Panel Design and Construction.
2. CompactLogix PLCs with Remote I/O adapters shall be provided per Section 13450 – Modular Programmable Logic Controllers.
3. Refer to Section 13455 – SCADA Local Area Network (LAN) Equipment for additional details and requirements.

D. Instrumentation shall be provided as detailed in Section 13420 – Field-Mounted Instruments.

1.04 Codes, specifications, and standards referred to by number of title shall form a part of this specification to the extent required by the references thereto.

1.05 Pre-Construction Submittals

A. Provide all submittals, including the following, as specified in Section 01300.

1. Project schedule, which shall represent the best projections of when activities listed below will occur. Update project schedules at the Engineer's request when major changes in the schedule occur. The activities shall include, but not be limited to, the following:
   a. Coordination meetings
   b. Shop drawing submittals for each group of equipment
   c. Shop drawing approvals for each group of equipment
   d. Equipment manufacturing/ fabrication
   e. Equipment delivery
   f. Equipment installation
   g. System testing and calibration
   h. Operational testing and demonstration.
   i. As-built submittals
   j. Operation and Maintenance Manual submittals
   k. Operator training
   l. Follow-up Operator training at six months after substantial completion.
2. Manufacturer's certification of compliance with the referenced specifications and standards.
3. Certified copies of reports of factory tests specified herein and required by the referenced standards.
4. Shop drawings, indicating performance and physical data of the equipment specified herein.
5. Manufacturer's installation instructions.
6. Provide mounting details for field mounted equipment.
7. Manufacturer's operation and maintenance instructions.
8. If available, DVD or CD ROM media produced by the equipment manufacturer, which contain demonstrations of operation and maintenance procedures for the equipment specified herein.

B. Shop Drawings:

1. Instrument index, including instrument tag numbers, instrument description and instrument calibrated ranges.
2. Typewritten specification sheets, including manufacturer's names and complete catalog numbers.
3. Detailed calculations including, but not limited to:
   a. Power supply sizing calculations
   b. Thermal loading (heat dissipation) calculations
4. Cut sheets and catalog information, including equipment specifications, dimensions, wiring and piping drawings, and installation and mounting details.
5. Loop drawings, containing, but not limited to, the following information:
   a. Loop numbers and instrument tag numbers
   b. Individual loop component locations
   c. Actual equipment wiring terminal designations, point to point wiring, and cable shield terminations
   d. Wire type, size and identification number
   e. Signal types (e.g., 120 Volt AC, 4-20 Ma DC, pulse frequency, 3-15 psig, etc.)
   f. Contact orientations (e.g., normally open, normally closed, etc.)
   g. Equipment grounding requirements
   h. Sources of loop power, or power supply identifications
   i. Signal boosters, interposing relays and shunt resistors
   j. For each loop, present a tabular summary of the following:
      1) Load impedance capability of each transmitting instrument output
      2) Input impedance of each receiving instrument
      3) Calculated loop wiring impedance, based on wire sizes and lengths
      4) Total loop impedance
      5) Reserve output capacity
6. Instrument panel layout drawings, including, but not limited to:
   a. Bill of materials
   b. Front panel layout drawings
   c. Internal panel layout drawings
   d. Internal wiring diagrams, including wire type, size and identification number
   e. Terminal block layout drawings
   f. Nameplate lists
   g. Color schedules and samples
7. Elementary control diagrams.
8. Other descriptive information that will assist the Engineer with review.

1.06 Record Drawings (As-Built)

A. Submit record drawings as specified in Section 01720 to the Engineer, including, but not limited to:

1. One set of corrected contract documents. Mark the original contract documents to reflect 'as-built' conditions. Make corrections in red ink.
2. One set of corrected loop description. Mark the original loop description to reflect 'as-built' conditions. Make corrections in red ink.

3. One set to the Engineer and one set to the Owner: printer outputs of the final configuration or programs of all programmable controller based equipment.
4. Where applicable, submit to the Owner standard storage devices, such as CD/DVD disks, of all programmable controller based equipment and all software and programs.
5. Submit original licensed copies and original documentation for all software. All software licenses shall be in Owner's name.
6. Where applicable, submit to the Owner two sets of pre-configured Read-only Memory Modules, such as EEPROMs or UVPROMs, of all programmable microprocessor based equipment. Submit each memory module in an anti-static zippered poly-bag, clearly labeled and identified.

1.07 Operation and Maintenance Manuals

A. Prepare and furnish Operation and Maintenance Manuals of the system, which shall be submitted to the Engineer prior to operator training described below in accordance with Section 01300.

B. The Operation and Maintenance Manuals shall include, but not be limited to, the following:

1. Approved shop drawings amended by approved change orders and as-built conditions.
2. Manufacturer supplied operating and installation manuals.
3. Detailed procedures and instructions on the operation, removal, installation, adjustment, calibration, and maintenance of each component provided under this contract.
4. As-built control panel and enclosure drawings, including termination drawings, PLC input/output (I/O) wiring diagrams, and panel bill of materials.
5. List of recommended spare parts, which shall include complete catalog numbers
6. List of local or the nearest manufacturer approved repair and service centers.

1.08 Quality Assurance

A. Contractor, Electrical Subcontractor, and Control System Supplier are responsible for the requirements of this Section.

1. Provide all electrical, instrumentation, and control related work.
2. Prepare and submit shop drawings, diagrams, schedules, certifications, reports, manuals, as-builts, test results, and warranties.
3. Install new hardware. This includes grounding rods, providing connections and conduit etc. to provide all signals listed on Drawings.
4. Provide signal converters, buffer amplifiers, and isolation devices to make signal levels, reference to ground, etc. compatible between devices specified in this Section and existing equipment.
5. Provide any temporary wiring necessary during construction and careful removal of existing unneeded control panels.

6. Examine the existing equipment and control system in order to understand control strategies of the existing system in order to maintain the overall integrity of the existing system and proposed upgrades specified in this Section.
7. Investigate and confirm details of operation of the existing system and system components and program screens for monitoring and control of the entire system accordingly. The new system shall interface with existing signals as specified.
8. Plan, schedule and coordinate with Owner or Owner's representative for the integration of the plant equipment and instruments into a control system.

B. The SCADA CSS shall be an experienced and reputable firm, which has been engaged in the business of providing instrumentation and control systems for water and wastewater treatment facilities for at least five years.

C. Drawings and specifications shown are intended to convey information required for a complete functioning system for the purposes specified. The SCADA CSS shall be responsible for all details which may be necessary to properly install, adjust, and place in operation a complete and working system, including all final wiring diagrams, connections, and the final layout, sizes and quantities of conduit and wiring communicated to the Contractor and Electrical Subcontractor.

D. In order to achieve standardization in appearance, operation, maintenance, and spare parts, similar equipment provided shall be the end products of a single manufacturer.

E. The SCADA CSS shall provide all materials and work necessary for a complete and functioning I&C system and shall have full coordination responsibility for the electrical, mechanical, and structural work Control with the I&C system, as specified herein and as shown on the drawings, including conveying all conduit and wiring information to the Contractor and Electrical Subcontractor.

1.09 Sequencing

A. Determine the sequencing of work necessary.

1.10 Coordination

A. Coordination and control loop review meetings shall be attended by representatives of the Contractor and the Owner. The meetings shall be held periodically during the course of the project. The purpose of these meetings shall be to document the compatibility of the mechanical and electrical work as described above.

B. For bidding purposes, the Contractor and the SCADA CSS shall include cost for participation in no less than TWO (2) coordination and control loop review meetings. Each meeting shall require at least one working day.

C. For bidding purposes, the Contractor and the SCADA CSS shall include cost for participation in no less than FIVE (5) site visits to conduct I/O validation activities with OWNER's personnel. Each site visit shall require at least one working day.

D. For bidding purposes, the Contractor and the SCADA CSS shall include cost for participation in no less than EIGHT (8) post-commissioning site visits. Each site visit shall require at least one working day.

1.11 Delivery, Storage and Handling

A. Deliver materials and equipment to the job site a maximum of ten days prior to installation and not before.

B. Store all instruments containing electronics components off the ground in weathertight enclosures. Keep dry at all times. All plug-in equipment which can be removed from panels without the necessity of disconnecting any wire terminations shall be removed from its panel before shipping. Ship in separate shipping containers.

C. Ship all equipment in a thoroughly clean condition, free from sand, oil, grit or grease (except when required for lubrication), weld splatter, or other foreign materials. All panel openings shall be capped.

1.12 Warranty

A. The Contractor shall guarantee the Functional Control System to be free from defective material and workmanship for a period of **one year** from the date of acceptance of the equipment by the Owner. The Contractor shall replace any defective materials, components, or workmanship during this time, including but not limited to all materials, labor, shipping, and transportation, at no additional cost to the Owner. Any repair work performed during this one-year period shall also be guaranteed to be free from defective material or workmanship for a period of one year from the date the repair work is complete and shall be addressed in the same manner at no additional cost to the Owner.

B. During the warranty period adjust, recalibrate, repair, replace and otherwise place back into service any instrument and any item(s) that may require service, including software, at no additional cost to the Owner for any reason.

C. During the warranty service, provide unlimited on-site software and operation support, at no additional cost to the Owner for any reason.

D. Respond to a call for service within 24 hours.

1.13 System Startup

A. Sequence start-up and testing so that they can be coordinated with the plant control system start-up and testing.

1.14 Commissioning

A. Refer to 13492, Testing and Commissioning for documentation and procedures related to system testing, start-up, and commissioning.

PART 2 - PROCESS CONTROL DESCRIPTION

2.01 SCADA PLCs and the SCADA System Software will be programmed BY OWNER. The following Process Control Descriptions are included for reference only, and to understand how hard-wired interlock and other signals support the overall control methodology.

2.02 Influent Lift Station

A. Process Overview

1. Influent Lift Station main function is to control the level of the Influent Wetwell. The level control is achieved by operating 5 Influent Station Pumps. The Influent Lift Station Pumps are controlled by PLC-ILS.
2. Three (3) pumps are controlled by VFDs.
3. Two (2) pumps are controlled by motor starters.
4. The number and speed of pumps running is based on the Wetwell level.
   a. Wetwell level is achieved currently by a FogRod.
   b. Backup is provided by an ultrasonic level transmitter (FMU90)

B. Control Equipment

1. Influent Lift Station Pump 1 (RWW-LSP-210)
2. Influent Lift Station Pump 2 (RWW-LSP-220)
3. Influent Lift Station Pump 3 (RWW-LSP-230)
4. Influent Lift Station Pump 4 (RWW-LSP-240)
5. Influent Lift Station Pump 5 (RWW-LSP-250)
6. Plant Influent pH#1 Probe (RWW-AIT_205)
7. Plant Influent pH#2 Probe (RWW-AIT_206)
8. Plant Influent pH#3 Probe (RWW-AIT_207)
9. Influent Lift Station Wet Well Level Transmitter (RWW-LVT_200)
10. Influent Lift Station Wet Well Level Fog Rod

C. Control Operations

1. The lead variable speed pump shall start as level in the wetwell rises to an adjustable level for one pump operation.
2. The pump speed shall be controlled by a Proportional plus Integral (PI) level controller to maintain the one pump operation level. If wetwell level drops an adjustable amount (operator selectable at the SCADA) below the setpoint level for one pump operation, the lead variable speed pump shall shut down.
3. If the wetwell level rises an adjustable amount (operator selectable at the SCADA) above the setpoint level for one pump operation, the lag variable speed pump shall start. Both variable speed pumps shall be controlled by the level controller to operate at the same speed and maintain the level in the wetwell at an adjustable level for two pump operation. If wetwell level drops below the setpoint level for two pump operation by the amount established in step 1, the lag variable speed pump shall shut down. If the wetwell level rises above the setpoint level for two pump operation by the amount established in step 2, the lead constant speed pump shall start. Both variable speed pumps

shall be controlled by the level controller to operate at the same speed and maintain the level in the wetwell at an adjustable level for three pump operation. If wetwell level drops below the setpoint level for three pump operation by the amount established in step 1, the lead constant speed pump shall shut down.

4. If the wetwell level rises above the setpoint level for three pump operation by the amount established in step 3, the lag constant speed pump shall start. All variable speed pumps shall be controlled by the level controller to operate at the same speed and maintain the level in the wetwell at an adjustable level for four pump operation (operator selectable on the Operator Workstation from EL 566.50 to EL 572.00, initially set at EL 567.50). If wetwell level drops below the setpoint level for four pump operation by the amount established in step 1, the lag constant speed pump shall shut down.
5. The third variable speed pump is designated as the stand-by pump to operate if either the lead variable speed pump or lag variable speed pump were to fail.

D. SCADA Interaction and Alarming:

1. The following shall be monitored in SCADA:
   a. Influent Lift Station Pump (1,2,3,4,5) Running
   b. Influent Lift Station Pump (1,2,3,4,5) Remote
   c. Influent Lift Station Pump (1,3,5) Speed (Hz)
   d. Plant Influent pH#1 (Indicate and Trend) (pH)
   e. Plant Influent pH#2 (Indicate and Trend) (pH)
   f. Plant Influent pH#3 (Indicate and Trend) (pH)
   g. Influent Lift Station Wetwell Level (Indicate and Trend) (Feet)
2. The following shall be controlled/adjusted in SCADA:
   a. Influent Lift Station Pump (1,3,5) Speed (Hz)
   b. Influent Lift Station Wetwell Level Setpoint (Feet)
   c. Influent Lift Station Wetwell High Level Setpoint (Feet)
   d. Influent Lift Station Wetwell Low Level Setpoint (Feet)
   e. Plant Influent pH#1 High pH Alarm Setpoint (pH)
   f. Plant Influent pH#1 Low pH Alarm Setpoint (pH)
   g. Plant Influent pH#2 High pH Alarm Setpoint (pH)
   h. Plant Influent pH#2 Low Setpoint pH Alarm (pH)
   i. Plant Influent pH#3 High Setpoint pH Alarm (pH)
   j. Plant Influent pH#3 Low Setpoint pH Alarm (pH)
3. The following alarms shall be generated in SCADA:
   a. Influent Lift Station Pump (1,2,3,4,5) Failed
   b. Plant Influent pH#1 High pH Alarm (pH)
   c. Plant Influent pH#1 Low pH Alarm (pH)
   d. Plant Influent pH#2 High pH Alarm (pH)
   e. Plant Influent pH#2 Low pH Alarm (pH)
   f. Plant Influent pH#3 High pH Alarm (pH)
   g. Plant Influent pH#3 Low pH Alarm (pH)
   h. Plant Influent Differential Level High Level Alarm (Feet)
   i. Plant Influent Differential Level Low Level Alarm (Feet)
   j. Plant Influent Wetwell Level High Level Alarm (Feet)
   k. Plant Influent Wetwell Level Low Level Alarm (Feet)
   l. Influent Wetwell Level High-High (Feet)
   m. Influent Wetwell Level Low Water Cut-Off

2.03 Mechanically Cleaned Screen

A. Process Overview

1. Mechanically Cleaned Screen operations will be monitored by the PLC-ILS (PLC 1).

B. Control Equipment

1. Screen (RWW-SCR-260)
2. Screen Differential Level Transmitter (RWW-LDIT_261)

C. Control Operations

1. Local Manual control of the screen shall be provided through the screen control panel. When the HAND-OFF-AUTO (H-O-A) switch at the screen is in the HAND position, the screen rake shall be controlled by momentary FORWARD and REVERSE push buttons at the screen.
2. Local automatic control of the screen shall be provided through the screen control panel. When the HAND-OFF-AUTO (H-O-A) switch at the screen is in the AUTO position, the screen shall be controlled to rake when differential level across the screen increases and the high differential level switch trips or based on a panel mounted 24 hour programmed timer. When initiating condition occurs, the screen control panel shall send a start signal to the screenings washer/compactor to start. The screen shall be interlocked to start when an initiating condition occurs, and the screenings washer/compactor is running. The screen control panel shall control the raking operation and bring the rake back to the home position. When the raking action is complete, the screen control panel shall send a shutdown signal to the screening washer/compactor. If the screenings washer/compactor stops while the screen is running, the screen shall complete the cleaning cycle, then stop.
3. In all control modes, the screen shall be interlocked to prevent operation if the water level in the channel rises and trips the high-level float switch.
4. The PLC shall receive a screen fail input from the control panel for motor overload, high torque, or high influent level.

D. SCADA Interaction and Alarming:

1. The following shall be monitored in SCADA:
   a. Screen Running
   b. Screen Remote
   c. Screen Differential Level (Indicate and Trend) (Feet)
2. The following shall be controlled/adjusted in SCADA:
   a. Screen Differential Level High Alarm Setpoint (Feet)
   b. Screen Differential Level High-High Alarm Setpoint (Feet)
3. The following alarms shall be generated in SCADA:
   a. Screen Failed
   b. Screen Differential Level High Alarm (Feet)
   c. Screen Differential Level High-High Alarm (Feet)

2.04 Screenings Washer/Compactor

A. Process Overview

1. Screening Washer and Compactor operations will be monitored by the PLC-ILS (PLC 1)

B. Control Equipment

1. Screening Compactor (SCRS-DWS-280)

C. Control Operations

1. Local Manual control of the washer/compactor shall be provided through an ON-OFF-AUTO (O-O-A) selector switch near the washer/compactor. When the O-O-A is in the ON position, the washer/compactor shall run. When the washer/compactor is running its flushing water solenoid valve shall be energized to open and provide flushing water.
2. Local automatic control shall be provided through an interlock with the mechanical fine screen. When the O-O-A selector switch is in the AUTO position, the washer/compactor shall run whenever the fine screen is running and shall continue to run after the fine screen has stopped for a sufficient time to clear the washer/compactor. The delay off time shall be adjustable through a time delay relay. When the washer/compactor is running its flushing water solenoid valve shall be energized to open and provide flushing water.
3. In all control modes, the spray wash valve shall be hardwired interlocked to open when the washer/compactor is running.
4. The PLC shall receive a washer/compactor fail input from the control panel for motor overload.

D. SCADA Interaction and Alarming

1. The following shall be monitored in SCADA:
   a. Screening Compactor Running
2. The following alarms shall be generated in SCADA:
   a. Screening Compactor Failed
   b. Screenings Room Combustible Gas (Methane) Level High
   c. Screenings Room Combustible Gas (Methane) Level High-High
   d. Screenings Room Combustible Gas (Methane) Sensor Failure
   e. Screenings Room Combustible Gas (Gasoline) Level High
   f. Screenings Room Combustible Gas (Gasoline) Level High-High
   g. Screenings Room Combustible Gas (Gasoline) Sensor Failure

2.05 Plant Influent Lift Station Generator

A. Process Overview

1. Generator signals are modified by SCADA.

B. Control Equipment

1. Generator (via Annunciator panel)

C. SCADA Interaction and Alarming

2.06 Vortex Grit Basin Flushing Water Valve

A. Process Overview

1. Vortex Grit Basin Flushing Water Valve will be controlled by the PLC-GRT. The process of the water flushing consists of the two valves which open after each of the grit pumps stops operating and stays open for an adjustable time delay.

B. Control Equipment:

1. Flushing Water Valve #1 (NPW-V-314)
2. Flushing Water Valve #2 (NPW-V-324)

C. Control Operations

1. Local Manual control of the vortex grit basin flushing water valve shall be provided through the LOCAL-OFF-REMOTE (L-O-R) selector switch and OPENSTOP-CLOSE (O-S-C) push buttons mounted near the valve. In the LOCAL position, the valve shall be operated using the OPEN-STOP-CLOSE push buttons.
2. Remote manual control shall be provided through the PLC. When the L-O-R selector switch near the valve is in the REMOTE position and MANUAL is selected at the Operator Workstation, the valve shall be opened and closed from the Operator Workstation using manual operator commands.
3. The PLC shall generate a Valve Fail alarm when the valve position switch indicates that the valve did not reach the commanded position within an adjustable (0-30 sec, initially set at 15 sec) time delay. The alarm shall be generated only when the valve is in remote mode.
4. The Operator Workstation shall indicate the following valve status: Valve in Local/Remote, Valve in Manual/Auto, Valve Open, Valve Closed, and Valve Fail.
5. On PLC power-up, control of the valve shall be set to remote manual mode.
6. Control of the valve shall resume with the control mode established prior to the power failure.
7. Remote automatic control shall be provided through the PLC. When the L-O-R selector switch near the valve is in the REMOTE position and AUTO is selected at the Operator Workstation, the valve shall open when a grit pumping cycle is initiated.
8. The valve shall close after the grit pump stops after an adjustable time delay (operator selectable at the Operator Workstation from 0-120 seconds, initially set at 30 seconds).
9. Remote manual control shall be provided through the PLC. When the L-O-R selector switch near the valve is in the REMOTE position and MANUAL is

selected at the Operator Workstation, the valve shall be opened and closed from the Operator Workstation using manual operator commands.

D. SCADA Interaction and Alarming:

1. The following shall be monitored in SCADA:
   a. Flushing Water Valve (1,2) Remote
   b. Flushing Water Valve (1,2) Opened
   c. Flushing Water Valve (1,2) Closed
2. The following shall be controlled in SCADA:
   a. Flushing Water Valve (1,2) Open CMD
   b. Flushing Water Valve (1,2) Close CMD
3. The following alarms shall be generated in SCADA:
   a. Flushing Water Valve (1,2) Fail

2.07 Grit Pump Suction Valves

A. Process Overview

1. Grit Pump Suction Valves will be controlled by the PLC GRT.

B. Control Equipment:

1. Grit Pump 360 Suction Valve (GRT-V-361)
2. Grit Pump 370 Suction Valve (GRT-V-371)

C. Control Operations

1. Local Manual control of the Grit Pump Suction Valve shall be provided through the LOCAL-OFF-REMOTE (L-O-R) selector switch and OPEN-STOP-CLOSE (O-S-C) push buttons mounted near the valve. In the LOCAL position, the valve shall be operated using the OPEN-STOP-CLOSE push buttons.
2. Remote manual control shall be provided through the PLC. When the L-O-R selector switch near the valve is in the REMOTE position and MANUAL is selected at the Operator Workstation, the valve shall be opened and closed from the Operator Workstation using manual operator commands.
3. Remote automatic control shall be provided through the PLC. When the L-O-R selector switch near the valve is in the REMOTE position and AUTO is selected at the Operator Workstation,
4. The valve shall open when a ON cycle is initiated (either through Time Cycle or Plant Influent Override)
5. The PLC shall generate a Valve Fail alarm when the valve position switch indicates that the valve did not reach the commanded position within an adjustable (0-30 sec, initially set at 15 sec) time delay. The alarm shall be generated only when the valve is in remote mode.
6. On PLC power-up, control of the valve shall be set to remote manual mode.
7. Control of the valve shall resume with the control mode established prior to the power failure.

D. SCADA Interaction and Alarming:

1. The following shall be monitored in SCADA:
   a. Grit Pump Suction Valve (1,2) Remote
   b. Grit Pump Suction Valve (1,2) Opened
   c. Grit Pump Suction Valve (1,2) Closed
2. The following shall be controlled in SCADA:
   a. Grit Pump Suction Valve (1,2) Open CMD
   b. Grit Pump Suction Valve (1,2) Close CMD
3. The following alarms shall be generated in SCADA:
   a. Grit Pump Suction Valve (1,2) Fail

2.08 Grit Pumps

A. Process Overview

1. Grit Pumps will be controlled by the PLC GRT.

B. Control Equipment

1. Grit Pump 360 (GRT-P-360)
2. Grit Pump 370 (GRT-P-370)

C. Control Operations

1. Local manual control of the grit pump shall be provided through the ON-OFFREMOTE (O-O-R) selector switch mounted next to the pump. When ON is selected the pump shall run.
2. In all control modes, the grit pump shall have a hardwired interlock preventing operation of the pump if the duty grit washer/classifier is not running or if the seal water flow rate is low and the seal water low flow switch trips.
3. Remote manual control shall be provided through the PLC to operate the pumps continuously. When the O-O-R selector switch at the pump is in the REMOTE position and MANUAL is selected at the Operator Workstation, the pump ON/OFF shall be controlled from the Operator Workstation using operator manual commands.
4. Remote automatic control shall be provided through the PLC. When the O-O-R selector switch at the pump is in the REMOTE position and AUTO is selected at the Operator Workstation, the pump shall operate based on an operator adjustable timed cycle. The operator shall enter the frequency of operation (the period between the beginning of one cycle and the beginning of the next cycle, operator selectable at the Operator Workstation from 0-120 minutes, initially set at 60 minutes) and the duration of pump operation (selectable at the Operator Workstation from 0-30 minutes, initially set at 15 minutes). When a pumping cycle is initiated, the vortex grit basin flushing water valve shall open. See the vortex grit basin flushing water valve control description. The pump shall start operation after an adjustable time (0-120 seconds, initially set at 30 seconds) following opening of the flushing water valve and shall shut down when the pump operation duration timer times out.

5. The operator shall enter the frequency of operation (the period between the beginning of one cycle and the beginning of the next cycle, operator selectable at the Operator Workstation from 0-120 minutes, initially set at 60 minutes) and the duration of pump operation (selectable at the Operator Workstation from 0-30 minutes, initially set at 15 minutes).
6. Cycle time has to be equal to or greater than the Pump operating time.
7. When the Cycle timer is done, it will open the NPW valve.
8. The grit pumps will be provided with an excessive flow override to handle large instantaneous increases of plant influent flow. The pump shall start if the percent of influent flow increases by a set percentage (0-50 percent, initially set at 20 percent).
9. The PLC shall receive a pump fail signal from the pump motor starter for motor overload and shutdown on low seal water flow.
10. On PLC power-up, control of the pump shall be set to remote manual mode.

D. SCADA Interaction and Alarming:

1. The following shall be monitored in SCADA:
   a. Grit Pump (1,2) Running
   b. Grit Pump (1,2) Remote
2. The following shall be controlled/adjusted in SCADA:
   a. Grit Pump (1,2) Run Command
3. The following alarms shall be generated in SCADA:
   a. Grit Pump (1,2) Failed

2.09 Grit Washer

A. Process Overview

1. Grit Washer/Classifier will be controlled by the PLC GRT.

B. Control Equipment

1. Grit Classifier 380 (GRT-DWS-380)
2. Grit Classifier 390 (GRT-DWS-390)
3. Grit Clarifier 380 (GRT-CL-380)
4. Grit Clarifier 390 (GRT-CL-390)

C. Control Operation

1. Local manual control of the grit classifier and dewatering screw shall be provided through the ON-OFF-REMOTE (O-O-R) selector switch mounted near the classifier. When ON is selected the classifier shall run.
2. Remote manual control shall be provided through the PLC. When the O-O-R selector switch at the washer/classifier is in the REMOTE position and MANUAL is selected at the Operator Workstation, the washer/classifier ON/OFF shall be controlled from the Operator Workstation using operator manual commands.
3. Remote automatic control shall be provided through the PLC. When the O-O-R selector switch at the washer is in the REMOTE position and AUTO is

selected at the Operator Workstation, the duty classifier shall start when a grit pumping cycle is initiated. The washer shall shut down after an adjustable time delay following shut down of the grit pump.

4. The PLC shall receive a washer fail signal from the washer/classifier motor starter which shall be for motor overload and high torque. If LOCAL or MANUAL is selected for the duty washer/classifier, the PLC shall generate an alarm.
5. On PLC power-up, control of the washer/classifier shall be set to remote manual mode.

D. SCADA Interaction and Alarming:

1. The following shall be monitored in SCADA:
   a. Classifier (1,2) Running
   b. Classifier (1,2) Remote
2. The following shall be controlled/adjusted in SCADA:
   a. Classifier (1,2) Run Command
3. The following alarms shall be generated in SCADA:
   a. Washer/Classifier (1,2) Failed

2.10 Phosphorus Removal Metering Pumps

A. Process Overview

1. Phosphorus Removal Metering Pumps will be controlled by the PLC-GRT

B. Control Equipment

1. Phosphorus Removal Pump 410 (FECL-P-410)
2. Phosphorus Removal Pump 420 (FECL-P-420)
3. Phosphorus Removal Metering Pump 430 (FECL-P-430)
4. Phosphorus Removal Storage Tank Level (LIT-401)

C. Process Operation

1. Local control of the metering pump shall be provided through an ON-OFF switch. When the switch is in the ON position the metering pump shall run. Selection of LOCAL or REMOTE speed control shall be provided on the metering pump. When LOCAL speed control is selected, speed shall be controlled by the adjustment device on the metering pump.
2. Remote manual speed control shall be provided through the PLC. When REMOTE speed control is selected at the metering pump and MANUAL is selected at the Operator Workstation, speed shall be manually adjusted from the Operator Workstation.
3. Remote automatic speed control shall be provided through the PLC. When REMOTE speed control is selected at the metering pump and AUTO is selected at the Operator Workstation, the metering pump output (feed rate) shall be controlled by the flow pacing signal and the dosage (adjustable at the Operator Workstation from 0 - 60 mg/L) entered by the operator.

4. The metering pump output in gallons per hour (feed rate) and stroke speed setpoint shall be calculated as indicated below. The PLC shall output the speed signal to the metering pump based on the appropriate flow pacing signal.
5. The PLC shall receive a metering pump fail signal from the metering pump.
6. On PLC power-up, control of the metering pump feed rate shall be set to remote manual mode.
7. Control of the metering pump feed rate shall resume with the control mode established prior to the power failure.

D. SCADA Interaction and Alarming:

1. The following shall be monitored in SCADA:
   a. FECL Pump (1,2,3) Running
   b. FECL Pump (1,2,3) Remote
   c. FECL Pump (1,2,3) Speed Indication
   d. FECL Pump (1,2,3) Stroke Length
   e. FECL Storage Tank Level (Indicate and Trend) (Feet)
2. The following shall be controlled/adjusted in SCADA:
   a. FECL Pump (1,2,3) Stroke Speed Control
   b. FECL Pump (1,2,3) Stroke Length Control
   c. FECL Storage Tank Level Low Alarm Setpoint (Feet)

3. The following alarms shall be generated in SCADA:
   a. FECL Pump (1,2,3) Failed
   b. FECL Storage Tank Level Low Alarm (Feet)

2.11 Primary Sludge Pump Station

A. Process Overview

1. Primary Sludge Pumps are controlled by the PLC GRT

B. Control Equipment

1. Primary Sludge Pump #1 (PRS-P-810)
2. Primary Sludge Pump #2 (PRS-P-820)
3. Primary Clarifier #1 Sludge Blanket Level (PCLR-LIT-391)
4. Primary Clarifier #2 Sludge Blanket Level (PCLR-LIT-392)
5. Primary Sludge Storage Tank Level (Remote signal from PLC-SHF, PRS-LIT-832)

C. Control Operations

1. Local control of the primary sludge pump shall be provided through the ON-OFF-REMOTE (O-O-R) switch mounted near the pump. When the O-O-R switch is in the ON position, the pump shall run.
2. In all control modes, the pump shall be interlocked to shut down on high discharge pressure or low suction pressure.
3. In all control modes, the pump shall be interlocked to shut down on primary sludge storage tank high-high alarm and high level.

4. Remote manual control shall be provided through the PLC. When the O-O-R selector switch on the pump is in the REMOTE position and MANUAL is selected at the Operator Workstation, the pump shall be controlled from the Operator Workstation using operator manual commands.
5. Remote automatic control shall be one of two modes:
    a. Mode 1 (Level Control): Remote Automatic Control shall be provided through the PLC. When the O-O-R selector switch at the pump is in the REMOTE position and AUTO-Level Control is selected at the Operator Workstation, the pump shall operate based on sludge blanket level in the primary clarifiers. The operator shall enter the start and stop level setpoints at the Operator Workstation from 0-96 inches, initially set at 1.5 inches for start and 1.7 inches for stop).
    b. Mode 2 (Timer Control): Remote Timer control shall be provided through the PLC. OOR, selector switch, etc… the pump shall operate based on a timer control. Pump ON and OFF durations are set by the operator on the OWS. 3 minutes off, 1.5 second on, etc… time shall be set by the operator, ON and OFF time enabled through SCADA.

6. On PLC power-up, control of the pump shall be set to remote manual mode.
7. Control of the pump shall resume with the control mode established prior to the power failure.

D. SCADA Interaction and Alarming:

1. The following shall be monitored in SCADA:
    a. Primary Sludge Pump (1,2) Running
    b. Primary Sludge Pump (1,2) Remote
    c. Primary Clarifier #1 Sludge Blanket Level (Indicate and Trend) (inches)
    d. Primary Clarifier #2 Sludge Blanket Level (Indicate and Trend) (inches)
2. The following shall be controlled/adjusted in SCADA:
    a. Primary Sludge Pump (1,2) Run Command
    b. Primary Clarifier #1 Sludge Blanket Start/Stop Level Setpoint (inches)
    c. Primary Clarifier #2 Sludge Blanket Start/Stop Level Setpoint (inches)
    d. Primary Clarifier #1 Sludge Blanket Low Level Setpoint (inches)
    e. Primary Clarifier #1 Sludge Blanket Low-Low Level Setpoint (Feet)
    f. Primary Clarifier #1 Sludge Blanket High Level Setpoint (Feet)
    g. Primary Clarifier #1 Sludge Blanket High-High Level Setpoint (Feet)
    h. Primary Clarifier #2 Sludge Blanket Low Level Setpoint (Feet)
    i. Primary Clarifier #2 Sludge Blanket Low-Low Level Setpoint (Feet)
    j. Primary Clarifier #2 Sludge Blanket High Level Setpoint (Feet)
    k. Primary Clarifier #2 Sludge Blanket High-High Level Setpoint (Feet)
3. The following alarms shall be generated in SCADA:
    a. Primary Sludge Pump (1,2) Failed
    b. Primary Clarifier #1 Sludge Blanket Low Level Alarm (Feet)
    c. Primary Clarifier #1 Sludge Blanket Low-Low Level Alarm (Feet)
    d. Primary Clarifier #1 Sludge Blanket High Level Alarm (Feet)
    e. Primary Clarifier #1 Sludge Blanket High-High Level Alarm (Feet)
    f. Primary Clarifier #2 Sludge Blanket Low Level Alarm (Feet)
    g. Primary Clarifier #2 Sludge Blanket Low-Low Level Alarm (Feet)
    h. Primary Clarifier #2 Sludge Blanket High Level Alarm (Feet)

i. Primary Clarifier #2 Sludge Blanket High-High Level Alarm (Feet)

2.12 Primary Clarifiers Scum Wet Well Pump

A. Process Overview

1. Primary Clarifiers Scum Pump will be controlled by the PLC GRT

B. Control Equipment

1. Primary Clarifiers Scum Wet Well Pump (PRSC-P-800)

C. Primary Scum Pump Operation

1. Local control of the primary scum pump shall be provided through the Local Control Panel ON-OFFREMOTE (O-O-R) switch mounted near the pump. When the O-O-R switch is in the ON position, the pump shall run.
2. In all control modes, the pump shall be interlocked to shut down on high discharge pressure or low suction pressure.
3. Remote manual control shall be provided through the PLC. When the O-O-R selector switch on the pump is in the REMOTE position and MANUAL is selected at the Operator Workstation, the pump shall be controlled from the Operator Workstation using operator manual commands.
4. Remote automatic control shall be provided through the PLC. When the O-O-R selector switch at the pump is in the REMOTE position and AUTO is selected at the Operator Workstation, the pump shall operate based on sludge blanket level in the primary clarifiers. The operator shall enter the start and stop level setpoints at the Operator Workstation from 0-96 inches, initially set at 24 inches for start and 18 inches for stop).
5. The Operator Workstation shall indicate the following pump status:
6. Pump Running (derived from run command), Pump in Local/Remote, Pump in Manual/Auto. If the pump can be valved and selected for operation with more than one primary clarifier, the primary clarifier served by the pump shall also be displayed.
7. On PLC power-up, control of the pump shall be set to remote manual mode.
8. Control of the pump shall resume with the control mode established prior to the power failure.

D. SCADA Interaction and Alarming:

1. The following shall be monitored in SCADA:
   a. Primary Scum Pump Running
   b. Primary Scum Pump Remote
   c. Primary Scum Pump Speed (Hz)
2. The following shall be controlled/adjusted in SCADA:
   a. Primary Scum Pump Speed Command (Hz)
3. The following alarms shall be generated in SCADA:
   a. Primary Scum Pump (1,2) Failed

2.13 Plant Influent Flow

A. Process Overview

1. Plant Influent Flow will be being recorded by the PLC GRT

B. Control Equipment

1. RWW-FIT-301
   a. 4-20 mA Signal
   b. 0-15 MGD
   c. Daily Flow Total – Automatically reset at midnight.

C. Control Operations

1. Plant Influent Flow shall be measured, totalized and trended on SCADA

D. SCADA Interaction and Alarming:

1. The following shall be indicated/monitored in SCADA
   a. Total Influent Flow (MGD) – indicate, totalize and record
2. The following alarms shall be generated in SCADA:
   a. High Influent Flow alert

2.14 Septage Receiving Station Influent Valve

A. Process Overview

1. The Septage Receiving Station Influent Valve shall open when a septage receiving cycle is initiated from the card reader located at the Septage Receiving Station. The valve shall close after an adjustable time delay (operator selectable at the Operator Workstation from 10-60 minutes, initially set at 20 minutes. The Septage Receiving Station Influent Valve will be controlled by the PLC SHF

B. Control Equipment

1. Septage Receiving Station Influent Valve (SEPT-V-101)
2. Septage Return Flow Transmitter (SEPT-FIT-132)
3. Septage Receiving Basin Level Transmitter (SEPT-LIT-102)

C. Control Operations

1. The Septage Receiving Valve shall be operated from SCADA if the selector switch is set to remote at the valve.
2. The Septage Receiving Valve shall be controlled by SCADA by selecting the HOA operation on the SCADA.
3. When SCADA HAND is selected the Septage Receiving valve shall open. The Valve should be able to

4. When SCADA AUTO is selected the valve shall open for the specified amount of time and then close. This operation should be initiated by the card reader authorization signal.
5. The valve shall open when in SCADA AUTO mode when a septage receiving cycle is initiated from the card reader located at the Septage Receiving Station.
6. The valve shall close when in SCADA AUTO after an adjustable time delay (10-60 minutes) expires.
7. The SCADA shall report the remaining cycle on the screen.
8. The SCADA shall limit the min and max time for the valve to remain open to be between 10 and 60 minutes.
9. The valve will automatically close after the max open time expires. This operation will happen regardless of SCADA HOA status.
10. The Septage Receiving Valve shall not open if the high-level switch (LSHH-103) is active.
11. The Septage Receiving Valve shall not open if the high-level switch (LAHH-102) is active.
12. The valve shall not open in SCADA auto mode if the transfer is not authorized.
13. The SCADA shall calculate the gallons transferred amount every time the Septage Receiving Valve is opened.
14. The total gallons will be calculated by using the following formula: DH * L * W * 7.48 gal/cu ft where DH is the change in level, L is the length of the basin(17.333ft), W is the width of the basin(16.667ft).

D. SCADA Interaction and Alarming:

1. The following shall be monitored in SCADA:
   a. Septage Receiving Station Influent Valve Remote
   b. Septage Receiving Station Influent Valve) Opened
   c. Septage Receiving Station Influent Valve Closed
   d. Gallons Transferred During Septage Transfer
   e. Septage Return Flow (Indicate and Trend) (Feet)
   f. Septage Receiving Basin Level (Indicate and Trend) (Feet)
2. The following shall be controlled/adjusted in SCADA:
   a. Septage Receiving Station Influent Valve) Open
   b. Septage Receiving Station Influent Valve Close
   c. Septage Return Flow High Level Setpoint (Feet)
   d. Septage Return Flow Low Level Setpoint (Feet)
   e. Septage Return Flow High-High Level Setpoint (Feet)
   f. Septage Return Flow Low-Low Level Setpoint (Feet)
   g. Septage Receiving Basin Level High Level Setpoint (Feet)
   h. Septage Receiving Basin Level Low Level Setpoint (Feet)
3. The following alarms shall be generated in SCADA:
   a. Septage Receiving Station Influent Valve Fail
   b. Septage Return Flow High Level Alarm (Feet)
   c. Septage Return Flow Low Level Alarm (Feet)
   d. Septage Return Flow High-High Level Alarm (Feet)
   e. Septage Return Flow Low-Low Level Alarm (Feet)
   f. Septage Receiving Basin Level High Alarm (Feet)
   g. Septage Receiving Basin Level Low Level Alarm (Feet)
   h. Septage Receiving Basin Level High-High Level Alarm (Feet)

i. Septage Receiving Basin Level Low-Low Level Alarm (Feet)

2.15 Septage Pumps:

A. Process Overview

1. The Septage Pumps will be controlled by the PLC SHF

B. Control Equipment

1. Septage Pump #1 (SEPT-P-110)
2. Septage Pump #2 (SEPT-P-120)
3. Septage Receiving Basin Level Transmitter (SEPT-LIT-102)
4. Septage Pumps Discharge Pressure Transmitter (SEPT-PIT-134)

C. Control Operations

1. The pumps shall maintain the basin level between the two set points.
2. The Level value comes from the level transmitter LIT-102(4-20mA, 0-15ft)
3. Current Set Points are set between 8.0 and 9.0 ft.
4. The Level Control shall be adjusted on the HMI and SCADA via numerical input.
5. If the level raises above the high set point the duty pump shall start until the basin level drops below the low set point.
6. If the duty pump fails to operate, the standby pump will be placed in service automatically.
7. The pumps shall alternate in operation after the duty pump reaches the low level and stops operating.
8. The pumps shall not operate if the Septage Basin Low Low Alarm is Active
9. The pumps shall not operate if the Septage Receiving Basin Low Low Alarm is Active.
10. The pumps shall not operate if the Septage Pump Common Fault is Active on either pump.
11. The pumps shall not operate if the Septage Pumps are not in service – Remote signal is off.

D. SCADA Interaction and Alarming:

1. The following shall be monitored in SCADA:
   a. Septage Pump (1,2) Running
   b. Septage Pump (1,2) Remote
   c. Septage Pump (1,2) Speed (Hz)
   d. Septage Pumps Discharge Pressure (Indicate and Trend) (Psi)
2. The following shall be controlled/adjusted in SCADA:
   a. Septage Pump (1,2) Run Command
   b. Septage Receiving Basin Level Pump Run Setpoint (Feet)
   c. Septage Pumps Discharge Pressure Low-Low Alarm Setpoint (Psi)
   d. Septage Pumps Discharge Pressure Low Alarm Setpoint (Psi)
   e. Septage Pumps Discharge Pressure High Alarm Setpoint (Psi)
   f. Septage Pumps Discharge Pressure High-High Alarm Setpoint (Psi)

3. The following alarms shall be generated in SCADA:
    a. Septage Pump (1,2) Failed
    b. Septage Pumps Discharge Pressure Low-Low Alarm (Psi)
    c. Septage Pumps Discharge Pressure Low Alarm (Psi)
    d. Septage Pumps Discharge Pressure High Alarm (Psi)
    e. Septage Pumps Discharge Pressure High-High Alarm (Psi)

2.16 Septage Receiving Station Recirculation

A. Process Overview

1. Septage Receiving Station Recirculation will be controlled by the PLC SHF.

B. Control Equipment:

1. Septage Recirculation Flow Control Valve #1 (SEPT-V-130)
2. Septage Recirculation Flow Control Valve #2 (SEPT-V-131)

C. Control Operations

1. There will be two modes of operation, Recirculation Flow or Plant Flow Control
2. In Recirculation Flow(recirc) Control, the valve V-130 shall open and valve V-131 shall close.
3. In Plant Influent Flow Mode, the valve V-130 shall modulate around the pressure setpoint and valve V-131 shall open.
4. The pressure set point shall be set on the SCADA.
5. The pressure feedback will be provided by the Septage Pumps Discharge Pressure transmitter PIT-134(0-30psi)

D. SCADA Interaction and Alarming:

1. The following shall be monitored in SCADA:
    a. Septage Recirculation Flow Control Valve (1,2) Remote
    b. Septage Recirculation Flow Control Valve (1,2) Opened
    c. Septage Recirculation Flow Control Valve (1,2) Closed
    d. Septage Recirculation Flow Control Valve (1,2) Position Feedback (0-100%)
2. The following shall be controlled/adjusted in SCADA:
    a. Septage Recirculation Flow Control Valve (1,2) Open
    b. Septage Recirculation Flow Control Valve (1,2) Close
    c. Septage Recirculation Flow Control Valve (1,2) Position Command (0-100%)
    d.
3. The following alarms shall be generated in SCADA:
    a. Septage Recirculation Flow Control Valve (1,2) Fail

2.17 Septage Receiving Station Flow Control Valve

A. Process Overview

1. Septage Receiving Station Flow Control Valve will be controlled by the PLC SHF.

B. Control Equipment:

1. Septage Receiving Station Flow Control Valve (SEPT-V-133)

C. Control Operations

1. Local Manual control of the Septage Receiving Station flow control valve shall be provided through the LOCAL-OFF-REMOTE (L-O-R) selector switch and OPENSTOP-CLOSE (O-S-C) push buttons mounted on the valve actuator. In the LOCAL position, the valve can be operated using the OPEN-STOP-CLOSE push buttons.
2. Remote manual control shall be provided through the PLC. When the L-O-R selector switch on the valve actuator is in the REMOTE position and MANUAL is selected at the Operator Workstation, the valve shall be positioned using the operator entered position at the Operator Workstation.
3. Remote automatic control shall be provided through the PLC. When the L-O-R selector switch on the valve actuator is in the REMOTE position and AUTO is selected at the Operator Workstation, the operator shall select Flow Setpoint Control/Percent of Plant Influent Flow Control. In either mode the valve shall modulate to maintain the operator entered setpoint. Setpoint shall be a setpoint for a Proportional plus Integral (PI) controller used to maintain the required septage receiving station flow rate.
4. When the difference between the Septage Receiving Station flow rate and the flow setpoint is greater than +/-5% for an adjustable time (0-600 sec, initially set at 60 sec) or if the valve is commanded to close, and does not close within an adjustable time (0-120 sec, initially set at 15 sec), a Valve Fail alarm shall be generated by the PLC. The alarm shall be generated only when the valve is under PLC control.
5. On PLC power-up, control of the valve shall be set to remote manual mode.
6. Control of the valve shall resume with the control mode established prior to the power failure.
7. The flow setpoint shall be entered in gallons per day and divided by 1440 to correspond the flow meter rate which is provided in gallons per minute (gpm). The Percent of Plant Influent Flow setpoint shall be entered in percent and multiplied with the measured plant influent flow rate.

D. SCADA Interaction and Alarming:

1. The following shall be monitored in SCADA:
   a. Septage Receiving Station Flow Control Valve Remote
   b. Septage Receiving Station Flow Control Valve Opened
   c. Septage Receiving Station Flow Control Valve Closed

d. Septage Receiving Station Flow Control Valve (1,2) Position Feedback (0-100%)

2. The following alarms shall be generated in SCADA:
   a. Septage Receiving Station Flow Control Valve Fail

2.18 Polymer Feed System

A. Process Overview

1. Polymer Feed System will be controlled by the PLC SHF

B. Control Equipment

1. Polymer Storage Tank POLY-T_501
2. Polymer Storage Tank Mixer POLY_MX_501

C. Control Operations

1. Polymer mixer shall be operated from SCADA by selecting the ON/OFF selector switch on the SCADA screen.

D. SCADA Interaction and Alarming:

1. The following shall be monitored in SCADA:
   a. Polymer Storage Tank Mixer Running
   b. Polymer Storage Tank Mixer Remote
2. The following shall be controlled/adjusted in SCADA:
   a. Polymer Storage Tank Mixer Run Command
3. The following alarms shall be generated in SCADA:
   a. Polymer Storage Tank Mixer Failed

2.19 Primary Scum Tank Submersable Pump/Mixer

A. Process Overview

1. Primary Scum Tank Submersable Pump/Mixer will be controlled by the PLC SHF

B. Control Equipment:

1. Primary Storage Tank Pump (PRS-P-840)
2. Primary Storage Tank Mixer (PRS-MX-830)

C. Control Operation

1. The Pump is operated by manually selecting the start/stop button on the SCADA screen and modifying the pump speed.
2. The mixer is operated by manually selecting the start stop button on the SCADA screen.
3. The pump shall not operate if the pump fault signal is active.

D. SCADA Interaction and Alarming:

1. The following shall be monitored in SCADA:
   a. Primary Storage Tank Mixer Running
   b. Primary Storage Tank Mixer Remote
   c. Primary Storage Tank Pump Speed (Hz)
2. The following shall be controlled/adjusted in SCADA:
   a. Polymer Storage Tank Mixer Command Speed (Hz)
3. The following alarms shall be generated in SCADA:
   a. Primary Storage Tank Mixer Failed

2.20 Polymer Blender/Feeder Metering Pumps

A. Process Overview

1. Polymer Blender/Feeder Metering pumps will be controlled by the PLC SHF

B. Control Equipment

1. Polymer Feeder/Blender Metering Pump (POLY-PFB-510)
2. Polymer Feeder/Blender Metering Pump (POLY-PFB-520)
3. Blending Tank Feed Pump #1 Flow Meter (BLS-FIT-119-1)
4. Blending Tank Feed Pump #2 Flow Meter (BLS-FIT-119-2)
5. Blending Tank Feed Pump #3 Flow Meter (BLS-FIT-119-3)

C. Control Operations

1. Local control of the metering pump shall be provided through an ON-OFF switch. When the switch is in the ON position the metering pump shall run. Selection of LOCAL or REMOTE stroke speed control shall be provided on the metering pump. When LOCAL stroke speed control is selected, stroke speed shall be controlled by the adjustment device on the metering pump.
2. Remote control shall be provided through the PLC. When REMOTE control is selected at the blender control panel and MANUAL is selected at the Operator Workstation, the blender shall be manually started from the Operator Workstation which shall start the metering pump, the water booster pump. In addition, the stroke speed shall be manually adjusted, and the solution ratio shall be manually adjusted from the Operator Workstation.
3. Remote automatic control shall be provided through the PLC. When REMOTE control is selected at the blender control panel and AUTO is selected at the Operator Workstation, the blender shall start automatically once the plant influent flow has risen above the start setpoint. As in manual, the metering pump, the booster pump, and the blender shall start. The metering pump output (feed rate) shall be controlled by the flow pacing signal and the dosage (adjustable at the Operator Workstation from 0.25 - 0.75 mg/L) entered by the operator. The solution ratio shall be manually adjusted at the Operator Workstation.
4. The metering pump output in gallons per hour (feed rate) and stroke speed setpoint shall be calculated as indicated below.

5. The PLC shall output the speed signal to the metering pump based on the appropriate flow pacing signal.
6. On PLC power-up, control of the metering pump feed rate shall be set to remote manual mode.
7. Control of the metering pump feed rate shall resume with the control mode established prior to the power failure.
8. Feed Rate Calculation:
9. Dosage - Polymer dosage (mg/L, adjustable at the Operator Workstation) Flow rate - Process flow at feed point (MGD)
10. Conc - Polymer concentration expressed as a decimal (adjustable at the Operator Workstation)
11. Density - Polymer density (adjustable at the Operator Workstation) FR - Feed rate (gallons/hour)
12. FR = [Dosage x 8.34 x Flow rate] / [Conc x Density x 24]
13. Stroke Speed Calculation:
14. FR (Max) - Pump capacity (gph, adjustable at the Operator Workstation) SP - Stroke speed (strokes/min)
15. SP (Max) - Maximum stroke speed (strokes/min)
16. SP = [FR x SP (Max)] / FR(Max)

D. SCADA Interaction and Alarming:

1. The following shall be monitored in SCADA:
   a. Polymer Feeder/Blender Metering Pump (1,2) Running
   b. Polymer Feeder/Blender Metering Pump (1,2) Remote
   c. Polymer Feeder/Blender Metering Pump (1,2) Speed Feedback (Hz)
2. The following shall be controlled/adjusted in SCADA:
   a. Polymer Feeder/Blender Metering Pump (1,2) Speed Command (Hz)
   b. Blending Tank Feed Pump Flow (1,2,3) Low-Low Alarm Setpoint (GPM)
   c. Blending Tank Feed Pump Flow (1,2,3) Low Alarm Setpoint (GPM)
   d. Blending Tank Feed Pump Flow (1,2,3) High Alarm Setpoint (GPM)
   e. Blending Tank Feed Pump Flow (1,2,3) High-High Alarm Setpoint (GPM)
3. The following alarms shall be generated in SCADA:
   a. Polymer Feeder/Blender Metering Pump (1,2) Failed
   b. Blending Tank Feed Pump Flow (1,2,3) Low-Low Alarm (GPM)
   c. Blending Tank Feed Pump Flow (1,2,3) Low Alarm (GPM)
   d. Blending Tank Feed Pump Flow (1,2,3) High Alarm (GPM)
   e. Blending Tank Feed Pump Flow (1,2,3) High-High Alarm (GPM)

2.21 Sludge Handling Primary Scum Tank Submersible Sludge Pump/Mixer

A. Process Overview

1. Sludge Handling Primary Scum Tank Submersible Sludge Pump/Mixer will be controlled by the PLC SHF

B. Control Equipment:

1. Primary Storage Tank Pump (PRS-P-840)
2. Primary Storage Tank Mixer (PRS-MX-830)

C. Control Operation

1. Local control of the primary scum pump shall be provided through the ON-OFFREMOTE (O-O-R) switch mounted near the pump. When the O-O-R switch is in the ON position, the pump shall run.
2. In all control modes, the pump shall be interlocked to shut down on high discharge pressure or low suction pressure.
3. Remote manual control shall be provided through the PLC. When the O-O-R selector switch on the pump is in the REMOTE position and MANUAL is selected at the Operator Workstation, the pump shall be controlled from the Operator Workstation using operator manual commands.
4. In all remote modes, pump speed shall be manually adjustable.
5. On PLC power-up, control of the pump shall be set to remote manual mode.
6. Control of the pump shall resume with the control mode established prior to the power failure.

D. SCADA Interaction and Alarming:

1. The following shall be monitored in SCADA:
   a. Primary Storage Tank Pump Running
   b. Primary Storage Tank Pump Remote
   c. Primary Storage Tank Pump Speed (Hz)
2. The following alarms shall be generated in SCADA:
   a. Primary Storage Tank Pump Failed

2.22 TWAS Sludge Handling Submersable Pump/Mixer

A. Process Overview

1. TWAS Sludge Handling Submersable Pump/Mixer will be controlled by the PLC SHF

B. Control Equipment

1. TWAS Storage Tank Pump (TWAS-P-860)
2. TWAS Storage Tank Mixer (TWAS-MX-850)
3. TWAS Storage Tank Level (TWAS-LIT-852)
4. Belt Filter Press #1 Flow (FIT-120-1)
5. Belt Filter Press #2 Flow (FIT-120-2)
6. Potassium Permanganate Tank Level (KMNO-LIT-117)
7. Sludge Blending Tank Level (TWAS_LIT_872)

C. Control Operation

1. The Pump is operated by manually selecting the start/stop button on the SCADA screen and modifying the pump speed.
2. Local control of the primary scum pump shall be provided through the ON-OFFREMOTE (O-O-R) switch mounted near the pump. When the O-O-R switch is in the ON position, the pump shall run.

3. In all control modes, the pump shall be interlocked to shut down on high discharge pressure or low suction pressure.
4. Remote manual control shall be provided through the PLC. When the O-O-R selector switch on the pump is in the REMOTE position and MANUAL is selected at the Operator Workstation, the pump shall be controlled from the Operator Workstation using operator manual commands.
5. The PLC shall receive a pump fail signal from the pump which includes motor overload and shut down on low suction or high discharge pressure.
6. , control of the pump shall be set to remote manual mode.
7. Control of the pump shall resume with the control mode established prior to the power failure.

D. SCADA Interaction and Alarming:

1. The following shall be monitored in SCADA:
   a. TWAS Storage Tank Pump Running
   b. TWAS Storage Tank Pump Remote
   c. TWAS Storage Tank Pump Speed (Hz)
   d. TWAS Storage Tank Mixer Running
   e. TWAS Storage Tank Mixer Remote
   f. TWAS Storage Tank Mixer Speed (Hz)
   g. Belt Filter Press #1 Flow (1,2) (Indicate and Trend) (GPM)
   h. Potassium Permanganate Tank Level (Indicate and Trend) (Feet)
   i. Sludge Blending Tank Level (Indicate and Trend) (Feet)
2. The following shall be controlled/adjusted in SCADA:
   a. TWAS Storage Tank Mixer Run Command
   b. Belt Filter Press #1 Flow (1,2) Low-Low Alarm Setpoint (GPM)
   c. Belt Filter Press #1 Flow (1,2) Low Alarm Setpoint (GPM)
   d. Belt Filter Press #1 Flow (1,2) High Alarm Setpoint (GPM)
   e. Belt Filter Press #1 Flow (1,2) High-High Alarm Setpoint (GPM)
   f. Potassium Permanganate Tank Level Low-Low Alarm Setpoint (Feet)
   g. Potassium Permanganate Tank Level Low Alarm Setpoint (Feet)
   h. Potassium Permanganate Tank Level High Alarm Setpoint (Feet)
   i. Potassium Permanganate Tank Level High-High Alarm Setpoint (Feet)
   j. Sludge Blending Tank Level Low-Low Alarm Setpoint (Feet)
   k. Sludge Blending Tank Level Low Alarm Setpoint (Feet)
   l. Sludge Blending Tank Level High Alarm Setpoint (Feet)
   m. Sludge Blending Tank Level High-High Alarm Setpoint (Feet)
3. The following alarms shall be generated in SCADA:
   a. TWAS Storage Tank Pump Failed
   b. TWAS Storage Tank Mixer Failed
   c. Belt Filter Press #1 Flow (1,2) Low-Low Alarm
   d. Belt Filter Press #1 Flow (1,2) Low Alarm
   e. Belt Filter Press #1 Flow (1,2) High Alarm
   f. Belt Filter Press #1 Flow (1,2) High-High Alarm (GPM)
   g. Potassium Permanganate Tank Level Low-Low Alarm (Feet)
   h. Potassium Permanganate Tank Level Low Alarm (Feet)
   i. Potassium Permanganate Tank Level High Alarm (Feet)
   j. Potassium Permanganate Tank Level High Alarm (Feet)
   k. Sludge Blending Tank Level Low-Low Alarm (Feet)

l. Sludge Blending Tank Level Low Alarm (Feet)
m. Sludge Blending Tank Level High Alarm (Feet)
n. Sludge Blending Tank Level High-High Alarm (Feet)

2.23 Return Activated Sludge (RAS) Pumps

A. Process Overview

1. Return Activated Sludge (RAS) Pumps will be controlled by the PLC RPS

B. Control Equipment:

1. RAS Pump #1 (RAS-P-710)
2. RAS Pump #2 (RAS-P-720)
3. RAS Pump #3 (RAS-P-730)
4. Primary Sludge Storage Tank Level (PRS-LIT-832)
5. RAS Flow to Aeration Basin #1 Flow Meter (EFF-FIT-711)
6. RAS Flow to Aeration Basin #2 Flow Meter (EFF-FIT-731)
7. RAS Flow to Primary Effluent Splitter Box Flow Meter (EFF-FIT-721)
8. RAS Wet Well Level Transmitter (RAS-LIT-700)

C. Control Operation

1. Remote manual control shall be provided through the PLC. When the H-O-A selector switch at the pump is in the AUTO position and MANUAL is selected at the Operator Workstation, the pump ON/OFF shall be controlled from the Operator Workstation using operator manual commands. Pump speed for Pumps 710 and 720 shall be adjusted based on the speed input entered at the Operator Workstation.
2. Remote automatic control shall be provided through the PLC. When the H-O-A selector switch at the pump is in the AUTO position and AUTO is selected at the Operator Workstation, the pumps shall be started based on average plant influent flow. The PLC shall average the plant influent flow over an adjustable time period (adjustable at the Operator Workstation from 0-24 hours, initially set at 12 hours). The total RAS flow setpoint shall be an adjustable ratio (adjustable at the Operator Workstation from 0-100%, initially set at 30%) of the average plant flow. This flow setpoint shall be the setpoint for a Proportional plus Integral (PI) controller to maintain the required pump speed of the two adjustable speed pumps. The total RAS flow measured shall be the process variable of the controller.
3. The total RAS flow measured is the sum of the three RAS flow meters.
4. The PLC shall receive a pump fail signal from the pump AFD. The fail signal shall include high motor winding temperature, seal water pressure low signal, and AFD fail.
5. On PLC power-up, control of the pump shall be set to remote manual mode.
6. Control of the pump shall resume with the control mode established prior to the power failure.

D. SCADA Interaction and Alarming:

1. The following shall be monitored in SCADA:
   a. RAS Pump (1,2,3) Running
   b. RAS Pump (1,2,3) Remote
   c. RAS Pump (1,2,3) Speed Feedback (Hz)
   d. RAS Flow to Aeration Basin #1 (Indicate and Trend) (GPM)
   e. RAS Flow to Aeration Basin #2 (Indicate and Trend) (GPM)
   f. RAS Flow to Primary Effluent Splitter Box (Indicate and Trend) (GPM)
   g. RAS Wet Well Level (Indicate and Trend) (Feet)
2. The following shall be controlled/adjusted in SCADA:
   a. RAS Pump (1,2,3) Speed Command (Hz)
   b. Primary Sludge Storage Tank Level Low Alarm Setpoint (Feet)
   c. Primary Sludge Storage Tank Level Low-Low Alarm Setpoint (Feet)
   d. Primary Sludge Storage Tank Level High Alarm Setpoint (Feet)
   e. Primary Sludge Storage Tank Level High-High Alarm Setpoint (Feet)
   f. RAS Flow to Aeration Basin #1, #2 Low-Low Alarm Setpoint (GPM)
   g. RAS Flow to Aeration Basin #1 #2 Low Alarm Setpoint (GPM)
   h. RAS Flow to Aeration Basin #1 #2 High Alarm Setpoint (GPM)
   i. RAS Flow to Aeration Basin #1 #2 High-High Alarm Setpoint (GPM)
   j. RAS Flow to Primary Effluent Splitter Box Low-Low Alarm Setpoint (GPM)
   k. RAS Flow to Primary Effluent Splitter Box Low Alarm Setpoint (GPM)
   l. RAS Flow to Primary Effluent Splitter Box High Alarm Setpoint (GPM)
   m. RAS Flow to Primary Effluent Splitter Box High-High Alarm Setpoint (GPM)
   n. RAS Wet Well Level Low-Low Alarm Setpoint (Feet)
   o. RAS Wet Well Level Low Alarm Setpoint (Feet)
   p. RAS Wet Well Level High Alarm Setpoint (Feet)
   q. RAS Wet Well Level High-High Alarm Setpoint (Feet)
3. The following alarms shall be generated in SCADA:
   a. RAS Pump (1,2,3) Failed
   b. Primary Sludge Storage Tank Level Low Alarm
   c. Primary Sludge Storage Tank Level Low-Low Alarm
   d. Primary Sludge Storage Tank Level High Alarm
   e. Primary Sludge Storage Tank Level High-High Alarm
   f. Primary Sludge Storage Tank Level High-High Alarm (Feet)
   g. RAS Flow to Aeration Basin #1, #2 Low-Low Alarm (GPM)
   h. RAS Flow to Aeration Basin #1 #2 Low Alarm (GPM)
   i. RAS Flow to Aeration Basin #1 #2 High Alarm (GPM)
   j. RAS Flow to Aeration Basin #1 #2 High-High Alarm Setpint (GPM)
   k. RAS Flow to Primary Effluent Splitter Box Low-Low Alarm (GPM)
   l. RAS Flow to Primary Effluent Splitter Box Low Alarm (GPM)
   m. RAS Flow to Primary Effluent Splitter Box High Alarm (GPM)
   n. RAS Flow to Primary Effluent Splitter Box High-High Alarm (GPM)
   o. RAS Wet Well Level Low-Low Alarm (Feet)
   p. RAS Wet Well Level Low Alarm (Feet)
   q. RAS Wet Well Level High Alarm (Feet)
   r. RAS Wet Well Level High-High Alarm (Feet)

2.24 Return Activated Sludge (RAS) Valves

A. Process Overview

1. Return Activated Sludge Valves will be controlled by the PLC RPS

B. Control Equipment:

1. RAS Valve #1 (RAS-V-751)
2. RAS Valve #2 (RAS-V-755)
3. RAS Valve #3 (RAS-V-757)

C. Control Operation

1. Local manual control of the return activated sludge valves shall be provided through the LOCAL-OFF-REMOTE (L-O-R) selector switch on the valve actuator. When LOCAL is selected, the valve shall open or close based on respective OPEN-CLOSE switch selections.
2. Remote manual control shall be provided through the PLC. When the L-O-R selector switch at the valve is in the REMOTE position and MANUAL is selected at the Operator Workstation, the valve OPEN/CLOSE shall be controlled from the Operator Workstation using operator manual commands.
3. Remote automatic control shall be provided through the PLC. When the L-O-R selector switch at the pump is in the REMOTE position and AUTO is selected at the Operator Workstation, the valves shall be modulated open based on average plant influent flow and operator adjustable flow splits - normally 25% for V-751, 50% for V-755, and 25% for V-757. The PLC shall average the plant influent flow over an adjustable time period (adjustable at the Operator Workstation from 0-24 hours, initially set at 12 hours). The total RAS flow setpoint shall be an adjustable ratio (adjustable at the Operator Workstation from 0-100%, initially set at 30%) of the average plant flow. This flow setpoint shall be the setpoint (after applying the appropriate flow split) for individual Proportional plus Integral (PI) controllers to maintain the required valve opening of the respective valves. The individual RAS flow measured upstream of each valve shall be the process variable of the respective controllers.
4. Control of the valve shall resume with the control mode established prior to the power failure.

D. SCADA Interaction and Alarming:

1. The following shall be monitored in SCADA:
   a. RAS Control Valve (1,2,3) Remote
   b. RAS Control Valve (1,2,3) Opened
   c. RAS Control Valve (1,2,3) Closed
   d. RAS Control Valve (1,2,3) Position Feedback (0-100%)
2. The following shall be controlled/adjusted in SCADA:
   a. RAS Control Valve (1,2,3) Open
   b. RAS Control Valve (1,2,3) Close
   c. RAS Control Valve (1,2,3) Position Command (0-100%)

3. The following alarms shall be generated in SCADA:
   a. RAS Control Valve (1,2,3) Fail

2.25 Waste Activated Sludge (WAS) Pump

A. Process Overview

1. Was Activated Sludge Pump will be controlled by the PLC RPS

B. Control Equipment:

1. WAS Pump (WAS-P-740)
2. WAS Flow to Thickened WAS Storage Tank Flow Meter (WAS-FIT-741)
3. WAS Wet Well Level Transmitter (WAS-LIT-703)

C. Control Operation

1. Local manual control of the waste activated sludge pump shall be provided through the HAND-OFF-AUTO (H-O-A) selector switch mounted near the pump. When the H-O-A switch is in the HAND position, the pump shall run.
2. Local Automatic Mode None
3. Remote Manual Mode
4. Remote manual control shall be provided through the PLC. When the H-O-A selector switch on the pump is in the AUTO position, the pump shall be controlled from the Operator Workstation using operator manual commands.
5. Remote Automatic Mode
6. Remote automatic control shall be provided through the PLC. When the H-O-A selector switch is in AUTO, the pump shall be controlled based on wetwell level.
7. The PLC shall receive a pump fail signal, for motor overload, from the pump starter.
8. On PLC power-up, control of the pump shall be set to remote manual mode.
9. Control of the pump shall resume with the control mode established prior to the power failure.

D. SCADA Interaction and Alarming:

1. The following shall be monitored in SCADA:
   a. WAS Pump Running
   b. WAS Pump Remote
   c. WAS Pump Speed (Hz)
   d. WAS Flow to Thickened WAS Storage (Indicate and Trend) (GPM)
   e. WAS Wet Well Level (Indicate and Trend) (Feet)
2. The following shall be controlled/adjusted in SCADA:
   a. Was Pump Speed Setpoint (Hz)
   b. Was Flow to Thickened WAS Storage Low-Low Alarm Setpoint (GPM)
   c. Was Flow to Thickened WAS Storage Low Alarm Setpoint (GPM)
   d. Was Flow to Thickened WAS Storage High Alarm Setpoint (GPM)
   e. Was Flow to Thickened WAS Storage High-High Alarm Setpoint (GPM)
   f. WAS Wet Well Level Low-Low Alarm Setpoint (Feet)

g. WAS Wet Well Level Low Alarm Setpoint (Feet)
h. WAS Wet Well Level High Alarm Setpoint (Feet)
i. WAS Wet Well Level High-High Alarm Setpoint (Feet)

3. The following alarms shall be generated in SCADA:
   a. WAS Pump Failed
   b. Was Flow to Thickened WAS Storage Low-Low Alarm (GPM)
   c. Was Flow to Thickened WAS Storage Low Alarm (GPM)
   d. Was Flow to Thickened WAS Storage High Alarm (GPM)
   e. Was Flow to Thickened WAS Storage High-High Alarm (GPM)
   f. WAS Wet Well Level Low-Low Alarm (Feet)
   g. WAS Wet Well Level Low Alarm (Feet)
   h. WAS Wet Well Level High Alarm (Feet)
   i. WAS Wet Well Level High-High Alarm (Feet)

2.26 Waste Activated Sludge (WAS) Valve

A. Process Overview

1. Waste Activated Sludge Valve will be controlled by the PLC RPS

B. Control Equipment:

1. WAS Valve (WAS-V-745)

C. Control Operation

1. Local Manual control of the WAS flow control valve shall be provided through the LOCAL-OFF-REMOTE (L-O-R) selector switch and OPEN-STOP-CLOSE (O-S-C) push buttons mounted on the valve actuator. In the LOCAL position, the valve can be operated using the OPEN-STOP-CLOSE push buttons.
2. Remote manual control shall be provided through the PLC. When the L-O-R selector switch on the valve actuator is in the REMOTE position and MANUAL is selected at the Operator Workstation, the valve shall be positioned using the operator entered position at the Operator Workstation.
3. Remote automatic control shall be provided through the PLC. When the L-O-R selector switch on the valve actuator is in the REMOTE position and AUTO is selected at the Operator Workstation, the operator shall select Daily WAS Flow Setpoint Control. Daily WAS Flow is entered as the total gallons to be wasted over a 24-hour period. The valve shall modulate to maintain the flow rate which corresponds with pumping the Daily WAS Flow setpoint over a 24-hour period. The setpoint shall be a setpoint for a Proportional plus Integral (PI) controller used to maintain the required WAS flow rate.
4. When the difference between the WAS flow rate and the flow setpoint is greater than +/-5% for an adjustable time (0-600 sec, initially set at 60 sec) or if the valve is commanded to close, and does not close within an adjustable time (0-120 sec, initially set at 15 sec), a Valve Fail alarm shall be generated by the PLC. The alarm shall be generated only when the valve is under PLC control.
5. On PLC power-up, control of the valve shall be set to remote manual mode.
6. Control of the valve shall resume with the control mode established prior to the power failure.

7. The Daily WAS Flow setpoint shall be entered in gallons per day and divided by 1440 to correspond to the flow meter rate which is provided in gallons per minute (gpm).

D. SCADA Interaction and Alarming:

1. The following shall be monitored in SCADA:
   a. WAS Control Valve Remote
   b. WAS Control Valve Opened
   c. WAS Control Valve Closed
   d. WAS Control Valve Position Feedback (0-100%)
2. The following shall be controlled/adjusted in SCADA:
   a. WAS Control Valve Open
   b. WAS Control Valve Close
   c. WAS Control Valve Position Command (0-100%)
3. The following alarms shall be generated in SCADA:
   a. WAS Control Valve Fail

2.27 Aeration Air Flow Control Valves (WAS) Valve

A. Process Overview

1. Aeration Air Flow Control Valves will be controlled by the PLC RPS

B. Control Equipment:

1. Aeration Air Flow Control Valve #1 (AA-V-613)
2. Aeration Air Flow Control Valve #2 (AA-V-623)
3. Aeration Air Flow Control Valve #3 (AA-V-633)
4. Aeration Air Flow Control Valve #4 (AA-V-643)
5. Aeration Air Flow Control Valve #5 9AA-V-653)

C. Control Operation

1. Local manual control of the aeration air flow control valves shall be provided through the LOCAL-OFF-REMOTE (L-O-R) selector switch and OPEN-STOPCLOSE (O-S-C) push buttons mounted on the valve actuator. In the LOCAL position, the valve shall be operated using the OPEN-STOP-CLOSE push buttons.
2. Remote manual control shall be provided through the PLC. When the L-O-R selector switch at the valve is in the REMOTE position and MANUAL is selected at the Operator Workstation, the valve shall be positioned using the position setpoint entered by the operator at the Operator Workstation.
3. Remote automatic control shall be provided through the PLC. When the L-O-R selector switch on the valve actuator is in the REMOTE position and AUTO is selected at the Operator Workstation, the valve shall be controlled as described below. A selector shall be provided at the Operator Workstation to select between the two automatic control modes.

4. Constant Air Flow Mode: The valve shall be controlled with a Proportional Integral Derivative (PID) controller to maintain an operator entered airflow setpoint, selectable at the Operator Workstation from 0 to 4500 SCFM.
5. DO Mode: A cascade controller shall be provided to control the valve to maintain a setpoint DO level in the basin. The desired DO, selectable at the Operator Workstation from 0-5 mg/l, shall be the setpoint for a PID controller. The output of the controller shall be in SCFM and shall be the setpoint for a second PID controller that shall control the air flow to the basin. A minimum air flow as determined by the OWNER shall also be maintained to provide adequate mixing in the basin. While operating at the minimum airflow, the reset on the DO controller shall be inhibited to prevent reset windup.
6. In both constant air flow mode and DO mode, a minimum and maximum total airflow shall be maintained. These limits are required to keep the blowers in their operating range through seasonal variations. The minimum and maximum air flow for each blower shall be adjustable at the Operator Workstation, initially set at 60% and 100% respectively of each blower's capacity. The minimum and maximum total air flow shall be the sum of the minimum and maximum air flows of all on-line blowers. The air flow feedback for these controls shall be the airflow calculated by the blow control panels based on the blower current. When the air demand drops to the minimum total air flow, control of the air flow control valves to further close shall be inhibited. When the air demand rises to the maximum total air flow, control of the air flow control valves to further open shall be inhibited. While control is inhibited, all controller resets shall be inhibited to prevent reset windup. Valves shall be controlled based on a most open possible philosophy to minimize pressure on the discharge header of the blowers.
7. Transfer between the constant air flow and DO modes shall be free of bumps.
8. While the lag blower is starting or stopping, the position of the air flow control valves shall be maintained.

D. SCADA Interaction and Alarming:

1. The following shall be monitored in SCADA:
   a. Aeration Air Flow Control Valve (1,2,3,4,5) Remote
   b. Aeration Air Flow Control Valve (1,2,3,4,5) Opened
   c. Aeration Air Flow Control Valve (1,2,3,4,5) Closed
   d. Aeration Air Flow Control Valve (1,2,3,4,5) Position Feedback (0-100%)
2. The following shall be controlled/adjusted in SCADA:
   a. Aeration Air Flow Control Valve (1,2,3,4,5) Open
   b. Aeration Air Flow Control Valve (1,2,3,4,5) Close
   c. Aeration Air Flow Control Valve (1,2,3,4,5) Position Command (0-100%)
3. The following alarms shall be generated in SCADA:
   a. Aeration Air Flow Control Valve (1,2,3,4,5,6) Fail

2.28 Aeration Blowers

A. Process Overview

1. Aeration Blowers will be controlled by the PLC RPS

B. Control Equipment:

1. Aeration Blower #1 (AA-BL-610)
2. Aeration Blower #2 (AA-BL-620)
3. Aeration Blower #3 (AA-BL-630)
4. Aeration Blower #4 (AA-BL-640)
5. Aeration Blower #5 (AA-BL-650)
6. Aeration Basin #1 Air Flow Transmitter (AA-FIT-601)
7. Aeration Basin #2 Air Flow Transmitter (AA-FIT-602)
8. Aeration Basin #3 Air Flow Transmitter (AA-FIT-603)
9. Reaeration Basin Header Air Flow Transmitter (AA-FIT-661)
10. Reaeration Basin #2 Air Flow Transmitter (AA-FIT-662)
11. Aeration Basin #1 Dissolved Oxygen Probe (AER-AIT-604)
12. Aeration Basin #2 Dissolved Oxygen Probe (AER-AIT-605)
13. Aeration Basin #3 Dissolved Oxygen (AER-AIT-606)
14. Reaeration Basin #1 Dissolved Oxygen Probe (AER-AIT-663)
15. Reaeration Basin #2 Dissolved Oxygen Probe (AER-AIT-664)
16. Aeration Blowers Discharge Header #1 Pressure Transmitter (AA-PIT-600)
17. Aeration Blowers Discharge Header #2 Pressure Transmitter (AA-PIT-610)

C. Control Operation

1. Local manual control of the aeration blowers shall be provided through the HAND-OFF-AUTO (H-O-A) selector switch and START-STOP push buttons mounted on the blower control panel.
2. In all modes of operation, the blower shall have a hardwired interlock preventing the blower from starting if the blower inlet valve is closed.
3. Remote manual control shall be provided through the PLC. When the H-O-A selector switch on the blower control panel is in the AUTO position and MANUAL is selected at the Operator Workstation, the blower ON/OFF shall be controlled from the Operator Workstation using operator manual commands.
4. Remote automatic control shall be provided through the PLC. When the H-O-A selector switch on the blower control panel is in the AUTO position and AUTO is selected at the Operator Workstation, the blower shall be controlled as described in the Aeration Blower Header Pressure control loop description. Blowers not in AUTO-AUTO shall not be included in the header pressure control system.
5. The PLC shall receive a Blower Fail alarm which includes shut down on overload, surge, high blower vibration, high motor vibration, and startup/shutdown sequence failure.
6. On PLC power-up, control of the blower shall be set to remote manual mode.

D. SCADA Interaction and Alarming:

1. The following shall be monitored in SCADA:
   a. Aeration Blower (1,2,3,4,5) Running
   b. Aeration Blower (1,2,3,4,5) Remote
   c. Aeration Blower (1,2,3,4,5) Speed (Hz)
   d. Aeration Blowers Discharge Header #2 Pressure (Indicate and Trend) (Psi)
   e. Aeration Basin Air Flow (1,2,3) (Indicate and Trend) (SCFM)

f. Reaeration Basin Header Air Flow (Indicate and Trend) (SCFM)
g. Reaeration Basin #2 Air Flow (Indicate and Trend) (SCFM)
h. Reaeration Basin (1,2) Dissolved Oxygen (Indicate and Trend) (ppm)
i. Aeration Basin (1,2,3) Dissolved Oxygen (Indicate and Trend) (ppm)
j. Aeration Blowers Discharge Header #1 Pressure ((Indicate and Trend) Psi)
k. Aeration Blowers Discharge Header #2 Pressure (Indicate and Trend) (Psi)

2. The following shall be controlled/adjusted in SCADA:
   a. Aeration Basin Air Flow (1,2,3) Low-Low Alarm Setpoint (SCFM)
   b. Aeration Basin Air Flow (1,2,3) Low Alarm Setpoint (SCFM)
   c. Aeration Basin Air Flow (1,2,3) High Alarm Setpoint (SCFM)
   d. Aeration Basin Air Flow (1,2,3) High-High Alarm Setpoint (SCFM)
   e. Reaeration Basin Header Air Flow Low-Low Alarm Setpoint (SCFM)
   f. Reaeration Basin Header Air Flow Low Alarm Setpoint (SCFM)
   g. Reaeration Basin Header Air Flow High Alarm Setpoint (SCFM)
   h. Reaeration Basin Header Air Flow High-High Alarm Setpoint (SCFM)
   i. Reaeration Basin #2 Air Flow Low-Low Alarm Setpoint (SCFM)
   j. Reaeration Basin #2 Air Flow Low Alarm Setpoint (SCFM)
   k. Reaeration Basin #2 Air Flow High Alarm Setpoint (SCFM)
   l. Reaeration Basin #2 Header Air Flow High-High Alarm Setpoint (SCFM)
   m. Aeration Basin (1,2,3) Dissolved Oxygen Low-Low Alarm Setpoint (ppm)
   n. Aeration Basin (1,2,3) Dissolved Oxygen Low Alarm Setpoint (ppm)
   o. Aeration Basin (1,2,3) Dissolved Oxygen High Alarm Setpoint (ppm)
   p. Aeration Basin (1,2,3) Dissolved Oxygen High-High Alarm Setpoint (ppm)
   q. Reaeration Basin (1,2) Dissolved Oxygen Low-Low Alarm Setpoint (ppm)
   r. Reaeration Basin (1,2) Dissolved Oxygen Low Alarm Setpoint (ppm)
   s. Reaeration Basin (1,2) Dissolved Oxygen High Alarm Setpoint (ppm)
   t. Reaeration Basin (1,2) Dissolved Oxygen High-High Alarm Setpoint (ppm)
   u. Aeration Blowers Discharge Header #1, #2 Pressure Low-Low Alarm Setpoint (Psi)
   v. Aeration Blowers Discharge Header #1, #2 Pressure Low Alarm Setpoint (Psi)
   w. Aeration Blowers Discharge Header #1, #2 Pressure High Alarm Setpoint (Psi)
   x. Aeration Blowers Discharge Header #1,#2 Pressure High-High Alarm Setpoint (Psi)

3. The following alarms shall be generated in SCADA:
   a. Aeration Blower (1,2,3,4,5) Failed
   b. Aeration Basin Air Flow (1,2,3) Low-Low Alarm (SCFM)
   c. Aeration Basin Air Flow (1,2,3) Low Alarm (SCFM)
   d. Aeration Basin Air Flow (1,2,3) High Alarm (SCFM)
   e. Aeration Basin Air Flow (1,2,3) High-High Alarm (SCFM)
   f. Reaeration Basin Header Air Flow Low-Low Alarm (SCFM)
   g. Reaeration Basin Header Air Flow Low Alarm (SCFM)
   h. Reaeration Basin Header Air Flow High Alarm (SCFM)
   i. Reaeration Basin Header Air Flow High-High Alarm (SCFM)
   j. Reaeration Basin #2 Air Flow Low-Low Alarm (SCFM)
   k. Reaeration Basin #2 Air Flow Low Alarm (SCFM)
   l. Reaeration Basin #2 Air Flow High Alarm (SCFM)
   m. Reaeration Basin #2 Header Air Flow High-High Alarm (SCFM)
   n. Aeration Basin (1,2,3) Dissolved Oxygen Low-Low Alarm (ppm)

o. Aeration Basin (1,2,3) Dissolved Oxygen Low Alarm (ppm)
p. Aeration Basin (1,2,3) Dissolved Oxygen High Alarm (ppm)
q. Aeration Basin (1,2,3) Dissolved Oxygen High-High Alarm (ppm)
r. Reaeration Basin (1,2) Dissolved Oxygen Low-Low Alarm (ppm)
s. Reaeration Basin (1,2) Dissolved Oxygen Low Alarm (ppm)
t. Reaeration Basin (1,2) Dissolved Oxygen High Alarm (ppm)
u. Reaeration Basin (1,2) Dissolved Oxygen High-High Alarm (ppm)
v. Aeration Blowers Discharge Header #1, #2 Pressure Low-Low Alarm (Psi)
w. Aeration Blowers Discharge Header #1, #2 Pressure Low Alarm (Psi)
x. Aeration Blowers Discharge Header #1, #2 Pressure High Alarm (Psi)
y. Aeration Blowers Discharge Header #1, #2 Pressure High-High Alarm (Psi)

2.29 Aeration Blower Inlet Valves

A. Process Overview

1. Aeration Blower Inlet Valves will be controlled by the PLC RPS

B. Control Equipment:

1. Aeration Blower Inlet Valve #1 (AA-V-611)
2. Aeration Blower Inlet Valve #2 (AA-V-621)
3. Aeration Blower Inlet Valve #3 (AA-V-631)
4. Aeration Blower Inlet Valve #4 (AA-V-641)
5. Aeration Blower Inlet Valve #5 (AA-V-651)
6. Primary Effluent Splitter Box #1 pH Probe (AER-AIT-681)
7. Primary Effluent Splitter Box #2 pH Probe (AER-AIT-682)
8. Primary Effluent Splitter Box #3 pH Probe (AER-AIT-683)
9. Final Effluent pH Probe #1 (AER-AIT-691)
10. Final Effluent pH Probe #2 (AER-AIT-692)
11. Final Effluent pH Probe #3 (AER-AIT-693)

C. Control Operation

1. Local manual control shall be provided through the blower control panel. When the L-O-R switch on the blower control panel is in LOCAL, the position of the valve shall be adjusted from the blower control panel.
2. Remote manual control shall be provided through the PLC. When the L-O-R switch on the blower control panel is in REMOTE and MANUAL is selected at the Operator Workstation, the position of the valve shall be adjusted from the Operator Workstation. Control of the valve to achieve the remote setpoint position shall be by the blower control panel to ensure the blower is protected throughout the valve travel. Operation of the valve at blower start up and shut down shall be by the blower control panel in accordance with the operation recommended by the blower manufacturer, without regard to the remote setpoint.
3. Remote automatic control shall be provided through the blower control panel and PLC. When the L-O-R switch on the blower control panel is in REMOTE and AUTO is selected at the Operator Workstation, the position of the valve shall be adjusted as described in the Aeration Blower Header Pressure control

description. Control of the valve to achieve the remote setpoint position shall be by the blower control panel to ensure that the blower is protected throughout the valve travel. Operation of the valve at blower start up and shut down shall be in accordance with the operation recommended by the blower manufacturer, without regard to the remote setpoint.

4. On PLC power-up, control of the blower inlet valve shall be set to remote manual mode.
5. Control of the blower inlet valve shall resume with the control mode established prior to the power failure.

D. SCADA Interaction and Alarming:

1. The following shall be monitored in SCADA:
   a. Aeration Blower Inlet Valve (1,2,3,4,5) Remote
   b. Aeration Blower Inlet Valve (1,2,3,4,5) Opened
   c. Aeration Blower Inlet Valve (1,2,3,4,5) Closed
   d. Aeration Blower Inlet Valve (1,2,3,4,5) Position Feedback (0-100%)
   e. Primary Effluent Splitter Box (1,2,3) pH (Indicate and Trend) (pH)
   f. Final Effluent pH (1,2,3) pH (Indicate and Trend) (pH)
2. The following shall be controlled/adjusted in SCADA:
   a. Aeration Blower Inlet Valve (1,2,3,4,5) Open
   b. Aeration Blower Inlet Valve (1,2,3,4,5) Close
   c. Aeration Blower Inlet Valve (1,2,3,4,5) Position Command (0-100%)
   d. Primary Effluent Splitter Box pH (1,2,3) Low-Low Alarm Setpoint(pH)
   e. Primary Effluent Splitter Box pH (1,2,3) Low Alarm Setpoint (pH)
   f. Primary Effluent Splitter Box pH (1,2,3) High Alarm Setpoint (pH)
   g. Primary Effluent Splitter Box pH (1,2,3) High-High Alarm Setpoint (pH)
   h. Final Effluent pH (1,2,3) pH Low-Low Alarm Setpoint (pH)
   i. Final Effluent pH (1,2,3) pH Low Alarm Setpoint (pH)
   j. Final Effluent pH (1,2,3) pH High Alarm Setpoint (pH)
   k. Final Effluent pH (1,2,3) pH High-High Alarm Setpoint (pH)
3. The following alarms shall be generated in SCADA:
   a. Aeration Blower Inlet Valve (1,2,3,4,5,6) Fail
   b. Primary Effluent Splitter Box pH (1,2,3) Low-Low Alarm (pH)
   c. Primary Effluent Splitter Box pH (1,2,3) Low Alarm (pH)
   d. Primary Effluent Splitter Box pH (1,2,3) High Alarm (pH)
   e. Primary Effluent Splitter Box pH (1,2,3) High-High Alarm (pH)
   f. Final Effluent pH (1,2,3) pH Low-Low Alarm (pH)
   g. Final Effluent pH (1,2,3) pH Low Alarm (pH)
   h. Final Effluent pH (1,2,3) pH High Alarm (pH)
   i. Final Effluent pH (1,2,3) pH High-High Alarm (pH)

2.30 Plant Effluent Flow

A. Process Overview

1. Plant Effluent Flow will be being recorded by the PLC RPS

B. Control Equipment

1. EFF-FIT-010
   a. 4-20 mA Signal
   b. 0-12 MGD
   c. Daily Flow Total – Automatically reset at midnight.

C. Control Operations

1. Plant Effluent Flow shall be measured, totalized and trended on SCADA

D. SCADA Interaction and Alarming:

1. The following shall be indicated/monitored in SCADA
   a. Total Effluent Flow (MGD) – indicate, totalize and record
2. The following alarms shall be generated in SCADA:
   a. High Effluent Flow Alarm
   b. Low Effluent Flow Alarm

2.31 Additional SCADA Requirements

A. General

1. Color coding for the status of equipment for the SCADA system screens shall be as follows:
2. When an alarm occurs, the alarm screen shall pop-up and display the alarm regardless of which screen is currently displayed.
3. All structures, process equipment, valves, and gates shown on all screens shall be labeled.
4. Where shown below for information to be displayed, (I)= indication function and (C)= control function, via the SCADA system
5. Provide hot buttons for switching between the screen currently displayed and (1) adjacent screens in the order shown below, (2) the Overall Plant Process Screen, and (3) the alarm summary screen.
6. Where pop-up screens are called for, provide hot button to switch back to current screen displayed.

PART 3 - EXECUTION

3.01 Installers

A. Provide all materials and work necessary for a complete and functioning I&C system and shall have full coordination responsibility of the electrical, mechanical, and structural work as specified herein and as shown on the drawings. Ensure that the instrumentation and control systems work is properly interfaced with equipment and other work furnished under other divisions of the contract documents.

B. Install, make final connections to, adjust, test, and start-up the complete instrumentation and control system utilizing the technical service and advice of the systems supplier.

C. The SCADA Controls System Programmer will be deployed once all I/O has passed field testing in accordance with Section 13492.

3.02 Installation

A. General

1. Installation shall be in strict compliance with individual equipment manufacturer's instructions. The Contractor shall assume full responsibility for additional costs which may result from unauthorized deviation from the equipment manufacturer's instructions.
2. All gages and indicators shall be mounted in the upright position.
3. Provide sufficient space around the equipment for maintenance and removal.
4. Cover front panels, gages and indicators, during construction for protection from weld and paint splatter.
5. Unless otherwise impractical, support instruments independent of process piping.

B. Installation Hardware

1. All nuts and bolts shall be stainless steel.
2. Support channels shall be stainless steel unistrut channels with stainless steel hardware.
3. Do not mount equipment directly to masonry or concrete walls. Provide unistrut channels on wall.
4. All equipment mounting plates shall be of 0.25-inch thick minimum stainless steel.
5. All contact surfaces between dissimilar metals shall be gasketed to prevent galvanic reaction.

C. Equipment Identification and Tag Numbers

1. All apparatus, control equipment, and instruments, both panel and field mounted, shall be plainly identified, using the following methods:
   a. Pipe-mounted instruments shall be provided with embossed stainless-steel tags, which shall be attached to the instruments by means of stainless steel wire or tie wrap.
   b. Wall, plate, or panel mounted instruments shall be provided with engraved laminated plastic tags, which shall be mounted above, or below instruments. The plastic tags shall be mounted at eye level and shall be visible from a minimum distance of 20 feet. Lettering shall be black on white background.
2. Tag numbers and engraved or embossed text shall be as shown on the drawings, or as approved by the Engineer during shop drawing approval.

3. Tag numbers shall conform to the current Instrument Society of America (ISA) Standards, which shall consist of a multi-character prefix, followed by a loop number. Tag numbers shall be as indicated on the drawings.

3.03 Field Quality Control

A. Site Tests

1. Test all analog loop zeroes and spans by disconnecting wiring at each transmitter and substituting an approved 4-20madc generator. Adjust the indicators and receiving instruments to indicate the correct value, correlated to the simulated current signal.
2. Test all annunciator points by placing jumpers across normally open contact Inputs, or by disconnecting wiring on normally closed contact inputs.
3. Submit testing and calibration reports for all instruments to the Engineer.

-END-

SECTION 13420 – FIELD-MOUNTED INSTRUMENTS

PART 1 - GENERAL

1.01 Summary

A. Section Includes: Provisioning, installation, start-up, testing and calibration of all field-mounted instruments required for this project.

B. This section covers field-mounted instruments provided separately from a manufactured system or process equipment package, to be used on the various portions of the project, and the Contractor shall meet the requirements of these Specifications wherever applicable.

1.02 System Description

A. The types of field-mounted instruments required for this project include the following:

1. Level Transmitters (RADAR)
2. Level Probes (Sludge Blanket)
3. Air Flow Meter (Thermal Mass)
4. Analytical Controllers

B. For each field-mounted instrument, provide a complete assembly with all required components, enclosures suitable for the environment and location, fittings, mounting brackets, and other components and accessories as needed to form a complete system.

C. In-line process probes and instruments shall be provided with a ball valve and retraction assembly suitable for each sensor. Sensors mounted in process pipes, tanks, and other in-line settings shall be removable under normal process conditions, without stopping the process or draining the tank.

D. Provide conduit, raceway accessories, wiring and connections necessary to place the instruments into service and necessary to interface the instruments to other equipment control panels, programmable controllers, SCADA system, and similar installations as required for the project.

E. Include TVSS units as specified per specification 13400.

1.03 Submittals

A. Prepare and submit information in accordance with Section 01300.

B. Provide ISA-TR20.00.01-2007 Specification Forms for Process Measurement and Control Instruments or forms with identical data. Complete forms with all known data and dash out the inapplicable fields.

1.04 Quality Assurance

A. Manufacturers: Firms regularly engaged in manufacture of field-mounted instruments and systems of types and sizes required, whose products have been in satisfactory use in similar service, and whose products meet all requirements specified herein.

B. Installer: Qualified with successful installation experience on projects with field-instrument work similar to that required for this project.

1. It is intended that an experienced electronic systems/instrumentation and control systems subcontractor shall be in responsible charge of all field instrument work.

C. All products used in potable water applications shall meet NSF Standard 61 and either NSF Standard 61 – Annex G or NSF Standard 372 and shall be clearly marked as being in compliance with these standards.

D. ISA Compliance: Comply with applicable Standards and Practices for Instrumentation published by the Instrument Society of America pertaining to field-mounted instruments and related installations.

E. UL Compliance and Labeling: Comply with provisions of UL safety standards pertaining to electrical systems. Provide products and components which have been UL-listed and labeled whenever such UL listed products are available.

F. NEC Compliance: Comply with requirements as applicable to construction and installation of field-mounted instruments and installations.

1.05 Delivery, Storage and Handling

A. Deliver, store, and handle equipment and materials in accordance with Section 01600.

PART 2 - PRODUCTS

2.01 Manufacturers

A. Acceptable manufacturers are listed below. Other manufacturers of equivalent products may be submitted.

1. Level Transmitters (RADAR)
   a. VegaPuls C21, VegaMet 841
   b. No Substitutues
2. Level Probes (Sludge Blanket)
   a. Hach SONATAX sc
   b. Or Equal
3. Air Flow Meter (Thermal Mass)
   a. Endress+Hauser- T-Mass A/B 150
   b. Or Equal

4. Analytical Controllers
   a. AIT-604
      1) Hach – sc4500
      2) No Substitutes
   b. All Other Locations
      1) Hach
      2) YSI
      3) Or Equal

2.02 Level Element/Transmitter (RADAR)

A. Level Element

1. Two-wire 4…20 mA/HART Radar sensor for continuous measurement
2. Measuring Range up to 20 m (65.62 ft)
3. Deviation ≤ 2mm
4. Beam Angle: 8°
5. Measuring Frequency: W-band (80 GHz technology)
6. Output Signal: 4…20 mA/HART
7. Process Fitting: Thread G1 1/2 1 ½ NPT, R1 1/2
8. Process Pressure: -1…+3 bar (-100…+300 kPa/-14.5…+43.51 psig)
9. Process Temperature: -40…+80 °C (-40…+176°F)
10. Ambient Temperature: -40…+80 °C (-40…+176°F)
11. Bluetooth Standard: Bluetooth 5.0
12. Bluetooth Range 25m (82 ft) typ.
13. Operating Voltage: 12…35 VDC
14. Protection Rating IP66/IP68 (3 bar, 24 h) acc. To IEC 60529, Type 4X/6P acc. To UL 50
15. Wetted Parts PVDF

B. Level Indicating Transmitter

1. Protection Rating IP66/IP67, Type 4X
2. Operating Voltage AC: 100…230 VAC
3. Operating Voltage DC: 24…65 VDC
4. Number of Sensors: 1
5. Input: 4…20 mA
6. Output: 4…20 mA current output
7. Output relay: 3
8. Failure relay: 1
9. Environmental: -40…60°C

C. Source Quality Control and Calibration

1. Provide complete documentation covering the calibration during manufacturing.

D. Safety

1. All electrical equipment shall meet the requirements of c-FM-us, c-CSA-us, UKEX, ATEX, IECEx

2.03 Level Probes (Sludge Blanket)

A. General: Digital probe for continuous ultrasonic monitoring of sludge level.

B. Performance requirements:

1. Measurement range: 0 – 40 ft
2. Measurement interval: 10 – 600 seconds (adjustable)
3. Accuracy: 0.33 feet
4. Resolution: 0.09 feet

C. Manufactured Unit

1. Self-cleaning, stainless steel immersion probe

D. Equipment

1. Equip the probe with the following:
   a. Magnetic coupled wiper that cleans the probe.
   b. Position sensor that also compensates for angle when the probe is not mounted exactly vertically.
   c. Automatically temperature compensation.
   d. Visual performance LED indicator light for assurance of proper performance.
   e. User-selected sludge concentration or “blanket threshold.”
   f. Factory calibration. Users may also enter a correction factor.
   g. Automatically detects deterioration of disrupted sedimentation. It senses the ultrasonic echo return with the information of the separation layer independent of density.
   h. Designed to connect to a universal digital controller.

E. Components

1. Probe
   a. Body: stainless steel
   b. Wiper: silicon

F. Accessories

1. Digital controller
2. Cables and power cord
3. Mounting hardware: stainless steel rail mounting assembly

2.04 Air Flow Meter (Thermal Mass)

A. Manufactured Units

1. The thermal mass flowmeter system shall consist of: a thermal sensing system, integral or remote transmitter, integrated gas engine and DAT modules.
   a. The system shall have an easy, safe and menu guided procedure to ensure precise measuring results.
   b. The system shall support remote configuration
2. The thermal sensing system shall consist of:
   a. Wetted materials of 316L stainless steel as standard.
   b. A sensor body with standard connections such as ASME B16.5 flanges (A 150) or 1” MNPT fittings (B 150) as specified by the customer data sheet.
   c. A design suitable for the process minimum and maximum temperature, -40 to 212□F.
   d. Wetted O-rings (EPDM, HNBR) and/or bushing/ferrule (PEEK) as intended for service.
   e. A vibration resistant design up to 2g at 10 to 150 Hz.
   f. Dual PT-100 RTD elements capable of providing an update of less than 2 seconds for a step change in measurement up to 63%.
3. The integral or remote transmitter shall integrate, control and allow setup of the measurement system. The output and source power shall be noted in the Drawings in one of the following formats:
   a. 4-20mA HART
   b. 4-20mA HART + Pulse/Frequency/Switch Output
   c. Pulse/Frequency/Switch Output
   d. 18 – 30 VDC
4. The transmitter shall provide:
   a. A powder coated cast aluminum housing with a NEMA 4X rating.
   b. A 4-line, backlit LCD display (16 characters) shall indicate flow rate, temperature, and/or up to 2 independent totalized flow values.
   c. Low flow cutoff control through the display pushbutton function or via a digital bus (if used).
   d. Display notification and history of process or system events.
   e. Interchangeability between 3" to 60" sizes without the need for additional calibration or adjustment.
   f. Power consumption of no more than 3.1 Watts, independent of meter size, compact or remote transmitter
5. The integrated DAT modules shall provide:
   a. Integral sensor and transmitter parameterization protection.
   b. Totalizer and overflow values protected by EEPROM during power outage.
   c. Retainage of key sensor parameters such as pipe type, nominal diameter, flow conditioner when applicable, serial number, zero point.
   d. Retainage of key transmitter parameters such as flow unit(s), totalizer unit(s), low flow cut-off values, fail-safe settings.

B. Source Quality Control

1. Each flow measuring system shall be verified at a facility traceable to the

National Institute of Standards and Technology (NIST) accredited to ISO 17025.
2. The flow measuring system maximum mass measured error under factory reference conditions shall be ± 3% of reading from 100% to 15% of range and ±0.45% of full scale from 15% to 1% of range.
3. The technique of sensor and transmitter verification must be by a traceable method per NIST or ISO.
4. Provide complete documentation covering the traceability of all calibration instruments.
5. Provide ISA data sheet ISA-TR20.00.01. Use the latest revision of form 20F2321. Complete the form with all known data and dash out the inapplicable fields. Incomplete data sheets submitted will be result in a rejected submittal.

C. Accessories

1. Stainless steel tag - labeled to match the Contract Documents.
2. Optionally, provide a mounting boss for the insertion version sensor
3. Optionally, provide an insertion style thermal mass flow sensor mounting kit, based on the process pressure and required maintenance procedure:
   a. Low pressure version for maximum 65 psig, with process connection, ball valve, safety chain and sensor connection.
   b. Atmospheric version for unpressurized pipes, with sensor connection, ball valve and weld boss.
4. Optionally, the thermal mass flow meter will be installed with a flow conditioner due to inadequate straight run requirements.
5. Optionally, provide sun shield for outdoor installations.

D. Safety

1. All electrical equipment shall meet the requirements of ANSI/NFPA 70, NATIONAL ELECTRIC CODE, latest edition.
2. All devices shall be certified for use in hazardous areas as: cCSAus non-incendive for Class I, Division 2 Groups A-D.
3. All devices shall be suitable for use as non-incendive devices when used with appropriate non-incendive associated equipment.
4. Electrical equipment housing shall conform to NEMA 4X classification.
5. Non-intrinsically safe electrical equipment shall be approved by a Nationally Recognized Testing Laboratory (NRTL) such as FM, UL, ETL, CSA, etc. for the specified electrical area classification.

2.05 Analytical Controllers

A. System Description

1. Microprocessor-based sensor controller.
2. Change digital sensors connected to the controller by unplugging and plugging in sensors as necessary.
3. Change analog sensor modules connected to the controller by unplugging and plugging analog sensor modules as necessary.

B. Manufactured Units

1. Power requirements:
   a. AC powered: 100 to 240 Vac ±10%, 50/60 Hz; 15 W with 7 W sensor/network card load, 37 W with 25 W sensor/network card load.
2. The controller uses a menu-driven operation system.
3. The controller display is graphic dot matrix LCD with LED backlighting.
4. The controller is equipped with a real-time clock.
5. The controller is equipped with two security levels.
6. The controller is equipped with a data logger with RS-232 capability.
7. The controller shall have worded operation menus in 19 languages.
8. The controller is equipped with an SD card reader for data download and controller software upload.
9. Four electromechanical, UL rated, SPDT relays (Form C) are provided for user-configurable contacts rated 100 to 230 Vac, 5 Amp at 30 VDC resistive maximum.
   a. The following can be programmed:
      1) Alarm
      2) Warning
      3) Timer/scheduled cleaning d.
      4) Feeder control
      5) Event control
      6) Pulse width modulation g.
      7) Frequency modulation
   b. The following can be assigned:
      1) Primary value measurement I
      2) Secondary value measurement I
      3) Tertiary value measurement I
      4) Quaternary value measurement I
      5) Primary value Measurement II
      6) Secondary value measurement II
      7) Tertiary value measurement II
      8) Quaternary value measurement II
      9) Real time clock
      10) Calculated values
10. Two analog 0/4-20 mA outputs are provided with a maximum impedance of 500 ohms.
    a. Equip controllers with additional analog output card with three additional 4-20 mA outputs with a maximum impedance of 500 ohms.
    b. The following can be programmed:
       1) Alarms:
          a) Low alarm point
          b) Low alarm point deadband
          c) High alarm point
          d) High alarm point deadband
          e) Off delay
          f) On delay
       2) Controls:
          a) Linear
          b) Bi-linear

c) Logarithmic
d) PID

c. The following can be assigned:
1) Primary value measurement I
2) Secondary value measurement I
3) Tertiary value measurement I
4) Quaternary value measurement I
5) Primary value measurement II
6) Secondary value measurement II
7) Tertiary value measurement II
8) Quaternary value measurement II
9) Calculated values

11. All user settings of the controller are retained for 10 years in flash memory.
12. The controller is equipped with a system check for:
a. Power up test (monitoring and shutdown)
b. Total power draw
c. Memory devices
d. Temperature mother board
13. The controller has the option of graphical measurement that tracks measurement values over time.

C. Standard Equipment

1. Controller
2. Mounting hardware for wall, pipe, and panel mounting

D. Accessories

1. Provide additional mA output card with three 4-20 mA outputs, for a total of five 4-20 mA outputs for each controller.

E. Manufacturer's Service and Start-Up

1. Contractor will include the manufacturer's services to perform start-up on instrument to include basic operational training and certification of performance of the instrument.
2. Contractor will include a manufacturer's Service Agreement that covers all the manufacturer's recommended preventative maintenance, regularly scheduled calibration and any necessary repairs beginning from the time of equipment startup through to end user acceptance / plant turnover and the first 12 months of end-user operation post turnover.
3. Items 1 and 2 above are to be performed by manufacturer's factory-trained service personnel. Field service and factory repair by personnel not employed by the manufacturer is not allowed.
4. Use of manufacturer's service parts and reagents is required. Third-party parts and reagents are not approved for use.

PART 3 - EXECUTION

3.01 Installation

A. Each instrument or system shall be installed, wired, and calibrated in strict compliance with the manufacturer's instructions and recommendations.

B. Installation Hardware

1. All nuts and bolts shall be stainless steel.
2. Support channels mount externally, or mounted in a corrosive atmosphere, shall be stainless steel unistrut channels.
3. Do not mount equipment directly to masonry or concrete walls. Provide unistrut channels on wall.
4. All equipment mounting plates shall be of 0.25-inch thick minimum 316 stainless steel.
5. All contact surfaces between dissimilar metals shall be gasketed to prevent galvanic reaction.

C. All test instruments used for field calibrations shall have a minimum accuracy of 3 times greater than that of the instrument being calibrated. Test instruments shall have been calibrated to National Bureau of Standards requirements within 6 months of their use on this project. Provide evidence of such calibration upon request by the Owner of Engineer.

D. Final conduit connection to the instruments shall be through watertight flexible conduit. Where noted, final connection shall be by extra hard service cable rated for wet location. Use explosion-proof or liquid-tight flexible conduit where required.

E. Line powered units shall receive 120 volt AC supply through a disconnect switch and surge protector.

1. 120 volt AC power to each field-mounted instrument shall be provided with a disconnect switch and a surge protector, which shall be enclosed in a NEMA 4X box and labeled.
   a. Disconnect switch – Hubbell HBLDS3 or equal
   b. TVSS – APT TE series (include NEMA 4X enclosure), Liebert LTAC series.
2. All analog signal wiring shall be provided with surge protection at both the transmitting end and at the receiving end.
   a. At the instrument – TP48 by Telematic, Liebert FLW series.
   b. At PLC – SD Series by MTL Surge Technologies or equal.

F. Environmental Protection

1. Transmitters and similar items located outdoors or in unheated or untreated spaces must be manufactured for the environment to be encountered. If not suitable for the environment where located, the Contractor shall provide a heated and insulated and exhaust fan ventilated or air conditioned enclosure suitable for the environment, to protect the transmitter or instrument.

2. All instruments shall be rated for operation from –30 to 140 degrees F, with a relative humidity of 0% to 90% noncondensing, unless noted otherwise.
3. All externally located instruments, indicators, totalizers, control panels and control stations shall be mounted on a panel or mounting plate, which shall be provided with an aluminum or stainless steel weather shield to protect the instruments from direct exposure to the sun and weather. This weather shield shall be 3" wider at each end and have a 6" overhang in front of the instrument. All edges shall be smooth and rounded.
4. Unless noted otherwise or impractical, all externally located instruments shall be installed to face north.

G. Sludge Blanket Level Probe

1. Install the probe with a minimum 8-inches submergence.
2. Coordinate with Owner and manufacturer for the monitor installation location along the clarifier access walkway.
3. Include startup and training services by a factory trained technician.

3.02 Calibration

A. In addition to the above requirements, calibrate each system as follows:

1. Each system, including its complete instrument loop, shall be calibrated. Reading on the remote receiving instruments shall be equal to reading at the converter indicator.
2. Provide a written loop-calibration report for each system, which shall include but shall not be limited to the following:
   a. Date & time the final calibration was completed.
   b. Atmospheric conditions when the final calibration was performed.
   c. Comparison of readings at the converter with readings at the remote receiving instruments.
   d. Provide a table showing calculated and measured values at 0%, 25%, 50%, 75% & 100%.
   e. Verification of accuracy of the outputs, including those at the receiving instruments.
   f. Verification of operation of all contact outputs, including those at the receiving instruments.
   g. Description of method of calibration.
   h. The names and signatures of personnel performing the calibration. Provide room for 2 names.
   i. The names and signatures of engineer's field representatives. Provide room for 2 names.
   j. Special comments or notes, including "as left" conditions.

SCHEDULE A – LEVEL DEVICES (ANALOG)

Tag(s)	Name / (Location)	Type	Operating Range	Transmitter/ Display	Provided Under
LE-391 / LIT-391	Primary Clarifier No. 2 Sludge Blanket Level	Level Probe	0 – 50’	Remote	Div. 13
LE-392 / LIT-392	Primary Clarifier No. 1 Sludge Blanket Level	Level Probe	0 – 50’	Remote	Div. 13
LE-694 / LIT-694	Final Clarifier No. 1 Sludge Blanket Level	Level Probe	0 – 50’	Remote	Div. 13
LE-695 / LIT-695	Final Clarifier No. 2 Sludge Blanket Level	Level Probe	0 – 50’	Remote	Div. 13
LE-696 / LIT-696	Final Clarifier No. 3 Sludge Blanket Level	Level Probe	0 – 50’	Remote	Div. 13
LE-832A / LIT-832A	Primary Storage Tank Level (Redundant)	RADAR LT	0 – 50’	Remote	Div. 13
LE-852A / LIT-852A	TWAS Storage Tank Level (Redundant)	RADAR LT	0 – 50’	Remote	Div. 13

SCHEDULE B – FLOW DEVICES (ANALOG)

Tag(s)	Name / (Location)	Type	Operating Range	Size / Detail	Transmitter/ Display	Provided Under
FE/FIT-612	Blower No. 1 Air Flow	T-Mass	0 – 2000 cfm	N/A	Remote	Div. 13
FE/FIT-622	Blower No. 2 Air Flow	T-Mass	0 – 2000 cfm	N/A	Remote	Div. 13
FE/FIT-632	Blower No. 3 Air Flow	T-Mass	0 – 2000 cfm	N/A	Remote	Div. 13
FE/FIT-642	Blower No. 4 Air Flow	T-Mass	0 – 2000 cfm	N/A	Remote	Div. 13
FE/FIT-652	Blower No. 5 Air Flow	T-Mass	0 – 2000 cfm	N/A	Remote	Div. 13

SCHEDULE C – ANALYSIS DEVICES (ANALOG)

Tag(s)	Name / (Location)	Type	Operating Range	Size / Detail	Transmitter/ Display	Provided Under
AE-205	Plant Influent pH No. 1	pH Probe	0-14	N/A	N/A	Div. 13
AE-206	Plant Influent pH No. 2	pH Probe	0-14	N/A	N/A	Div. 13
AE-207	Plant Influent pH No. 3	pH Probe	0-14	N/A	N/A	Div. 13
AIT-205/206/207	Plant Influent pH Analyzer/Controller	Analyzer	N/A	N/A	Indicating Transmitter	Div. 13
AE-681	Primary Splitter Box pH No. 1	pH Probe	0-14	N/A	N/A	Div. 13
AE-682	Primary Splitter Box pH No. 2	pH Probe	0-14	N/A	N/A	Div. 13
AE-683	Primary Splitter Box pH No. 3	pH Probe	0-14	N/A	N/A	Div. 13
AIT-681/682/683	Primary Splitter Box pH Analyzer/Controller	Analyzer	N/A	N/A	Indicating Transmitter	Div. 13
AE-691	UV Effluent pH No. 1	pH Probe	0-14	N/A	N/A	Div. 13
AE-692	UV Effluent pH No. 2	pH Probe	0-14	N/A	N/A	Div. 13
AE-693	UV Effluent pH No. 3	pH Probe	0-14	N/A	N/A	Div. 13
AIT-691/692/693	UV Effluent pH Analyzer/Controller	Analyzer	N/A	N/A	Indicating Transmitter	Div. 13
AIT-604	Aeration Basin No. 2 Analyzer	Analyzer	N/A	N/A	Indicating Transmitter	Div. 13

-END-

SECTION 13431 – CONTROL PANEL DESIGN AND CONSTRUCTION

PART 1 - GENERAL

1.01 Summary

A. One (1) new Control Panel shall be assembled and provided for the Blower Structure No.1 PLC and associated equipment.

B. The following locations will require the installation of new hardware into existing enclosures:

1. Influent Lift Station Control Panel (CP-ILS)
2. Grit Control Panel (CP-GRIT)
3. Solids Handling Facility Control Panel (CP-SHF)
4. Residuals Pump Station Control Panel (CP-RPS)

C. Work under this section is subject to the requirements of the contract documents.

D. This section covers the technical requirements for the fabrication, engineering, wiring and installation for instrument panels and enclosures.

E. Industrial Control Panels (ICPs) shall be designed and manufactured in accordance with ANSI/UL 508A for use in Ordinary (Unclassified) locations, or ANSI/UL 698A for panels relating to Hazardous (Classified) locations. Each Industrial Control Panel (ICP) shall be identified as an “Enclosed Industrial Control Panel” with the associated UL Listing Mark label affixed within.

F. Related Sections:

1. Section 13441 – Miscellaneous Control Panel Components
2. Section 13450 – Modular Programmable Logic Controllers
3. Section 13455 – SCADA Local Area Network (LAN) Equipment

1.02 References

A. IEC: International Electrotechnical Commission

B. ISA: International Society of Automation

C. NEC: National Electric Code

D. NEIS: National Electrical Installation Standards

E. NFPA 70: National Fire Protection Association

F. NRTL: Nationally Recognized Testing Laboratory

G. OSHA: Occupational Safety and Health Administration

H. UL: Underwriters Laboratories

1.03 Submittals

A. Submittals shall comply with the Contract Documents. Shop drawings and descriptive data shall be submitted complete, in a single submittal.

B. Submit in accordance with the following specification sections:

1. Section 01300: Submittals
2. Section 13400: Measurement and Control Instrumentation

C. Product Data:

1. Catalog literature and product specifications for submitted hardware.
2. Dimensional data of panel and enclosure equipment.

D. Shop Drawings shall include the following:

1. Wiring Diagrams: Show control connections and distinguish between factory-installed and field-installed wiring.
2. Installation and assembly drawings and specifically prepared technical data for panels and enclosures submitted.
3. Detailed calculations, including power supply sizing calculation.
4. Other descriptive information that will assist the Engineer with assessment of the shop drawings.
5. Interface terminations and cable data for all components.
6. Detailed bill of materials with manufacturer’s part numbers for all components.

E. See Section 13450 for additional submittal requirements for panels and enclosures that include programmable logic controllers.

F. Operation and Maintenance (O&M) Data:

1. Provide in accordance with Section 01300.
2. Operating instructions and maintenance data for materials and products for inclusion in O&M Manual.
3. Manufacturer's written instructions for periodic replacement of any backup batteries used on equipment including estimated battery replacement calendar dates.

1.04 Quality Assurance

A. Manufacturer Qualifications: Firms experienced in manufacturing panels and enclosures of types and materials indicated that have record of successful in-service performance. Manufacturers of Industrial Control Panels (ICPs) shall be authorized by Underwriters Laboratories to apply the UL Mark to completed, custom-built ICPs per ANSI/UL Standard 508A or 698A.

B. Panels for use in Ordinary (Unclassified) locations

1. Industrial Control Panels (ICPs) for use in Ordinary (Unclassified) locations shall be designed and manufactured in accordance with ANSI/UL 508A.
   a. Each ICP shall be identified as an “Enclosed Industrial Control Panel” with the associated UL Listing Mark label affixed within.
      1) An enclosed industrial control panel is comprised of the enclosure, all components located within the enclosure, and all components mounted to the walls or cover of the enclosure.
      2) The construction of the entire unit shall be investigated, including its ability to safely function within the specified marked voltage, current and short circuit current ratings.

C. In-Factory Inspection – see Section 13492

1. Verify following in accordance with approved submittals:
   a. Panel dimensions
   b. Equipment layout
   c. Wiring
   d. Wire and terminal identification
   e. Device identification
2. Verify proper access to equipment for maintenance
3. Verify proper access to field wire and network cable/fiber termination points
4. Inspect for neatness of wiring and wire harness construction

1.05 Delivery, Storage, and Handling

A. Deliver panels and enclosures to their final locations in protective wrappings, containers, and other protection that will exclude dirt, moisture and prevent damage from construction operations. Remove protection only after equipment is made safe from such hazards and is ready for immediate installation.

B. Store panels and enclosures in clean, dry location.

1.06 Maintenance

A. Extra Materials:

1. Furnish extra materials matching products installed, as described below packaged with protective covering for storage, dated and identified with labels describing contents.
   a. Provide minimum quantity of 5 or 10% of total, whichever is greater, of each type fuse used on project.
   b. Provide minimum quantity of 5 or 10% of total, whichever is greater, of each type relay used on project.
   c. Provide minimum quantity of 5 or 10% of total, whichever is greater, of each type pilot light replacement bulb used on project.

PART 2 - PRODUCTS

2.01 Manufacturers

A. Hoffman

B. Saginaw

C. Hammond

D. Wiegmann

E. Rittal

F. Or Equal

2.02 General

A. The instrument panels and enclosures shall be as follows:

1. NEMA 4X – type 316 stainless steel for indoor enclosures in wet or corrosive environments and for all outdoor enclosures.

B. Conduit knockouts on the enclosure shall be made prior to installation of any equipment within the enclosure. The size and the number of conduit knockouts shall be as required. Provide malleable iron water tight conduit hubs for all NEMA 4X enclosures.

C. All enclosures exposed to weather conditions shall be provided with sun shields to protect the enclosure from direct exposure from the sun and rain.

D. Size to adequately dissipate heat generated by equipment mounted in or on panel.

E. Equip enclosures in non-temperature-controlled areas and all outdoor enclosures with thermostatically controlled heaters capable of maintaining an internal panel temperature of 50°F. Use ambient temperature of -20°F with 20mph wind for outdoor calculations.

1. 120V AC, 60Hz power
2. Forced air type
3. Integral thermostat control

2.03 Panel Construction

A. General

1. Panels shall be constructed using factory-fabricated enclosures.
2. Incorporate stiffening members for strength and stiffness as required.
3. Seamless welded construction.
4. Exposed seams continuously welded and ground smooth.
5. Lifting rings for panels in excess of 100 pounds.

6. Padlocking handle or padlocking latch kit.
7. Provided subpanels must be easy to remove and install.
8. Provide subpanels with white powder coated surface or with 2 coats if white enamel paint.
9. Include print pockets on the inside of each door.

B. NEMA 4X Enclosures

1. Fabricated from minimum 12-gauge type 316 stainless steel or better.
2. Enclosure door shall be provided with neoprene gasket, which shall be attached to the enclosure with oil-resistant adhesive and held in place with stainless steel retaining strips.
3. Door clamps on three sides of the enclosure door.
4. Include breather drains and corrosion inhibitors inside the panel.
5. Equip outdoor enclosures with hinged dead-front inner doors and rubber-gasketed, continuous metal hinged outer weather doors. Equip weather doors with toggle style door clamps.
6. Do not paint stainless steel surface.
7. Sandblast, roughen, or chemically etch surface to reduce gloss, reflections, and glare.

2.04 Fabrication

A. Follow PLC manufacturer's written installation requirements for layout of PLC-specific panels.

B. Provide a minimum of 25% free back panel space for future expansion unhindered by current devices, wiring, etc.

C. Provide a minimum of 20% free terminal blocks of each type used in each panel. This is in addition to planned spare wiring terminations. Show spares on panel drawings.

D. Arrange panel to allow all conduits for intrinsically safe wiring to enter the panel enclosure within the intrinsically safe section of the panel. Provide separate terminal strips for intrinsically safe wiring entering and leaving the panel.

E. Install instruments and devices, plumb, and wire panels at panel shop or other facility prior to shipment to job-site.

F. Standard Signal Interfaces:

1. Unless otherwise specified, discrete input and output signals shall conform to the following:
   a. Isolated non-powered (dry) contact closure.
   b. Dry contacts shall be powered from panel or device receiving signal.
   c. PLC based outputs shall be provided with an interposing relay when any of the following conditions apply:
      1) Potential in-rush current exceeds 75% of rated capacity of the I/O Module.

2) The current requirement of the driven device is insufficient to fully engage the output module consistently.
3) The voltage required to drive the output is incompatible with the output module.

2. Prior to final fabrication of panels, verify layout of front-of-panel devices with respect to rear-of- panel devices. Maintain a 3-inch minimum clearance between door and sub-panel mounted devices.
3. Unless otherwise specified, analog input and output signals shall conform to the following:
   a. 4-20 mA DC.
   b. For 2-wire, loop-powered transmitters, provide regulated, fused, and isolated 24V DC power supply at panel for driving of devices. Size power supply for 50% minimum spare capacity minimum. The enclosure vendor shall submit power supply load calculations with the panel shop drawings.
   c. Where isolation is required for interfacing with equipment supplied, provide necessary I/I converters. Provide I/I converters where impedance capabilities of new or existing signal transmitter will be exceeded by addition of PLC input.

G. Panel Grounding

1. Where noted or specified, provide a ground bus tied to the facility grounding system.
   a. The ground busbars shall be of nickel-plated copper, rated for at least 100 amperes.
   b. The busbar shall be provided with a sufficient quantity of termination points of the required size for the application, including future additional components.

H. Wiring:

1. In addition to NEC and NEMA requirements, wiring shall conform to following:
   a. Power: 12 AWG stranded minimum, type MTW, 600V.
   b. Control: 16 AWG stranded minimum, type MTW, 300V.
   c. Analog Signal: Twisted pair with shield, 18 AWG, Belden 8760 or equal.
2. Wire color code:
   a. AC neutral conductor: White.
   b. AC hot conductor: Black.
   c. Grounding conductor: Green.
   d. AC control conductor, powered from within panel: Red.
   e. AC control conductor, powered from remote source: Yellow.
   f. DC (+) power conductor, discrete signal: Blue.
   g. DC (-) power conductor, discrete signal: White with blue stripe.
   h. DC control conductor, discrete signal: Blue.
   i. Twisted pair cable (+) signal conductor, analog signal: White.
   j. Twisted pair cable (-) signal conductor, analog signal: Black.
   k. Intrinsically safe wiring: Light Blue.

3. Design control panels to keep 480V AC power, 120V AC power and discrete signals, and analog and other low voltage signals separated.
    a. Do not run 480V AC power, 120V AC power and discrete signals, or analog or other low voltage signals in the same conduit or wire-duct.
    b. Where 480V AC power, 120V AC power and discrete signals, or analog or other low voltage signals must cross, they shall do so at right angles.
4. Wiring Within Wire Duct:
    a. Wherever feasible plastic wire duct with cover shall be used for routing of wire within control panel.
    b. Size wire duct to be no more than 50% full.
    c. Maintain 2-inch clearance between wire duct and terminals.
5. Wiring outside of wire duct:
    a. Wiring outside of ducts shall be restrained by use of plastic wire-ties.
    b. Restrain wiring every six inches (minimum).
    c. Provide abrasion protection for wires passing through holes or across abrasive metal edges.
    d. Wiring passing a door hinge shall be grouped and wrapped in a protective wire harness.
    e. Adhesive type wire fasteners shall not be used. Hard screw type shall be employed.
6. Each conductor or twisted pair cable shall be labeled near its termination point.
7. Color-coded multi-conductor cable or multi-pair cable shall be labeled on overall jacket near its point of fan-out. Each pair of a multi-pair cable, when not color-coded, shall be labeled at its termination point in addition to the overall jacket.
8. Labels shall be machine-printed, wrap-around adhesive or heat shrink type, with tag visible from front without removal of wire from termination.
9. Wiring of PLC I/O modules may be through pre-wired cable assemblies. Cable assemblies shall have PLC I/O module-specific wiring arms on one end and cable connectors specific to terminal blocks on the other.

I. Terminations:

1. Wiring within control panel shall be continuous and terminated only at terminal blocks or equipment terminals. Splices or butt connectors shall not be used within panel.
2. Do not exceed manufacturer’s rated number of wires on any termination point.
3. No more than two wires shall be terminated at any one terminal even if terminal is rated for more than two.
4. Make external connections by way of numbered terminal blocks on numbered terminal strips.
5. When external signals are powered from within panel, fused terminal blocks or circuit breakers shall be used where conductors enter or leave panel.
6. Provide integral bussing system on terminal block array where more than two terminations require common source or drain connection. Jumpered terminations shall not be acceptable.
7. Equipment and signal ground wiring, as well as Neutral wiring, shall not be daisy-chained; they shall each be terminated at isolated, bussed terminal blocks.

8. Provide knife disconnect-type terminal blocks with test sockets for all analog loops.
9. Include provisions for grounding of shields on shielded twisted pair cables entering or leaving panel. Cable shields shall be grounded at terminal block end only. Shields shall run entire length of cable within panels. Running of twisted pairs without shields within panels is not permissible.
10. Provide separate terminal strips for each of the following types of signals.
    a. 480V AC power circuits
    b. 120V AC power circuits
    c. 120V AC discrete signals
    d. 12V DC, 24V DC or 48V DC discrete signals
    e. Analog signals
    f. Serial or parallel digital communication signals
    g. Intrinsically safe circuits

J. Power Distribution:

1. Panels having 240V AC or 480V AC power supply:
    a. Provide internal main circuit breaker to isolate power to panel.
    b. Provide circuit breakers for all motor starters provided.
    c. If panel includes separate 120V AC control power supply, provide auxiliary contact to isolate control power when main circuit breaker is opened.
    d. 480V AC to 120V AC control power transformer requirements:
        1) Both primary leads shall be fused.
        2) First secondary lead shall be fused.
        3) Second secondary lead shall be grounded.
        4) Provide single-phase surge suppression/line conditioner, sized for total panel loadings between secondary leads and 120V AC power distribution block.
2. Panels having 120V AC power supply:
    a. Provide circuit breaker on power supply entering panel.
    b. Provide single-phase surge suppression/line conditioner, sized for total panel loadings between circuit breaker and 120V AC power distribution block.
3. Provide individual circuit breakers to supply power to each major panel component.
4. Additional panel requirements:
    a. Provide individual circuit breakers for panel powered devices entering panel from field. Provide separate circuit for each device.
        1) Solenoid actuated valves
        2) Loop powered transmitters
        3) 120V AC switched cord and receptacles
        4) Relays
    b. Include digital transient surge suppressor/varistor installed in parallel with output contact at terminal strip for each PLC output signal driving an inductive load including:
        1) Relays
        2) Solenoids
        3) Motor starters
        4) Motors

K. Labels and Nameplates:

1. Panel Designation:
   a. Engraved with Engineer's tag number and description shown on the Drawings and in Specifications.
   b. Laminated white plastic with ½-in. high black characters.
   c. Fastened with stainless steel screws.
2. Front of panel mounted devices.
   a. Provide nameplate for each front of panel device with descriptive phrase using nomenclature as listed on Drawings and in Specifications.
   b. Laminated white plastic with 3/16-in. high black characters.
   c. Fastened with stainless steel screws.
3. Rear of panel mounted devices.
   a. Provide nametag for each rear of panel device with labels used on panel drawings.
   b. Thermo-embossed or laser printed with 1/8-in. high black characters on clear or white background or laminated white plastic with 3/16-in. high black characters.
   c. Self-adhesive backing.
   d. Clean area with mineral spirits prior to affixing labels.

L. Panel Finish:

1. Remove mill scale, grease, and oil.
2. Primer thickness shall be 0.8 mil., minimum.
3. Finish coat shall be two-part epoxy or baked dry powder, 3-mil., minimum dry film thickness.
4. Color: Standard manufacturer's finish.

M. Conveniences:

1. All control panels shall be provided with door-activated, internal LED panel lighting units.
   a. One unit shall be provided for every 3 feet of panel width and shall be mounted on the inside, top of the panel.
   b. Lighting shall be consistent for entire project.
2. UPS receptacle – Provide simplex non-GFCI receptacle for plug in of UPS where applicable. Receptacle shall be labeled "120V AC FOR UPS ONLY".

PART 3 - EXECUTION

3.01 Installation

A. Install and wire in accordance with equipment/instrument manufacturer's written instructions, approved submittals, applicable requirements of the NEC, NEIS, and recognized industry practices.

B. Install control panels in locations indicated on Drawings and in accordance with manufacturer's written instructions and approved submittals.

C. Touch up all nicks, scratches, etc. with materials as recommended by the enclosure manufacturer.

D. All panels shall be installed level and plumb.

E. Installation Hardware

1. All nuts and bolts shall be stainless steel.
2. Support channels mount externally, or mounted in a corrosive atmosphere, shall be either reinforced fiberglass or stainless steel unistrut channels. All cuts and holes on fiberglass unistrut channels shall be coated with appropriate resin coating to protect them from deterioration.
3. Do not mount equipment directly to masonry or concrete walls. Provide unistrut channels on wall.
4. All equipment mounting plates shall be of 0.25-inch thick minimum clear anodized aluminum.
5. All contact surfaces between dissimilar metals shall be gasketed to prevent galvanic reaction.

3.02 Identification and Name Plate Requirement

A. Engrave Engineer tag number as listed in Specifications and on Drawings.

B. Include required Name Plate information per NEC 409.110

1. Manufacturer's name, trademark, or other descriptive marking by which the organization responsible for the product can be identified.
2. Supply voltage, number of phases, frequency, and full-load current for each incoming supply circuit.
3. Industrial control panels supplied by more than one power source such that more than one disconnecting means is required to disconnect all power within the control panel shall be marked to indicate that more than one disconnecting means is required to de-energize the equipment.
4. Short-circuit current rating of the industrial control panel based on one of the following:
   a. Short-circuit current rating of a listed and labeled assembly.
   b. Short-circuit current rating established utilizing an approved method.
5. If the industrial control panel is intended as service equipment, it shall be marked to identify it as being suitable for use as service equipment.
6. Electrical wiring diagram or the identification number of a separate electrical wiring diagram or a designation referenced in a separate wiring diagram.
7. An enclosure type number shall be marked on the industrial control panel enclosure.

SCHEDULE A – INDUSTRIAL CONTROL PANEL

AG	ICP Location Classification	Enclosure NEMA Type (Material)	Form Factor	Access	Closure Type	Hinge Type	Panel Description & Additional Requirements
CP-BS1	Ordinary (Unclassified)	Type 4X (**316L** Stainless)	Wall or Rack Mount	Single Door	¼ Turn Latches	Continuous Hinge	Blower Skid No. 1 Control Panel SCADA PLC-BS1 **(Note 1)**
LIT-391	Ordinary (Unclassified)	Type 4X w/UV Glass	Wall or Rack Mount	Single Door	¼ Turn Latches	Hidden Hinge	Primary Clarifier No. 2 Level Enclosure Contains LIT-391 & TVSS Reference Sht. 4E1
LIT-392	Ordinary (Unclassified)	Type 4X w/UV Glass	Wall or Rack Mount	Single Door	¼ Turn Latches	Hidden Hinge	Primary Clarifier No. 1 Level Enclosure Contains LIT-392 & TVSS Reference Sht. 4E1
LIT-694	Ordinary (Unclassified)	Type 4X w/UV Glass	Wall or Rack Mount	Single Door	¼ Turn Latches	Hidden Hinge	Final Clarifier No. 1 Level Enclosure Contains LIT-694 & TVSS Reference Sht. 4E1
LIT-695	Ordinary (Unclassified)	Type 4X w/UV Glass	Wall or Rack Mount	Single Door	¼ Turn Latches	Hidden Hinge	Final Clarifier No. 2 Level Enclosure Contains LIT-695 & TVSS Reference Sht. 4E1
LIT-696	Ordinary (Unclassified)	Type 4X w/UV Glass	Wall or Rack Mount	Single Door	¼ Turn Latches	Hidden Hinge	Final Clarifier No. 3 Level Enclosure Contains LIT-696 & TVSS Reference Sht. 4E1
PB-CLAR1	Ordinary (Unclassified)	Type 4X (**316L** Stainless)	Pull Box/Junction Box	Single Door	¼ Turn Latches	Hidden Hinge	Final Clarifier No.1 Pull Box
PB-CLAR2	Ordinary (Unclassified)	Type 4X (**316L** Stainless)	Pull Box/Junction Box	Single Door	¼ Turn Latches	Hidden Hinge	Final Clarifier No.2 Pull Box

Note 1: Indicated ICPs are required to have a heater for freeze protection and to reduce condensation in the panel when installed outside or in an unconditioned building.

-END-

SECTION 13441 – MISCELLANEOUS CONTROL PANEL COMPONENTS

PART 1 - GENERAL

1.01 Summary

A. This specification covers the technical requirements for control panel components for Process Instrumentation and Control Systems.

B. Related Sections:

1. Section 13431 – Control Panel Design and Construction
2. Section 13450 – Modular Programmable Logic Controllers
3. Section 13455 – SCADA Network Equipment

1.02 References

A. IEC: International Electrotechnical Commission

B. ISA: International Society of Automation

C. NEC: National Electric Code

D. NEIS: National Electrical Installation Standards

E. NFPA 70: National Fire Protection Association

F. NRTL: Nationally Recognized Testing Laboratory

G. OSHA: Occupational Safety and Health Administration

H. UL: Underwriters Laboratories

1.03 Submittals

A. Submittals shall comply with the Contract Documents. Shop drawings and descriptive data shall be submitted complete, in a single submittal.

B. Submit in accordance with the following specification sections:

1. Section 01300: Submittals
2. Section 13400: Measurement and Control Instrumentation

C. Product Data:

1. Catalog literature and product specifications for submitted hardware.

D. Shop Drawings shall include the following:

1. Installation and assembly drawings and specifically prepared technical data for panels and enclosures submitted.
2. Other descriptive information that will assist the Engineer with assessment of the shop drawings.
3. Interface terminations and cable data for all components.
4. Detailed bill of materials with manufacturer’s part numbers for all components.

E. See Section 13450 for additional submittal requirements for panels and enclosures that include programmable logic controllers.

F. Operation and Maintenance (O&M) Data:

1. Provide in accordance with Section 01300.
2. Operating instructions and maintenance data for materials and products for inclusion in O&M Manual.
3. Manufacturer's written instructions for periodic test/calibration/cleaning for instrumentation and controls in service.

1.04 Quality Assurance

A. Manufacturer Qualifications: Firms experienced in manufacturing instrumentation of types and capacities indicated that have record of successful in-service performance.

B. Devices shall be latest and most modern design at time of bidding.

C. As much as possible devices shall be products of one manufacturer to achieve standardization for maintenance, spare parts, operation, and service.

PART 2 - PRODUCTS

2.01 General

A. The SCADA Control System Integrator (CSI) and Contractor shall be responsible for all accessories, including interposing relays, analog signal isolators, terminal blocks, power distribution blocks, grounding blocks, fuse blocks and fuses, circuit breakers, duplex receptacle, heaters, exhaust fans, louvers and filters, DIN mounting rails, plastic wiring channels, hardware, wire tags, engraved nameplates, and all such accessories needed for a professional class panel fabrication.

2.02 Terminal Blocks

A. Manufacturer:

1. Phoenix Contact
2. Weidmuller
3. Or Equal

B. High density modular types, constructed of nylon material.

C. Termination type shall be tubular screw with serrated pressure plate.

D. All current carrying parts (metal bodies) shall be made of nickel/tin-plated copper.

E. 300 v rating for 120 v circuits and below, 600 v rating for 480 v circuits.

F. Isolating end caps for each terminal.

G. Identification on both terminals.

H. Clip-mounted on DIN rail.

I. Accepts AWG 12 to 22.

J. Feed-through Terminals:

1. 20 Amp rating

K. Switched Terminals:

1. Knife disconnect with test sockets.
2. 10 Amp rating.

L. Fused Terminals:

1. Hinged fuse removal/disconnect.
2. 10 Amp rating.
3. Include blown fuse indication.

M. Ground terminals shall be color coded in accordance with international standard, which shall be yellow/green.

N. Matching jumper bridges shall be color coded to the wiring colors.

2.03 Pilot Devices

A. Manufacturer

1. Allen Bradley 800T/800H.
2. Square D Class 9001, Type K.
3. General Electric type CR104P
4. Or Equal

B. Construction

1. Heavy duty
2. Watertight
3. Oil-tight
4. Flush panel mounting

5. Size to mount in 30.5-mm diameter cutout
6. Match NEMA rating of device with the installed location environmental classification.

C. Pushbuttons

1. Flush head unless specified elsewhere.
2. Contact Blocks:
   a. Double break silver contacts
   b. Ac Ratings: 7,200 VA make, 720 VA break
   c. Single pole, single throw
   d. Up to six tandem blocks
3. Momentary contact unless specified elsewhere
4. Non-illuminated
5. Legend plates, as required, for type of operation or as specified elsewhere

D. Selector Switches

1. Maintained position unless specified elsewhere.
2. Contact Blocks:
   a. Double break silver contacts
   b. Ac Ratings: 7,200 VA make, 720 VA break
   c. Single pole, double throw or double pole, single throw
   d. Up to six tandem blocks
3. Operators:
   a. Number of positions as specified elsewhere
   b. Standard knob type unless specified elsewhere
4. Legend plates as required for type of operation or specified elsewhere

E. Pilot Lights

1. LED Lamp
2. Transformer type
3. Bayonet, 6V AC bulb
4. Colored lens as specified elsewhere
5. Interchangeable lenses
6. Transformer rated for 120V AC
7. Push to test
8. Legend plates as specified elsewhere

F. For Class 1, Division 2 areas, devices shall either be explosion proof type, or all contacts and other items which may arc or spark shall be hermetically sealed. Hermetically sealed contacts and devices shall meet the current and voltage ratings required for the circuit.

2.04 Control Relays

A. Manufacturer

1. Allen Bradley

2. Potter and Brumfield
3. Idec
4. Magnecraft
5. Square D
6. Or Equal

B. Operating Data

1. Pickup Time: 13 ms maximum
2. Dropout Time: 10 ms maximum
3. Operating Temperature: -45ºF to 150ºF

C. AC Coil

1. 120V AC.
2. Continuous rated
3. 3.5 VA inrush maximum
4. 1.2 VA sealed, maximum
5. 50-60 Hz
6. Minimum Dropout Voltage: 10% of coil rated voltage

D. DC Coil

1. 24V DC
2. Continuous rated
3. Minimum Coil Resistance:
   a. 24V DC: 450 ohm

E. Contacts

1. Gold flashed fine silver, gold diffused for 1 amp or less resistive load
2. Silver cadmium oxide
3. 3 form C
4. 300V AC
5. 10-amp make, 1.5-amp break, (inductive)

F. Relays shall have as a minimum two pole, double throw contacts (2PDT).

G. Rated at 10 million operations minimum

H. DIN rail mountable

I. Enclosed and protected by polycarbonate cover

J. Visible indication of energized coil

K. Provide relay-retaining clips.

L. Provide at a minimum 20% spare wired control relays

M. Provide a control relay to monitor utility power (control power relay).

2.05 DC Power Supplies

A. Manufacturer:

1. Phoenix Contact
2. Sola/Hevi-Duty
3. Pulsa
4. Or Equal

B. General

1. The enclosure vendor shall be responsible for providing and sizing all instrument loop power supplies. The instrument loop power supplies shall be sized to include at least 100% spare capacity. The enclosure vendor shall submit power supply load calculations with the panel shop drawings.
2. Power supply shall be fully enclosed and provide screw terminations. All wiring points and plug connections shall be "touch safe" with no live voltages that can make contact with a misplaced finger in accordance with IEC 529. Housing shall be at IP20 or equal minimum.
3. Power Supplies shall have an efficiency of at least 80%.
4. The power shall have an MTBF (Mean Time Between Failures) greater than 500,000 hours according to IEC 1709.
5. The power supply shall be able to withstand shock of 15G in all space directions according to IEC 68-2-27 and vibration up to 2.3G 90 min. (<15hz, amplitude = +/-2.5mm/15-150hz) according to IEC 68-2-6.
6. Power supplies shall be UL listed to allow the use of the power supply at full rated output amperage with no "de-rating".

C. Equipment

1. Nominal current rating to be based on an operating temperature of 60°C or higher
2. Power supplies shall have a visible "DC Power OK" indicator. This indicator will flash when the output drops below 10% of the adjusted output voltage.
3. Ambient temperature range for operation shall be at least -25°C to +70°C
4. Residual ripple shall not exceed 100 mV peak to peak at nominal current values
5. Integral "fine" surge suppression shall be incorporated into the power supply
6. Power supplies shall conform to CE electromagnetic compatibility as described in EN61000-6-2 and EN50081-2.
7. Power supplies shall have means of limiting DC current in case of short circuit or an overload and shall automatically reset themselves when the fault is corrected.
8. Power supplies when wired in parallel will not require external circuitry.
9. Power supplies shall have a voltage monitoring relay contact and signaling output.
10. Input must auto-range between 85 to 264VAC and 90 to 350VDC for 1 phase power supplies with no manual intervention.

D. Mounting

1. All power supplies shall have integral metal mounting foot to attach to 35mm DIN-rail conforming to DIN EN50022.

E. Wire Connections:

1. Attach wires to the power supplies by means of a cable-clamping terminal block activated by a screw. Connections shall be gas-tight, and the terminal block shall be fabricated with non-ferrous, non-corrosive materials.
2. Wire connection for currents less than 20A shall use pluggable terminals on both input and output ends.
3. Pluggable terminals shall accept wire sizes 24 through 14 AWG.

2.06 Electronic Current Isolator

A. Manufacturer

1. Phoenix Contact Model MCR Series.
2. PR Electronics.
3. Or Equal

B. Solid state instrument to electrically isolate one instrument loop from another instrument loop. Converter to accept 4-20 mA DC input signal and provide equal but isolated and power-boosted output.

C. Mounting: DIN Rail

D. Temperature compensated, calibration-free

E. Input: 4-20 mA DC into 50 ohms

F. Output: 4-20 mA DC into output load up to 500 ohms

G. Isolation: Common mode up to 700Vac between input and output

H. Accuracy: 0.5% of span

I. Provide power supply specific to isolator

J. All analog input wiring within the same building as the control panel shall be provided with analog isolators within the control panel.

K. Provide at a minimum 20% spare wired isolators

2.07 Surge Protection Device

A. Manufacturer

1. MTL Surge Technologies SD Series
2. Citel DLA Series

3. Or Equal

B. Surge protection device that protects electronic equipment and system against surges on signal and I/O cabling.

C. Mounting: DIN Rail

D. Input: 4-20 mA DC

E. Output: 4-20 mA DC

F. Nominal Line Voltage: 24VDC

G. Nominal discharge current: 5kA

H. Maximum discharge current: 20kA

I. All analog input wiring coming into the building shall be provided with surge protection within the control panel.

2.08 Surge Protectors

A. Manufacturer

1. Islatrol - IE-100 series
2. SOLA STFE Elite Series
3. Allen Bradley
4. Or Equal

B. High frequency noise filter/surge protector to protect control panel incoming power supply.

C. Wire to protect specified microprocessor-based process control system devices including:

1. PLC
2. Ethernet Switches
3. HMI
4. Radio
5. All other microprocessor-based equipment located in or powered from PLC Panel

D. Input power

1. 120V AC
2. 47-63 Hz

E. Peak surge current: Minimum 10,000-amp line-neutral, line to ground, and neutral to ground.

F. Frequency response

1. Normal mode: 90 dB max, 100 kHz to 50 MHz
2. Common mode: 60 dB max, 5 MHz to 50 MHz

G. Response time

1. < 0.5 ns normal mode
2. <5 ns common mode

H. Transient protection per IEEE C62.41

1. Category A Ringwave (6kV, 200A, 100 MHz): < 60 V peak
2. Category B Ringwave (6kV, 500A, 100 MHz): < 100 V peak

I. LED status indicator

J. Form C contact for remote status indication

2.09 Intrinsically Safe Barriers

A. Manufacturer

1. MTL
2. PR Electronics
3. Or Equal

B. Intrinsically safe barrier located in safe area, allow intrinsically safe interface to devices located in Class 1, Division 1 or 2, Group C or D hazardous (classified) locations per National Electrical Code ANSI/NFPA 70 (NEC).

C. Non-Zener configuration

D. UL and CE listed, FM approved

E. Operating temperature range -20 to 60 degrees F

F. Supply voltage: 20–35 VDC

G. DIN rail mounted

H. Isolation: 250 V RMS between safe and hazardous area terminals

I. LED indication of operation status and malfunction

J. Discrete Input

1. Suitable for monitoring of switch closure, NAMUR sensors
2. Capable of line fault detection when specified, provide series and parallel resistors at switch location when line fault detection specified
3. Safe area contact ratings: 125 VAC, 0.5 A, resistive

K. Analog Input

1. Suitable for monitoring of 4-20 mA DC signals
2. Safe area output: Isolated 4-20 mA DC, active or passive dependent on application

2.10 Elapsed Time Totalizers (ETT's) shall be the synchronous motor driven type with digital readout to indicate the total time a piece of equipment is energized. Totalizer shall have a minimum of six-digit wheels including a 1/10 digit wheel to provide the range of time measured in hours, unless noted otherwise. Units shall be non-resettable and operate on 120V AC or 24V DC as required. Elapsed Time Meter (ETM) shall be considered synonymous with Elapsed Time Totalizer (ETT).

PART 3 - EXECUTION

3.01 Installation

A. Install and wire in accordance with equipment/instrument manufacturer's written instructions, approved submittals, applicable requirements of the NEC, NEIS, and recognized industry practices.

3.02 Equipment Identification and Wire Tagging

A. All equipment and wiring identifications shall conform to and be compatible with the Owner's current labeling system and shall be completed prior to final acceptance of the work. It is the responsibility of the Contractor to coordinate with the Owner's Engineer all labeling standards and documentation.

B. All control wiring shall be identified by means of computer-generated, heat shrink type wire marker. Wire numbers shall be as shown on the drawings.

C. Each component mounted within the enclosure shall be provided with equipment identification. Equipment and device nameplates or identification shall be of engraved laminated plastic, with black lettering on white background. Nameplates shall be as listed herein or as shown on the project Drawings.

-END-

SECTION 13450 – MODULAR PROGRAMMABLE LOGIC CONTROLLERS

PART 1 - GENERAL

1.01 Summary

A. This Section describes the hardware required for a Modular Programmable Logic Controller (PLC) system.

B. Related Sections

1. Section 13431 – Control Panel Design and Construction
2. Section 13455 – SCADA Local Area Network (LAN) Equipment

1.02 References

A. IEC: International Electrotechnical Commission

B. NEC: National Electric Code

C. NEIS: National Electrical Installation Standards

D. NFPA 70: National Fire Protection Association

E. NRTL: Nationally Recognized Testing Laboratory

F. OSHA: Occupational Safety and Health Administration

G. UL: Underwriters Laboratories

1.03 Abbreviations

A. DLR: Device Level Ring

B. I/O: Input / Output

C. PLC: Programmable Logic Controller

D. RIO: Remote IO Device

1.04 System Description

A. Modular PLC system including power supply, controller, I/O cards, communication cards, and all appurtenances for a complete system.

1.05 Submittals

A. Submittals shall comply with the Contract Documents. Shop drawings and descriptive data shall be submitted complete, in a single submittal.

B. Product Data:

1. Catalog literature and product specifications for submitted hardware
2. Dimensional data of PLC equipment
3. Interface terminations and cable data for each module
4. Hardware manuals (4 sets)
5. Software manuals (4 sets)
6. Detailed bill of materials with manufacturer’s part numbers for each chassis

C. Shop Drawings shall include the following:

1. Wiring Diagrams: Show control connections and distinguish between factory-installed and field-installed wiring
2. Addressing system and card layout, including special configuration rules and limitations for each rack
3. Installation and assembly drawings and specifically prepared technical data for hardware
4. Detailed calculations, including power supply sizing calculation
5. Other descriptive information that will assist the Engineer with assessment of the shop drawings

D. Operation and Maintenance (O&M) Data:

1. Provide in accordance with Section 01300
2. Operating instructions and maintenance data for materials and products for inclusion in O&M Manual
3. Manufacturer's written instructions for periodic replacement of any backup batteries used on equipment including estimated battery replacement calendar dates

1.06 Quality Assurance

A. Items provided under this section shall be listed or labeled by Underwriters Laboratories Inc. (UL) or other Nationally Recognized Testing Laboratory (NRTL).

1. Term "NRTL" shall be as defined in Occupational Safety and Health Administration (OSHA) Regulation 1910.7
2. Terms "listed" and "labeled" shall be as defined in National Electrical Code (NEC), Article 100

1.07 Delivery, Storage, and Handling

A. Deliver equipment and system components to their final location in protective wrappings, containers, and other protection that will exclude dirt and moisture and prevent damage. Remove protection only after equipment is made safe from such hazards and ready to install.

B. Store items in a clean, dry, secure location.

1.08 Maintenance

A. Extra Materials: Furnish extra materials matching products installed, as described below, packaged with protective covering for storage, dated, and identified with labels describing contents.

1. Two shelf spares for each type of I/O module used on project
2. One shelf spare for each type processor used on project
3. One shelf spare for each type power supply used
4. One shelf spare for each type nonvolatile storage device used

PART 2 - PRODUCTS

2.01 Manufacturer

A. Rockwell Automation

B. No Substitute Permitted

C. Programmable Logic Controller System hardware shall be from single manufacturer unless noted otherwise

2.02 Processor

A. 5069-L320ER

1. At minimum, provide 5069-L320ER processors for all locations of the project.

B. Characteristics (5069-L320ER):

1. User Memory: 2 MB
2. Secure Digital Memory Card: 2 GB (optional, required)
3. Communication Ports: 2x Ethernet/IP ports, 1x USB
4. Module expansion capacity: 16 Local I/O modules and 40 Ethernet nodes
5. Memory retention: Internal energy storage (no battery)

2.03 Power Supply: integrated into 5069 PLC chassis.

2.04 I/O Modules

A. I/O modules specifically designed for interfacing of I/O signals to PLC processor.

B. Include sufficient I/O modules to accommodate I/O with provisions for 20% spare I/O prewired to terminal strips.

C. Digital Input:

1. 16 points per module
2. 24V DC sink/source
3. LED indication of on/off status of each point

4. 5069-IB16

D. Relay Output:

1. 4 points per module, individually isolated relay contacts
2. 2A contact rating
3. 5 - 250VAC 50/60HZ, 5-30VDC
4. LED indication of on/off status of each point
5. 5069-OW4I

E. Digital Output:

1. 16 points per module
2. 24V DC source
3. LED indication of on/off status of each point
4. 5069-OB16

F. Analog Input:

1. 8 inputs per module
2. Differential inputs
3. Accepts 0-20 mA DC, 4-20mA DC, and +/-10V DC
4. Include signal isolators in the control panel as required
5. 5069-IF8

G. Analog Output:

1. 8 outputs per module
2. Differential
3. Transmits 0-20 mA DC, 4-20 mA DC, +/- 10V DC
4. 5069-OF8

H. Address Reserve Module:

1. 45mA @ 18 – 32V DC MOD Power
2. 5069-ARM

I. Field Potential Distributor

1. 9.99 A @ 0-32V DC
2. 9.975 A @ 0-240V AC, 47-63 Hz
3. 5069-FPD

J. EtherNet/IP Adapters (Remote I/O Adapter)

1. Communication Rates: 10 Mbps, 100 Mbps, 1 Gbps
2. Linear Network and DLR Protocol Supported
3. Protected Mode Implicit
4. 5069-AENTR or 5069-AENTRK (Conformal Coated)

PART 3 - EXECUTION

3.01 Installation

A. Install hardware and wiring in accordance with equipment manufacturer's written instructions, approved submittals, applicable requirements of the NEC, NEIS, and recognized industry practices.

B. Analog I/O shall use specialty field terminal blocks specifically designed for 4-20mA signal wiring.

C. Provide analog isolators for all analog inputs contained within the building.

D. All analog signal wiring coming into the building shall be provided with surge protection at the control panel: SD Series by MTL Surge Technologies, Citel DLA Series or equal.

SCHEDULE A – PLC TYPES

Tag	Location	PLC Type	Provided Under
PLC-ILS	Influent Lift Station Control Panel (CP-ILS)	5069-L320ER	Div 13
PLC-SHF	Solids Handling Facility Control Panel (CP-SHF)	5069-L320ER	Div 13
PLC-GRT	Grit Building Control Panel (CP-GRT)	5069-L320ER	Div 13
PLC-RPS	Return Pump Station Control Panel (CP-RPS)	5069-L320ER	Div 13
PLC-BS1	Blower Structure No. 1 Control Panel (CP-BS1)	5069-L306ER	Div 13

-END-

SECTION 13452 – COMPUTER EQUIPMENT

PART 1 - GENERAL

1.01 Summary

A. Section Includes computer equipment and other hardware peripherals for the SCADA System.

B. All like products shall be furnished from a single manufacturer.

1.02 Definitions

A. Acronyms and abbreviations

1. ICN: Industrial Control Network
2. LAN: Local Area Network
3. OSE: Operating System Environment
4. PLC: Programmable Logic Controller
5. RCP: Redundant Computing Platform
6. SCADA: Supervisory Control and Data Acquisition
7. VM: Virtual Machine
8. WAN: Wide Area Network

1.03 Submittals

A. Provide the following submittals in accordance with Section 01300:

B. Product Data:

1. Data sheets and catalog literature.
2. Description of on-line diagnostic tests and off-line tests.
3. Dimensional data on computer equipment.
4. Interface and cable data.
5. Hardware manuals.
6. Software manuals.

1.04 Maintenance

A. Software Upgrades

1. Provide latest version of software at time of delivery to site.
2. Provide all software updates at no additional cost to OWNER for the duration of Project. Upgrades to include software revisions.

PART 2 - PRODUCTS

2.01 SCADA Operator Workstation Computers (QTY 1)

A. General

1. Provide one SCADA Operator Workstation Computer (OWS-1) connected to the SCADA Industrial Control Network in the Treatment Plant Control Room.

B. Manufacturers

1. Dell.
2. No Substitutes.

C. Configuration

1. Form Factor: Tower
2. Operating System Environment (OSE): Windows 11 Professional
3. Processor: 13th Gen Intel Core i7-13700 (16 Core, 2.10GHz, Turbo, 65W)
4. Memory: 16 GB (2 x 8 GB) of 4800 MT/s DDR5
5. Hard drive: C1 SSD Boot + SSD
6. Storage: 1 TB, M.2, Gen 4 PCIe NVMe, SSD, Class 40
7. Removable media: 8X DVD-ROM
8. Graphics: AMD Radeon Pro W6400 (4GB, GDDR6, 2DP)
9. Communications: Ethernet (2) 10/100/1000 LAN card
10. Monitor and Stand
    a. OWS-1
        1) (2) Dell 22” Monitors - P2222H
        2) (1) Dell Dual Monitor Stand (MDS19)
11. All SCADA monitors for OWS and Server must utilize identical NATIVE screen resolution.
12. Warranty: 3 years next business day, parts, labor, and 9x5 phone support

2.02 SCADA Panel Mount HMIs (QTY 4)

A. General

1. Provide industrial, panel-mounted computers for connectivity to the SCADA Servers at each of the following locations
    a. HMI-ILS located in the Influent Lift Station Control Panel (CP-ILS)
    b. HMI-SHF located in the Solids Handling Facility Control Panel (CP-SHF)
    c. HMI-GRT located in the Grit Building Control Panel (CP-GRT)
    d. HMI-RPS located in the Return Pump Station Control Panel (CP-RPS)
2. Mount SCADA HMIs to the front of the existing PLC Control Panel Enclosures.

B. Manufacturers

1. OnLogic – CV-P1101
2. Or approved equal

C. Configuration

1. 21.5", 1920 x 1080 pixel, TFT LCD
2. Resistive touchscreen
3. Intel Pentium N4200 1.1 GHz Quad-Core processor
4. Minimum 64 GB SSD, 1 x 2.5" SATA 3, MLC
   a. Or as required for SCADA software
5. Onboard DDR3L minimum 4 GB 1600 MHz
6. Operating System Environment (OSE):
   a. Microsoft Windows 10 IoT Enterprise LTSC 64-bit
   b. Or as required by SCADA software
7. 2 Ethernet ports
8. 2 Serial ports
9. 2 USB ports
10. 1 internal SD slot, up to 32 GB

2.03 Configuration Services

A. General

1. Identify and setup all SCADA Users with proper authorities and passwords.
2. All computers on the network shall be setup for time synchronization.

B. Servers

1. All Servers shall be configured with the end customer to determine user rights, permissions, and network and group rights.

C. Workstations / SCADA HMIs

1. All Clients shall have Microsoft Windows installed and operating properly.

D. Network Printers

1. Shall have a static IP address assigned and setup to received print jobs from all the computers on the network.

PART 3 - EXECUTION

3.01 Installation

A. Install and wire in accordance with SCADA Control System Integrator’s and/or Equipment manufacturer’s written instructions and approved submittals.

-END-

SECTION 13455 – SCADA LOCAL AREA NETWORK (LAN) EQUIPMENT

PART 1 - GENERAL

1.01 Summary

A. Section Includes:

1. Requirements of Plant-Wide Industrial Control Network and associated equipment. Network Equipment to be provided within remote station control panels is also included in this section.

B. Related Sections:

1. Section 13452 Computer Equipment

1.02 System Description

A. Design Requirements:

1. Industrial Control Network (ICN):
   a. Provide high speed link between PLCs and the SCADA System to allow sharing of real-time data.
   b. Provide expandable system to accommodate addition of future equipment as specified elsewhere.
   c. Provide couplers, terminators, junction boxes, and other associated cable connectors.
   d. Provide cabling suitable for conduit routing as shown elsewhere.
   e. Automation Network between buildings shall be Fiber Optic, installed by OWNER.
   f. Automation Network within buildings shall be CAT6 UTP, 10/100/1000 Base-T(X).
      1) Maximum distance between intra-building nodes (CAT6): 100 meters.
   g. Provide ICN Ethernet switches within PLC panels as indicated in the Schedule at the end of this section.

1.03 Submittals

A. In addition to requirements of Section 13400, provide following:

1. Product data cut sheets and catalog literature.
2. Shop Drawings:
   a. Cable routing drawings for the ICN.
   b. Cable termination detail drawings.
   c. Location and function of all communications module types.

1.04 Maintenance

A. Extra Materials:

1. One (1) spare network switch of each type as detailed below.

PART 2 - PRODUCTS

2.01 Unmanaged Industrial Ethernet Switch

A. Manufacturers:

1. Allen Bradley Stratix 2000
2. Or approved equal

B. Features:

1. Unmanaged Industrial Ethernet Switch
   a. Model Number: 1783-US8T
2. Eight RJ-45 Ports
3. Inrush Current: 1.31A
4. Power Consumption 4.6W
5. SFP modules: None
6. Extended Environmental Specifications
   a. -10° to 60°C Operating Temperature

PART 3 - EXECUTION

3.01 Installation

A. Install and wire in accordance with SCADA CSS's and/or Equipment manufacturer's written instructions and approved submittals, applicable requirements of the NEC, NECA "Standard of Installation", and recognized industry practices.

Industrial Control Network Switch Schedule

Switch Label	Location	Switch / Device Type	Ring Capable	Extended Temp.	Copper Ports		MM Fiber or SFP Slots		SFP Modules for MM Fiber	
					100 Mbps	1 Gbps	100 Mbps	1 Gbps	100 Mbps	1 Gbps
SW-ILS	CP-ILS	Influent Lift Station SCADA Unmanaged			8					
SW-SHF	CP-SHF	Solids Handling Facility SCADA Unmanaged			8					
SW-GRT	CP-GRT	Grit Building SCADA Unmanaged			8					
SW-RPS	CP-RPS	Residuals Pump Station SCADA Unmanaged			8					
SW-BS1	CP-BS1	Blower Structure No. 1 Unmanaged			8					

-END-

SECTION 13456 – UNINTERRUPTIBLE POWER SUPPLY (UPS)

PART 1 - GENERAL

1.01 Summary

A. Section Includes: UPS equipment

B. Items specified in this section shall conform to general requirements of Section 13400.

C. All Industrial Control Panels (Enclosures) that house a PLC, HMI, and/or Radio equipment shall include a UPS as specified in this Section.

D. All SCADA computers, HMIs, and network hardware devices shall be protected by a UPS as specified in this Section.

1.02 Submittals

A. In addition to submittal requirements of Section 13400, provide:

1. Load sizing data for equipment connected to UPS for each installation
2. Descriptive literature and catalog cut sheets
3. Installation details

1.03 Project/Site Conditions

A. Input power: 120VAC utility grade power

PART 2 - PRODUCTS

2.01 UPS Equipment

A. Manufacturer

1. APC by Schneider Electric
2. Alpha Technologies
3. MGE Pulsar Evolution
4. CyberPower
5. Or Equal.

2.02 Equipment

A. This Specification details requirements for Uninterruptible Power Supplies with three distinct form factors. Physical location and type of load being protected determine which UPS form factor shall be provided.

1. Control Panel UPS
   a. Located within industrial control panels

b. Protected loads are PLCs and associated equipment, or other critical equipment in control panels
c. For 1500VA locations (See Schedule), APC Back-UPS Pro 1500VA
d. For 650VA locations (See Schedule) CyberPower UPS, model number SX650U

B. Requirements common to all three UPS form factors

1. Maintain output frequency at 60Hz +/- 3 Hz
2. Output Voltage Distortion (Full Load)
   a. Less than 2% for 100% linear loads
   b. Less than 8% for 100% non-linear loads
3. UPS shall supply power to PLC, HMI, Ethernet Switches, DC power supplies, field instruments, and other low voltage control devices as specified and as shown on Drawings and Plans.
4. Size for 75% of connected electrical load or "Minimum Output Capacity" as indicated in the schedule below, whichever is greater.
5. UPS shall have enough capacity to power devices after the utility power has failed for a period of time indicated in the schedule below. Provide with extended battery module(s) if needed to meet this requirement.

C. Additional requirements for the Control Panel UPS form factor

1. Operating Temperature
   a. For indoor enclosures in an air conditioned area, the standard battery is acceptable (-S SKUs): +32 to 104 Deg. F
   b. For all outdoor enclosures, indoor enclosures that are NOT in an air conditioned area, or enclosures where the interior temperature is calculated to rise above 100 Deg. F, the high temperature battery option is required (-H SKUs): +32 to 122Deg. F.

PART 3 - EXECUTION

3.01 Preparation

A. Condition power as required to provide stable process control system operation.

3.02 Installation

A. Install and wire in accordance with SCADA Control System Integrator's and/or Equipment Manufacturer's written instructions.

B. Install internal to PLC Panel or adjacent to equipment that is being protected.

1. Control Panel UPS can be installed in one of the following configurations:
   a. UPS can be mounted to the bottom of the control panel. This should not impede access to wire trays, conduit penetrations, or any devices below or behind the UPS.
2. UPS must not block access to components on the backpanel.

3. Conduits for wiring typically enter enclosures from the bottom of the enclosure. If the UPS sits on the bottom of the enclosure, ensure there is enough panel depth for conduits to enter.
4. Final installations that have the UPS sitting on top of wiring or conduit entry points will not be accepted.

C. Protect UPS from the environment at a level equal to or greater than equipment being protected.

1. Do not place UPS on top of PLC enclosure.
2. If the PLC is in a Type 4X enclosure, UPS shall be in same enclosure or separate enclosure of the same rating.
3. In offices where UPS is providing backup power for computers and computers are not in enclosures, it is acceptable for UPSs to be in the open as well.

SCHEDULE A – UPS

TAG	Location	Form Factor	Minimum Runtime	Minimum Output Capacity	Additional Requirements
UPS-ILS	Influent Lift Station UPS (CP-ILS)	Control Panel	20 min.	1500 VA	
UPS-GRT	Grit Building UPS (CP-GRT)	Control Panel	20 min.	1500 VA	
UPS-SHF	Solids Handling Facility UPS (CP-SHF)	Control Panel	20 min.	1500 VA	
UPS-RPS	Residuals Pump Station UPS (CP-RPS)	Control Panel	20 min.	1500 VA	
UPS-BS1	Blower Structure No. 1 UPS (CP-BS1)	Control Panel	20 min.	650 VA	

-END-

SECTION 13482 – SCADA AND CONTROL SYSTEMS - I/O LIST

PART 1 - GENERAL

1.01 Summary

A. Section Includes

1. SCADA System hard-wired PLC I/O and programming parameters.
2. I/O Listings for SCADA PLCs.

B. Abbreviations and References

1. I/O: Inputs/Outputs
2. PLC: Programmable Logic Controller

PART 2 - SERVICES

2.01 I/O List Definitions

A. TYPE is defined as one of following:

1. DI Designates Discrete (Digital) Input
2. DO Designates Discrete (Digital) or Relay Output
3. AI Designates Analog Input
4. AO Designates Analog Output

B. INSTRUMENT TAG # is the field tagname given to the I/O point as designated on the Drawings.

1. This list is not to be considered a comprehensive list of tag names.

C. EQUIPMENT ID # describes associated equipment.

1. Shop Submittals for PLC Drawings shall have Instrument Tag Names and Equipment ID numbers as described on Process and Instrumentation Diagram (P&ID) Drawings.

Schedule 1 – PLC-ILS (PLC #1)

The following table lists I/O details for the Influent Lift Station PLC

Equipment Tag #	Instrument Tag #	PLC	Slot	Channel	Address	Equipment Signal	DI	DO	AI	AO	Signal Detail
Slot 1 – Analog Inputs											
	AIT-205	PLC-ILS	Slot 1	Ch. 0	I:1.0	Plant Influent pH #1			1		pH Level
	AIT-206	PLC-ILS	Slot 1	Ch. 1	I:1.1	Plant Influent pH #2			1		pH Level
	AIT-207	PLC-ILS	Slot 1	Ch. 2	I:1.2	Plant Influent pH #3			1		pH Level
	LDIT-261	PLC-ILS	Slot 1	Ch. 3	I:1.3	Screen 260 Differential Level			1		Level
	LIT-200	PLC-ILS	Slot 1	Ch. 4	I:1.4	Influent Lift Station Wet Well Level			1		Level
LSP-210		PLC-ILS	Slot 1	Ch. 5	I:1.5	RWW Pump 210 Speed Feedback			1		Speed Fdbk
LSP-230		PLC-ILS	Slot 1	Ch. 6	I:1.6	RWW Pump 230 Speed Feedback			1		Speed Fdbk
LSP-250		PLC-ILS	Slot 1	Ch. 7	I:1.7	RWW Pump 250 Speed Feedback			1		Speed Fdbk
Slot 2 – Analog Inputs											
		PLC-ILS	Slot 2	Ch. 0	I:2.0	Spare			1		Spare
		PLC-ILS	Slot 2	Ch. 1	I:2.1	Spare			1		Spare
		PLC-ILS	Slot 2	Ch. 2	I:2.2	Spare			1		Spare
		PLC-ILS	Slot 2	Ch. 3	I:2.3	Spare			1		Spare
		PLC-ILS	Slot 2	Ch. 4	I:2.4	Spare			1		Spare
		PLC-ILS	Slot 2	Ch. 5	I:2.5	Spare			1		Spare
		PLC-ILS	Slot 2	Ch. 6	I:2.6	Spare			1		Spare
		PLC-ILS	Slot 2	Ch. 7	I:2.7	Spare			1		Spare
Slot 3 – Slot Filler											
		PLC-ILS	Slot 3	N/A	N/A	Slot Filler (No I/O)					Slot Filler
Slot 4 – Slot Filler											
		PLC-ILS	Slot 4	N/A	N/A	Slot Filler (No I/O)					Slot Filler
Slot 5 – Analog Output											
LSP-210		PLC-ILS	Slot 5	Ch. 0	O:5.0	RWW Pump 210 Speed Command				1	Speed CMD
LSP-230		PLC-ILS	Slot 5	Ch. 1	O:5.1	RWW Pump 230 Speed Command				1	Speed CMD
LSP-250		PLC-ILS	Slot 5	Ch. 2	O:5.2	RWW Pump 250 Speed Command				1	Speed CMD
CS-1		PLC-ILS	Slot 5	Ch. 3	O:5.3	Raw Water Composite Sampler Pacing				1	Sampler Pacing CMD
Slot 6 – Analog Output											
		PLC-ILS	Slot 6	Ch. 0	O:6.0	Spare				1	Spare
		PLC-ILS	Slot 6	Ch. 1	O:6.1	Spare				1	Spare
		PLC-ILS	Slot 6	Ch. 2	O:6.2	Spare				1	Spare
		PLC-ILS	Slot 6	Ch. 3	O:6.3	Spare				1	Spare

Equipment Tag #	Instrument Tag #	PLC	Slot	Channel	Address	Equipment Signal	DI	DO	AI	AO	Signal Detail
Slot 7 – AC Inputs											
		PLC-ILS	Slot 7	Ch. 0	I:7/0	Screenings Compactor 280	1				Running
		PLC-ILS	Slot 7	Ch. 1	I:7/1	Screenings Compactor 280	1				Fail
		PLC-ILS	Slot 7	Ch. 2	I:7/2	Screenings Grinder 270	1				Running
		PLC-ILS	Slot 7	Ch. 3	I:7/3	Screenings Grinder 270	1				Fail
LSP-240		PLC-ILS	Slot 7	Ch. 4	I:7/4	RWW Pump 240	1				In Remote
LSP-240		PLC-ILS	Slot 7	Ch. 5	I:7/5	RWW Pump 240	1				Running
LSP-240		PLC-ILS	Slot 7	Ch. 6	I:7/6	RWW Pump 240	1				Fail
LSP-220		PLC-ILS	Slot 7	Ch. 7	I:7/7	RWW Pump 220	1				In Remote
LSP-220		PLC-ILS	Slot 7	Ch. 8	I:7/8	RWW Pump 220	1				Running
LSP-220		PLC-ILS	Slot 7	Ch. 9	I:7/9	RWW Pump 220	1				Fail
	AIT-265	PLC-ILS	Slot 7	Ch. 10	I:7/10	Screenings Room Combustible Gas Monitor (Methane)	1				Hi Level
	AIT-265	PLC-ILS	Slot 7	Ch. 11	I:7/11	Screenings Room Combustible Gas Monitor (Methane)	1				Hi-Hi Level
	AIT-265	PLC-ILS	Slot 7	Ch. 12	I:7/12	Screenings Room Combustible Gas Monitor (Methane)	1				Sensor Fail
	AIT-265	PLC-ILS	Slot 7	Ch. 13	I:7/13	Screenings Room Combustible Gas Monitor (Gasoline)	1				Hi Level
	AIT-265	PLC-ILS	Slot 7	Ch. 14	I:7/14	Screenings Room Combustible Gas Monitor (Gasoline)	1				Hi-Hi Level
	AIT-265	PLC-ILS	Slot 7	Ch. 15	I:7/15	Screenings Room Combustible Gas Monitor (Gasoline)	1				Sensor Fail
Slot 8 – AC Inputs											
		PLC-ILS	Slot 8	Ch. 0	I:8/0	Screen 260 Control Panel	1				Running
		PLC-ILS	Slot 8	Ch. 1	I:8/1	Screen 260 Control Panel	1				Fail
		PLC-ILS	Slot 8	Ch. 2	I:8/2	Screen 260 Control Panel	1				In Auto
	LSH-262	PLC-ILS	Slot 8	Ch. 3	I:8/3	Screen Upstream Level Transmitter	1				Hi Level
	LDSH-261	PLC-ILS	Slot 8	Ch. 4	I:8/4	Screen Differential Level Switch	1				Hi Level
	LSHH-201	PLC-ILS	Slot 8	Ch. 5	I:8/5	Influent Wetwell Level Switch	1				Hi-Hi Level
	LSL-202	PLC-ILS	Slot 8	Ch. 6	I:8/6	Influent Wetwell Low Water Cut-off	1				Low Water
LSP-210		PLC-ILS	Slot 8	Ch. 7	I:8/7	RWW Pump 210	1				In Remote
LSP-210		PLC-ILS	Slot 8	Ch. 8	I:8/8	RWW Pump 210	1				Running
LSP-210		PLC-ILS	Slot 8	Ch. 9	I:8/9	RWW Pump 210	1				Fail
LSP-230		PLC-ILS	Slot 8	Ch. 10	I:8/10	RWW Pump 230	1				In Remote
LSP-230		PLC-ILS	Slot 8	Ch. 11	I:8/11	RWW Pump 230	1				Fail
LSP-230		PLC-ILS	Slot 8	Ch. 12	I:8/12	RWW Pump 230	1				Running
LSP-250		PLC-ILS	Slot 8	Ch. 13	I:8/13	RWW Pump 250	1				In Remote
LSP-250		PLC-ILS	Slot 8	Ch. 14	I:8/14	RWW Pump 250	1				Fail
LSP-250		PLC-ILS	Slot 8	Ch. 15	I:8/15	RWW Pump 250	1				Running

Equipment Tag #	Instrument Tag #	PLC	Slot	Channel	Address	Equipment Signal	DI	DO	AI	AO	Signal Detail
Slot 9 – AC Inputs											
		PLC-ILS	Slot 9	Ch. 0	I:9/0	Seal Water Pump System	1				Fail
		PLC-ILS	Slot 9	Ch. 1	I:9/1	Pre-Aeration Blower #1	1				Running
		PLC-ILS	Slot 9	Ch. 2	I:9/2	Pre-Aeration Blower #1	1				Fail
		PLC-ILS	Slot 9	Ch. 3	I:9/3	Pre-Aeration Blower #2	1				Running
		PLC-ILS	Slot 9	Ch. 4	I:9/4	Pre-Aeration Blower #2	1				Fail
		PLC-ILS	Slot 9	Ch. 5	I:9/5	Engine Generator Status	1				Status
		PLC-ILS	Slot 9	Ch. 6	I:9/6	Utility Feed Status	1				Status
		PLC-ILS	Slot 9	Ch. 7	I:9/7	Spare	1				Spare
		PLC-ILS	Slot 9	Ch. 8	I:9/8	Spare	1				Spare
		PLC-ILS	Slot 9	Ch. 9	I:9/9	Spare	1				Spare
		PLC-ILS	Slot 9	Ch. 10	I:9/10	Spare	1				Spare
		PLC-ILS	Slot 9	Ch. 11	I:9/11	Spare	1				Spare
		PLC-ILS	Slot 9	Ch. 12	I:9/12	Spare	1				Spare
		PLC-ILS	Slot 9	Ch. 13	I:9/13	Spare	1				Spare
		PLC-ILS	Slot 9	Ch. 14	I:9/14	Spare	1				Spare
		PLC-ILS	Slot 9	Ch. 15	I:9/15	Spare	1				Spare
Slot 10 – Slot Filler											
		PLC-ILS	Slot 10	N/A	N/A	Slot Filler (No I/O)					Slot Filler
Slot 11 – AC Outputs											
LSP--240		PLC-ILS	Slot 11	Ch. 0	O:11/0	RWW Pump 240		1			Run CMD
LSP-220		PLC-ILS	Slot 11	Ch. 1	O:11/1	RWW Pump 220		1			Run CMD
LSP-210		PLC-ILS	Slot 11	Ch. 2	O:11/2	RWW Pump 210		1			Run CMD
LSP-230		PLC-ILS	Slot 11	Ch. 3	O:11/3	RWW Pump 230		1			Run CMD
LSP-250		PLC-ILS	Slot 11	Ch. 4	O:11/4	RWW Pump 250		1			Run CMD
		PLC-ILS	Slot 11	Ch. 5	O:11/5	Spare		1			Spare
		PLC-ILS	Slot 11	Ch. 6	O:11/6	Spare		1			Spare
		PLC-ILS	Slot 11	Ch. 7	O:11/7	Spare		1			Spare
		PLC-ILS	Slot 11	Ch. 8	O:11/8	Spare		1			Spare
		PLC-ILS	Slot 11	Ch. 9	O:11/9	Spare		1			Spare
		PLC-ILS	Slot 11	Ch. 10	O:11/10	Spare		1			Spare
		PLC-ILS	Slot 11	Ch. 11	O:11/11	Spare		1			Spare
		PLC-ILS	Slot 11	Ch. 12	O:11/12	Spare		1			Spare
		PLC-ILS	Slot 11	Ch. 13	O:11/13	Spare		1			Spare
		PLC-ILS	Slot 11	Ch. 14	O:11/14	Spare		1			Spare
		PLC-ILS	Slot 11	Ch. 15	O:11/15	Spare		1			Spare
Slot 12 – Slot Filler											
		PLC-ILS	Slot 12	N/A	N/A	Slot Filler (No I/O)					Slot Filler

Schedule 2 – PLC-GRT (PLC #2)

The following table lists I/O details for the Grit Building PLC.

Equipment Tag #	Instrument Tag #	PLC	Slot	Channel	Address	Equipment Signal	DI	DO	AI	AO	Signal Detail
Slot 1 – Analog Inputs											
	LIT-401	PLC-GRT	Slot 1	Ch. 0	I:1.0	FECL Storage Tank Level			1		Level
P-410		PLC-GRT	Slot 1	Ch. 1	I:1.1	FECL Pump P-410 Stroke Speed Indication			1		Stroke Speed
P-410		PLC-GRT	Slot 1	Ch. 2	I:1.2	FECL Pump P-410 Stroke Length Indication			1		Stroke Length
P-420		PLC-GRT	Slot 1	Ch. 3	I:1.3	FECL Pump P-420 Stroke Speed Indication			1		Stroke Speed
P-420		PLC-GRT	Slot 1	Ch. 4	I:1.4	FECL Pump P-420 Stroke Length Indication			1		Stroke Length
P-430		PLC-GRT	Slot 1	Ch. 5	I:1.5	FECL Pump P-430 Stroke Speed Indication			1		Stroke Speed
P-430		PLC-GRT	Slot 1	Ch. 6	I:1.6	FECL Pump P-430 Stroke Length Indication			1		Stroke Length
	LIT-391	PLC-GRT	Slot 1	Ch. 7	I:1.7	Clarifier #2 Sludge Blanket Level			1		Level
Slot 2 – Analog Inputs											
	LIT-392	PLC-GRT	Slot 2	Ch. 0	I:2.0	Clarifier #1 Sludge Blanket Level			1		Level
	LIT-393	PLC-GRT	Slot 2	Ch. 1	I:2.1	Clarifier #2 Sludge Scum Wetwell Level			1		Level
	LIT-394	PLC-GRT	Slot 2	Ch. 2	I:2.2	Clarifier #1 Sludge Scum Wetwell Level			1		Level
PRSC-P-800		PLC-GRT	Slot 2	Ch. 3	I:2.3	Primary Clarifiers Scum P800 Speed Indication			1		Speed
	FIT-301	PLC-GRT	Slot 2	Ch. 4	I:2.4	Plant Influent Flow			1		0-15 MGD
		PLC-GRT	Slot 2	Ch. 5	I:2.5	Spare			1		Spare
		PLC-GRT	Slot 2	Ch. 6	I:2.6	Spare			1		Spare
		PLC-GRT	Slot 2	Ch. 7	I:2.7	Spare			1		Spare
Slot 3 – Slot Filler											
		PLC-GRT	Slot 3	N/A	N/A	Slot Filler (No I/O)					Slot Filler
Slot 4 – Slot Filler											
		PLC-GRT	Slot 4	N/A	N/A	Slot Filler (No I/O)					Slot Filler
Slot 5 – Slot Filler											
		PLC-GRT	Slot 5	N/A	N/A	Slot Filler (No I/O)					Slot Filler
Slot 6 – Slot Filler											
		PLC-GRT	Slot 6	N/A	N/A	Slot Filler (No I/O)					Slot Filler
Slot 7 – Analog Outputs											
P-410		PLC-GRT	Slot 7	Ch. 0	O:7.0	FECL Pump P-410 Stroke Length Control				1	10-100% Length
P-410		PLC-GRT	Slot 7	Ch. 1	O:7.1	FECL Pump P-410 Stroke Speed Control				1	20-100 Strokes/ Min
P-420		PLC-GRT	Slot 7	Ch. 2	O:7.2	FECL Pump P-420 Stroke Length Control				1	10-100% Length
P-420		PLC-GRT	Slot 7	Ch. 3	O:7.3	FECL Pump P-420 Stoke Speed Control				1	20-100 Strokes/ Min
Slot 8 – Analog Outputs											
P-430		PLC-GRT	Slot 8	Ch. 0	O:8.0	FECL Pump P-430 Stroke Length Control				1	10-100% Length
P-430		PLC-GRT	Slot 8	Ch. 1	O:8.1	FECL Pump P-430 Stroke Speed Control				1	20-100 Strokes/ Min

Equipment Tag #	Instrument Tag #	PLC	Slot	Channel	Address	Equipment Signal	DI	DO	AI	AO	Signal Detail
PRSC-P-800		PLC-GRT	Slot 8	Ch. 2	O:8.2	Primary Clarifier Scum Pump P800 Speed Control				1	Speed Control
		PLC-GRT	Slot 8	Ch. 3	O:8.3	Spare				1	Spare
Slot 9 –Slot Filter											
		PLC-GRT	Slot 9	N/A	N/A	Slot Filler (No I/O)					Slot Filler
Slot 10 – AC Inputs											
	LSH-441	PLC-GRT	Slot 10	Ch. 0	I:10/0	FECL Sump Level High	1				Level High
V-361		PLC-GRT	Slot 10	Ch. 1	I:10/1	Grit Pump 360 Suction Valve In Remote	1				In Remote
V-361		PLC-GRT	Slot 10	Ch. 2	I:10/2	Grit Pump 360 Suction Valve Open	1				Open
V-361		PLC-GRT	Slot 10	Ch. 3	I:10/3	Grit Pump 360 Suction Valve Close	1				Closed
V-371		PLC-GRT	Slot 10	Ch. 4	I:10/4	Grit Pump 370 Suction Valve In Remote	1				In Remote
V-371		PLC-GRT	Slot 10	Ch. 5	I:10/5	Grit Pump 370 Suction Valve Open	1				Open
V-371		PLC-GRT	Slot 10	Ch. 6	I:10/6	Grit Pump 370 Suction Valve Close	1				Close
GRT-GRB-310		PLC-GRT	Slot 10	Ch. 7	I:10/7	Grit Basin 310 Drive Running	1				Running
GRT-GRB-310		PLC-GRT	Slot 10	Ch. 8	I:10/8	Grit Basin 310 Drive Fail	1				Fail
GRT-GRB-320		PLC-GRT	Slot 10	Ch. 9	I:10/9	Grit Basin 320 Drive Running	1				Running
GRT-GRB-320		PLC-GRT	Slot 10	Ch. 10	I:10/10	Grit Basin 320 Drive Fail	1				Fail
P-360		PLC-GRT	Slot 10	Ch. 11	I:10/11	Grit Pump 360 In Remote	1				In Remote
P-370		PLC-GRT	Slot 10	Ch. 12	I:10/12	Grit Pump 370 In Remote	1				In Remote
		PLC-GRT	Slot 10	Ch. 13	I:10/13	Grit Pump 380 In Remote	1				In Remote
		PLC-GRT	Slot 10	Ch. 14	I:10/14	Grit Classifier 390 In Remote	1				In Remote
		PLC-GRT	Slot 10	Ch. 15	I:10/15	Grit Classifier 390 Running	1				Running
Slot 11 – AC Inputs											
P-360		PLC-GRT	Slot 11	Ch. 0	I:11/0	Grit Pump 360 Running	1				Running
P-360		PLC-GRT	Slot 11	Ch. 1	I:11/1	Grit Pump 360 Fail	1				Fail
		PLC-GRT	Slot 11	Ch. 2	I:11/2	Grit Classifier 390 Fail	1				Fail
		PLC-GRT	Slot 11	Ch. 3	I:11/3	Grit Classifier 380 Running	1				Running
		PLC-GRT	Slot 11	Ch. 4	I:11/4	Grit Classifier 380 Fail	1				Fail
P-370		PLC-GRT	Slot 11	Ch. 5	I:11/5	Grit Pump 370 Running	1				Running
P-370		PLC-GRT	Slot 11	Ch. 6	I:11/6	Grit Pump 370 Fail	1				Fail
P-410		PLC-GRT	Slot 11	Ch. 7	I:11/7	FECL Pump 410 In-Remote	1				In-Remote
P-410		PLC-GRT	Slot 11	Ch. 8	I:11/8	FECL Pump 410 Fail	1				Fail
P-410		PLC-GRT	Slot 11	Ch. 9	I:11/9	FECL Pump 410 Running	1				Running
P-420		PLC-GRT	Slot 11	Ch. 10	I:11/10	FECL Pump 420 In-Remote	1				In-Remote
P-420		PLC-GRT	Slot 11	Ch. 11	I:11/11	FECL Pump 420 420 Fail	1				Fail
P-420		PLC-GRT	Slot 11	Ch. 12	I:11/12	FECL Pump 420 Running	1				Running
P-430		PLC-GRT	Slot 11	Ch. 13	I:11/13	FECL Pump 430 In-Remote	1				In-Remote
P-430		PLC-GRT	Slot 11	Ch. 14	I:11/14	FECL Pump 430 Fail	1				Fail
P-430		PLC-GRT	Slot 11	Ch. 15	I:11/15	FECL Pump 430 Running	1				Running

Equipment Tag #	Instrument Tag #	PLC	Slot	Channel	Address	Equipment Signal	DI	DO	AI	AO	Signal Detail
Slot 12 – AC Inputs											
NPW-V-314		PLC-GRT	Slot 12	Ch. 0	I:12/0	Grit Basin 310 Flushing Water Valve In-Remote	1				In-Remote
NPW-V-314		PLC-GRT	Slot 12	Ch. 1	I:12/1	Grit Basin 310 Flushing Water Valve Closed	1				Closed
NPW-V-314		PLC-GRT	Slot 12	Ch. 2	I:12/2	Grit Basin 310 Flushing Water Valve Open	1				Open
NPW-V-324		PLC-GRT	Slot 12	Ch. 3	I:12/3	Grit Basin 320 Flushing Water Valve In-Remote	1				In-Remote
NPW-V-324		PLC-GRT	Slot 12	Ch. 4	I:12/4	Grit Basin 320 Flushing Water Valve Closed	1				Closed
NPW-V-324		PLC-GRT	Slot 12	Ch. 5	I:12/5	Grit Basin 320 Flushing Water Valve Open	1				Open
PRSC-P-800		PLC-GRT	Slot 12	Ch. 6	I:12/6	Scum Wetwell Pump 800 Running	1				Running
PRSC-P-800		PLC-GRT	Slot 12	Ch. 7	I:12/7	Scum Wetwell Pump 800 Fail	1				Fail
PRSC-P-800		PLC-GRT	Slot 12	Ch. 8	I:12/8	Scum Wetwell Pump 800 In Remote	1				In Remote
P-810		PLC-GRT	Slot 12	Ch. 9	I:12/9	Primary Sludge Pump #1 In Remote	1				In Remote
P-820		PLC-GRT	Slot 12	Ch. 10	I:12/10	Primary Sludge Pump #2 In Remote	1				In Remote
	ZSO-311	PLC-GRT	Slot 12	Ch. 11	I:12/11	Grit Basin 310 Influent Gate Open	1				Open
	ZSO-321	PLC-GRT	Slot 12	Ch. 12	I:12/12	Grit Basin 320 Influent Gate Open	1				Open
	ZSO-331	PLC-GRT	Slot 12	Ch. 13	I:12/13	Grit Basins Bypass Gate Open	1				Open
MX-340		PLC-GRT	Slot 12	Ch. 14	I:12/14	Effluent Junction Box Mixer 340 Running	1				Running
MX-340		PLC-GRT	Slot 12	Ch. 15	I:12/15	Effluent Junction Box Mixer 340 Fail	1				Fail
Slot 13 – AC Inputs											
MX-350		PLC-GRT	Slot 13	Ch. 0	I:13/0	Effluent Junction Box Mixer 350 Running	1				Running
MX-350		PLC-GRT	Slot 13	Ch. 1	I:13/1	Effluent Junction Box Mixer 350 Fail	1				Fail
PCLR-CLR-1		PLC-GRT	Slot 13	Ch. 2	I:13/2	Primary Clarifier #1 Running	1				Running
PCLR-CLR-1		PLC-GRT	Slot 13	Ch. 3	I:13/3	Primary Clarifier #1 Fail	1				Fail
PCLR-CLR-1		PLC-GRT	Slot 13	Ch. 4	I:13/4	Primary Clarifier #1 Torque Alarm	1				Alarm
PCLR-CLR-2		PLC-GRT	Slot 13	Ch. 5	I:13/5	Primary Clarifier #2 Running	1				Running
PCLR-CLR-2		PLC-GRT	Slot 13	Ch. 6	I:13/6	Primary Clarifier #2 Fail	1				Fail
PCLR-CLR-2		PLC-GRT	Slot 13	Ch. 7	I:13/7	Primary Clarifier #2 Torque Alarm	1				Alarm
		PLC-GRT	Slot 13	Ch. 8	I:13/8	Seal Water System Common Alarm	1				Alarm
V-801		PLC-GRT	Slot 13	Ch. 9	I:13/9	Primary Sludge Pumps Discharge (Return Valve)	1				Open Indicator
V-801		PLC-GRT	Slot 13	Ch. 10	I:13/10	Primary Sludge Pumps Discharge (Return Valve)	1				Closed Indicator
V-801		PLC-GRT	Slot 13	Ch. 11	I:13/11	Primary Sludge Pumps Discharge (Return Valve)	1				In Remote
P-810		PLC-GRT	Slot 13	Ch. 12	I:13/12	Primary Sludge Pump #1 Run Status	1				Run Status
P-820		PLC-GRT	Slot 13	Ch. 13	I:13/13	Primary Sludge #2 Run Status	1				Run Status
		PLC-GRT	Slot 13	Ch. 14	I:13/14	Grit Bldg. Fire Alarm	1				Fire Alarm
		PLC-GRT	Slot 13	Ch. 15	I:13/15	Grit Bldg. Eyewash #1 in Use	1				Eyewash in use
Slot 14 – AC Inputs											
		PLC-GRT	Slot 14	Ch. 0	I:14/0	Grit Bldg. Eyewash #2 In Use	1				Eyewash in use
		PLC-GRT	Slot 14	Ch. 1	I:14/1	SPARE	1				SPARE
		PLC-GRT	Slot 14	Ch. 2	I:14/2	SPARE	1				SPARE

Equipment Tag #	Instrument Tag #	PLC	Slot	Channel	Address	Equipment Signal	DI	DO	AI	AO	Signal Detail
		PLC-GRT	Slot 14	Ch. 3	I:14/3	SPARE	1				SPARE
		PLC-GRT	Slot 14	Ch. 4	I:14/4	SPARE	1				SPARE
		PLC-GRT	Slot 14	Ch. 5	I:14/5	SPARE	1				SPARE
		PLC-GRT	Slot 14	Ch. 6	I:14/6	SPARE	1				SPARE
		PLC-GRT	Slot 14	Ch. 7	I:14/7	SPARE	1				SPARE
		PLC-GRT	Slot 14	Ch. 8	I:14/8	SPARE	1				SPARE
		PLC-GRT	Slot 14	Ch. 9	I:14/9	SPARE	1				SPARE
		PLC-GRT	Slot 14	Ch. 10	I:14/10	SPARE	1				SPARE
		PLC-GRT	Slot 14	Ch. 11	I:14/11	SPARE	1				SPARE
		PLC-GRT	Slot 14	Ch. 12	I:14/12	SPARE	1				SPARE
		PLC-GRT	Slot 14	Ch. 13	I:14/13	SPARE	1				SPARE
		PLC-GRT	Slot 14	Ch. 14	I:14/14	SPARE	1				SPARE
		PLC-GRT	Slot 14	Ch. 15	I:14/15	SPARE	1				SPARE
Slot 15 – Slot Filler											
		PLC-GRT	Slot 15	N/A	N/A	Slot Filler (No I/O)					Slot Filler
Slot 16- Slot Filler											
		PLC-GRT	Slot 16	N/A	N/A	Slot Filler (No I/O)					Slot Filler
Slot 17 – AC Outputs											
V-361		PLC-GRT	Slot 17	Ch. 0	O:17/0	Grit Pump 360 Suction Valve		1			Open CMD
V-361		PLC-GRT	Slot 17	Ch. 1	O:17/1	Grit Pump 360 Suction Valve		1			Close CMD
V-371		PLC-GRT	Slot 17	Ch. 2	O:17/2	Grit Pump 370 Suction Valve		1			Open CMD
V-371		PLC-GRT	Slot 17	Ch. 3	O:17/3	Grit Pump 370 Suction Valve		1			Close CMD
P-360		PLC-GRT	Slot 17	Ch. 4	O:17/4	Grit Pump 360 Run CMD		1			Run CMD
		PLC-GRT	Slot 17	Ch. 5	O:17/5	Grit Classifier 390 Run CMD		1			Run CMD
		PLC-GRT	Slot 17	Ch. 6	O:17/6	Grit Classifier 380 Run CMD		1			Run CMD
P-370		PLC-GRT	Slot 17	Ch. 7	O:17/7	Grit Pump 370 Run CMD		1			Run CMD
P-410		PLC-GRT	Slot 17	Ch. 8	O:17/8	FECL Pump P-410 Run CMD		1			Run CMD
P-420		PLC-GRT	Slot 17	Ch. 9	O:17/9	FECL Pump P-420 Run CMD		1			Run CMD
P-430		PLC-GRT	Slot 17	Ch. 10	O:17/10	FECL Pump P-430 Run CMD		1			Run CMD
NPW-V-314		PLC-GRT	Slot 17	Ch. 11	O:17/11	Grit Basin 310 Flushing Water Valve Close		1			Close CMD
NPW-V-314		PLC-GRT	Slot 17	Ch. 12	O:17/12	Grit Basin 310 Flushing Water Valve Open		1			Open CMD
NPW-V-324		PLC-GRT	Slot 17	Ch. 13	O:17/13	Grit Basin 320 Flushing Water Valve Close		1			Close CMD
NPW-V-324		PLC-GRT	Slot 17	Ch. 14	O:17/14	Grit Basin 320 Flushing Water Valve Open		1			Open CMD
PRSC-P-800		PLC-GRT	Slot 17	Ch. 15	O:17/15	Primary Clarifiers Scum Wetwell Pump 800 Run CMD		1			Run CMD
Slot 18 – AC Outputs											
P-810		PLC-GRT	Slot 18	Ch. 0	O:18/0	Primary Sludge Pump #1 Start CMD		1			Start CMD
V-801		PLC-GRT	Slot 18	Ch. 1	O:18/1	Primary Sludge Pumps Discharge Valve to Primary Split		1			Open CMD
V-801		PLC-GRT	Slot 18	Ch. 2	O:18/2	Primary Sludge Pumps Discharge Valve to Primary Split		1			Close CMD

Equipment Tag #	Instrument Tag #	PLC	Slot	Channel	Address	Equipment Signal	DI	DO	AI	AO	Signal Detail
P-820		PLC-GRT	Slot 18	Ch. 3	O:18/3	Primary Sludge Pump #2 Start CMD		1			Start CMD
		PLC-GRT	Slot 18	Ch. 4	O:18/4	SPARE		1			
		PLC-GRT	Slot 18	Ch. 5	O:18/5	SPARE		1			
		PLC-GRT	Slot 18	Ch. 6	O:18/6	SPARE		1			
		PLC-GRT	Slot 18	Ch. 7	O:18/7	SPARE		1			
		PLC-GRT	Slot 18	Ch. 8	O:18/8	SPARE		1			
		PLC-GRT	Slot 18	Ch. 9	O:18/9	SPARE		1			
		PLC-GRT	Slot 18	Ch. 10	O:18/10	SPARE		1			
		PLC-GRT	Slot 18	Ch. 11	O:18/11	SPARE		1			
		PLC-GRT	Slot 18	Ch. 12	O:18/12	SPARE		1			
		PLC-GRT	Slot 18	Ch. 13	O:18/13	SPARE		1			
		PLC-GRT	Slot 18	Ch. 14	O:18/14	SPARE		1			
		PLC-GRT	Slot 18	Ch. 15	O:18/15	SPARE		1			

Schedule 3 – PLC-RPS (PLC #3)

The following table lists I/O details for the Return Sludge Pump Station PLC.

Equipment Tag #	Instrument Tag #	PLC	Slot	Channel	Address	Equipment Signal	DI	DO	AI	AO	Signal Detail
Slot 1 – Analog Input											
	FIT-642	PLC-RPS	Slot 1	Ch. 0	I:1.0	Blower No. 4 Air Flow			1		0-2000 CFM
	FIT-652	PLC-RPS	Slot 1	Ch. 1	I:1.1	Blower No. 5 Air Flow			1		0-2000 CFM
	FIT-603	PLC-RPS	Slot 1	Ch. 2	I:1.2	Aeration Basin #3 Air Flow			1		0-2500 SCFM
	FIT-661	PLC-RPS	Slot 1	Ch. 3	I:1.3	Reaeration Basins Header Air Flow			1		0-2500 SCFM
	FIT-662	PLC-RPS	Slot 1	Ch. 4	I:1.4	Reaeration Basin #2 Air Flow			1		0-1300 SCFM
	FIT-665	PLC-RPS	Slot 1	Ch. 5	I:1.5	UV Cleaning Structure Air Flow Field Verify			1		Field Verify
		PLC-RPS	Slot 1	Ch. 6	I:1.6	SPARE			1		
		PLC-RPS	Slot 1	Ch. 7	I:1.7	SPARE			1		
Slot 2 – Analog Input											
		PLC-RPS	Slot 2	Ch. 0	I:2.0	SPARE			1		
		PLC-RPS	Slot 2	Ch. 1	I:2.1	SPARE			1		
		PLC-RPS	Slot 2	Ch. 2	I:2.2	SPARE			1		
		PLC-RPS	Slot 2	Ch. 3	I:2.3	SPARE			1		
V-633		PLC-RPS	Slot 2	Ch. 4	I:2.4	Aeration Basin #3 Air Valve Position Indication			1		0-100% Full Open
V-641		PLC-RPS	Slot 2	Ch. 5	I:2.5	Blower #4 Suction Valve Position Indication			1		0-100% Full Open
V-643		PLC-RPS	Slot 2	Ch. 6	I:2.6	Reaeration Basin #1 Air Valve Position Indication			1		0-100% Full Open
V-651		PLC-RPS	Slot 2	Ch. 7	I:2.7	Blower #5 Suction Valve Position Indication			1		0-100% Full Open
Slot 3 – Analog Input											
V-653		PLC-RPS	Slot 3	Ch. 0	I:3.0	Reaeration Basin #2 Air Valve Position Indication			1		0-100% Full Open
		PLC-RPS	Slot 3	Ch. 1	I:3.1	SPARE			1		
		PLC-RPS	Slot 3	Ch. 2	I:3.2	SPARE			1		
	AIT-606	PLC-RPS	Slot 3	Ch. 3	I:3.3	Aeration Basin #3 Dissolved Oxygen			1		0-20 PPM
	AIT-663	PLC-RPS	Slot 3	Ch. 4	I:3.4	Reaeration Basin #1 Dissolved Oxygen			1		0-20 PPM
	AIT-664	PLC-RPS	Slot 3	Ch. 5	I:3.5	Reaeration Basin #2 Dissolved Oxygen			1		0-20 PPM
	AIT-670	PLC-RPS	Slot 3	Ch. 6	I:3.6	Final Effluent Dissolved Oxygen			1		0-20 PPM
		PLC-RPS	Slot 3	Ch. 7	I:3.7	SPARE			1		
Slot 4 – Analog Input											
		PLC-RPS	Slot 4	Ch. 0	I:4.0	SPARE			1		
		PLC-RPS	Slot 4	Ch. 1	I:4.1	SPARE			1		
	AIT-691	PLC-RPS	Slot 4	Ch. 2	I:4.2	Final Effluent pH #1			1		0-14 pH
	AIT-692	PLC-RPS	Slot 4	Ch. 3	I:4.3	Final Effluent pH #2			1		0-14 pH
	AIT-693	PLC-RPS	Slot 4	Ch. 4	I:4.4	Final Effluent pH #3			1		0-14 pH
	FIT-010	PLC-RPS	Slot 4	Ch. 5	I:4.5	UV Effluent Flow			1		0-12 MGD

Equipment Tag #	Instrument Tag #	PLC	Slot	Channel	Address	Equipment Signal	DI	DO	AI	AO	Signal Detail
	LIT-011	PLC-RPS	Slot 4	Ch. 6	I:4.6	Effluent Chamber Level Deleted			1		0-10 FT
	FIT-711	PLC-RPS	Slot 4	Ch. 7	I:4.7	RAS Flow to Aeration Basin #1			1		0-2500 GPM
Slot 5 – Analog Input											
	FIT-721	PLC-RPS	Slot 5	Ch. 0	I:5.0	RAS Flow to Primary Effluent Splitter Box			1		0-2500 GPM
	FIT-731	PLC-RPS	Slot 5	Ch. 1	I:5.1	RAS Flow to Aeration Basin #2			1		0-2500 GPM
	LIT-700	PLC-RPS	Slot 5	Ch. 2	I:5.2	Ras Wetwell Level			1		0-11.5 FT
P-710		PLC-RPS	Slot 5	Ch. 3	I:5.3	RAS Pump 710 Speed Indication			1		50-100% Full Speed
P-720		PLC-RPS	Slot 5	Ch. 4	I:5.4	RAS Pump 720 Speed Indication			1		50-100% Full Speed
V-751		PLC-RPS	Slot 5	Ch. 5	I:5.5	RAS Flow to Aeration Basin #1 Valve Position Indication			1		0-100% Full Open
V-755		PLC-RPS	Slot 5	Ch. 6	I:5.6	RAS Flow to Primary Effluent Splitter Box Valve			1		0-100% Full Open
V-757		PLC-RPS	Slot 5	Ch. 7	I:5.7	RAS Flow to Aeration Basin #2 Valve Position Indication			1		0-100% Full Open
Slot 6 – Analog Input											
	FIT-741	PLC-RPS	Slot 6	Ch. 0	I:6.0	WAS Flow to Thickened WAS Storage Tank			1		0-260 GPM
	LIT-703	PLC-RPS	Slot 6	Ch. 1	I:6.1	WAS Wetwell Level			1		0-7 FT
WAS-V-745		PLC-RPS	Slot 6	Ch. 2	I:6.2	WAS Flow to Thickened WAS Storage Tank Valve			1		0-100% Open
P-730		PLC-RPS	Slot 6	Ch. 3	I:6.3	RAS Pump 730 Speed Indication			1		50-100% Full Speed
		PLC-RPS	Slot 6	Ch. 4	I:6.4	Aeration Header 2 Pressure			1		0-30.0 PSI
		PLC-RPS	Slot 6	Ch. 5	I:6.5	SPARE			1		
		PLC-RPS	Slot 6	Ch. 6	I:6.6	SPARE			1		
		PLC-RPS	Slot 6	Ch. 7	I:6.7	SPARE			1		
Slot 7 – Analog Input											
		PLC-RPS	Slot 7	Ch. 0	I:7.0	SPARE			1		
		PLC-RPS	Slot 7	Ch. 1	I:7.1	SPARE			1		
		PLC-RPS	Slot 7	Ch. 2	I:7.2	SPARE			1		
		PLC-RPS	Slot 7	Ch. 3	I:7.3	SPARE			1		
		PLC-RPS	Slot 7	Ch. 4	I:7.4	SPARE			1		
		PLC-RPS	Slot 7	Ch. 5	I:7.5	SPARE			1		
		PLC-RPS	Slot 7	Ch. 6	I:7.6	SPARE			1		
		PLC-RPS	Slot 7	Ch. 7	I:7.7	SPARE			1		
Slot 8 – Slot Filler											
		PLC-GRT	Slot 16	N/A	N/A	Slot Filler (No I/O)					Slot Filler
Slot 9 – Slot Filler											
		PLC-GRT	Slot 16	N/A	N/A	Slot Filler (No I/O)					Slot Filler
Slot 10 – Analog Output											
		PLC-RPS	Slot 10	Ch. 0	O:10.0	SPARE				1	
		PLC-RPS	Slot 10	Ch. 1	O:10.1	SPARE				1	
		PLC-RPS	Slot 10	Ch. 2	O:10.2	SPARE				1	
		PLC-RPS	Slot 10	Ch. 3	O:10.3	SPARE				1	

Equipment Tag #	Instrument Tag #	PLC	Slot	Channel	Address	Equipment Signal	DI	DO	AI	AO	Signal Detail
Slot 11- Analog Output											
		PLC-RPS	Slot 11	Ch. 0	O:11.0	SPARE				1	
V-633		PLC-RPS	Slot 11	Ch. 1	O:11.1	Aeration Basin #3 Air Valve Position Control				1	0-100% Full Close
V-641		PLC-RPS	Slot 11	Ch. 2	O:11.2	Blower #4 Suction Valve Position Control				1	0-100% Full Close
V-643		PLC-RPS	Slot 11	Ch. 3	O:11.3	Reaeration Basin #4 Air Valve Position Control				1	0-100% Full Close
Slot 12- Analog Output											
V-651		PLC-RPS	Slot 12	Ch. 0	O:12.0	Blower #5 Suction Valve Position Control				1	0-100% Full Close
V-653		PLC-RPS	Slot 12	Ch. 1	O:12.1	Reaeration Basin #5 Air Valve Position Control				1	0-100% Full Close
P-710		PLC-RPS	Slot 12	Ch. 2	O:12.2	RAS Pump 710 Speed Control				1	50-100% Full Speed
P-720		PLC-RPS	Slot 12	Ch. 3	O:12.3	RAS Pump 720 Speed Control				1	50-100% Full Speed
Slot 13- Analog Output											
V-751		PLC-RPS	Slot 13	Ch. 0	O:13.0	Flow to Aeration Basin #1 Valve Position Control				1	0-100% Full Close
V-755		PLC-RPS	Slot 13	Ch. 1	O:13.1	Flow to Primary Effluent Splitter Box Valve Position				1	0-100% Full Close
V-757		PLC-RPS	Slot 13	Ch. 2	O:13.2	Flow to Aeration Basin #2 Valve Position Control				1	0-100% Full Close
V-745		PLC-RPS	Slot 13	Ch. 3	O:13.3	Flow to Thickened WAS Storage Tank Valve Position				1	0-100% Full Close
Slot 14- Analog Output											
CS-2		PLC-RPS	Slot 14	Ch. 0	O:14.0	Clarifier Effluent Composite Sampler Pacing Signal				1	0-15 MGD
CS-3		PLC-RPS	Slot 14	Ch. 1	O:14.1	Clarifier Effluent Composite Sampler Pacing Signal				1	0-12 MGD
P-730		PLC-RPS	Slot 14	Ch. 2	O:14.2	RAS Pump 730 Speed Control				1	50-100% Full Speed
		PLC-RPS	Slot 14	Ch. 3	O:14.3	SPARE				1	
Slot 15- Analog Output											
		PLC-RPS	Slot 15	Ch. 0	O:15.0	SPARE				1	
		PLC-RPS	Slot 15	Ch. 1	O:15.1	SPARE				1	
		PLC-RPS	Slot 15	Ch. 2	O:15.2	SPARE				1	
		PLC-RPS	Slot 15	Ch. 3	O:15.3	SPARE				1	
Slot 16- Analog Output											
		PLC-RPS	Slot 16	Ch. 0	O:16.0	SPARE				1	
		PLC-RPS	Slot 16	Ch. 1	O:16.1	SPARE				1	
		PLC-RPS	Slot 16	Ch. 2	O:16.2	SPARE				1	
		PLC-RPS	Slot 16	Ch. 3	O:16.3	SPARE				1	
Slot 17- Slot Filler											
		PLC-GRT	Slot 17	N/A	N/A	Slot Filler (No I/O)					Slot Filler
Slot 18-Slot Filler											
		PLC-GRT	Slot 18	N/A	N/A	Slot Filler (No I/O)					Slot Filler
Slot 19- Slot Filler											
		PLC-GRT	Slot 19	N/A	N/A	Slot Filler (No I/O)					Slot Filler
Slot 20- Digital Input											
BL-610		PLC-RPS	Slot 20	Ch. 0	I:20/0	Blower #1 Fail	1				Fail

Equipment Tag #	Instrument Tag #	PLC	Slot	Channel	Address	Equipment Signal	DI	DO	AI	AO	Signal Detail
BL-610		PLC-RPS	Slot 20	Ch. 1	I:20/1	Blower #1 Running	1				Running
BL-610		PLC-RPS	Slot 20	Ch. 2	I:20/2	Blower #1 In Remote	1				In Remote
BL-620		PLC-RPS	Slot 20	Ch. 3	I:20/3	Blower #2 Fail	1				Fail
BL-620		PLC-RPS	Slot 20	Ch. 4	I:20/4	Blower #2 Running	1				Running
BL-620		PLC-RPS	Slot 20	Ch. 5	I:20/5	Blower #2 In Remote	1				In Remote
BL-630		PLC-RPS	Slot 20	Ch. 6	I:20/6	Blower #3 Fail	1				Fail
BL-630		PLC-RPS	Slot 20	Ch. 7	I:20/7	Blower #3 Running	1				Running
BL-630		PLC-RPS	Slot 20	Ch. 8	I:20/8	Blower #3 In Remote	1				In Remote
BL-640		PLC-RPS	Slot 20	Ch. 9	I:20/9	Blower #4 Fail	1				Fail
BL-640		PLC-RPS	Slot 20	Ch. 10	I:20/10	Blower #4 Running	1				Running
BL-640		PLC-RPS	Slot 20	Ch. 11	I:20/11	Blower #4 In Remote	1				In Remote
BL-650		PLC-RPS	Slot 20	Ch. 12	I:20/12	Blower #5 Fail	1				Fail
BL-650		PLC-RPS	Slot 20	Ch. 13	I:20/13	Blower #5 Running	1				Running
BL-650		PLC-RPS	Slot 20	Ch. 14	I:20/14	Blower #5 In Remote	1				In Remote
		PLC-RPS	Slot 20	Ch. 15	I:20/15	SPARE	1				
Slot 21 – Digital Input											
		PLC-RPS	Slot 21	Ch. 0	I:21/0	SPARE	1				
		PLC-RPS	Slot 21	Ch. 1	I:21/1	SPARE	1				
		PLC-RPS	Slot 21	Ch. 2	I:21/2	SPARE	1				
		PLC-RPS	Slot 21	Ch. 3	I:21/3	SPARE	1				
V-633		PLC-RPS	Slot 21	Ch. 4	I:21/4	Aeration Basin #3 Air Valve In-Remote	1				In-Remote
V-641		PLC-RPS	Slot 21	Ch. 5	I:21/5	Blower #4 Suction Valve In-Remote	1				In-Remote
V-643		PLC-RPS	Slot 21	Ch. 6	I:21/6	Aeration Basin #4 Air Valve In-Remote	1				In-Remote
V-651		PLC-RPS	Slot 21	Ch. 7	I:21/7	Blower #5 Suction Valve In-Remote	1				In-Remote
V-653		PLC-RPS	Slot 21	Ch. 8	I:21/8	Reaeration Basin #2 2 Air In-Remote	1				In-Remote
WAS-P-740		PLC-RPS	Slot 21	Ch. 9	I:21/9	WAS Pump 740 In Remote	1				In Remote
WAS-P-740		PLC-RPS	Slot 21	Ch. 10	I:21/10	WAS Pump 740 Running	1				Running
WAS-P-740		PLC-RPS	Slot 21	Ch. 11	I:21/11	WAS Pump 740 Fail	1				Fail
P-730		PLC-RPS	Slot 21	Ch. 12	I:21/12	RAS Pump 730 In Remote	1				In Remote
	LSHH-702	PLC-RPS	Slot 21	Ch. 13	I:21/13	RAS Wetwell Level High High	1				Level High High
	LSL-701	PLC-RPS	Slot 21	Ch. 14	I:21/14	RAS Wetwell Level Low Water Cut-Off	1				Low Water Cut-Off
P-710		PLC-RPS	Slot 21	Ch. 15	I:21/15	RAS Pump 710 In Remote	1				In Remote
Slot 22 – Digital Input											
P-710		PLC-RPS	Slot 22	Ch. 0	I:22/0	RAS Pump 710 Running	1				Running
P-710		PLC-RPS	Slot 22	Ch. 1	I:22/1	RAS Pump 710 Fail	1				Fail
P-720		PLC-RPS	Slot 22	Ch. 2	I:22/2	RAS Pump 720 In Remote	1				In Remote
P-720		PLC-RPS	Slot 22	Ch. 3	I:22/3	RAS Pump 720 Running	1				Running
P-720		PLC-RPS	Slot 22	Ch. 4	I:22/4	RAS Pump 720 Fail	1				Fail

Equipment Tag #	Instrument Tag #	PLC	Slot	Channel	Address	Equipment Signal	DI	DO	AI	AO	Signal Detail
P-730		PLC-RPS	Slot 22	Ch. 5	I:22/5	RAS Pump 730 Running	1				Running
P-730		PLC-RPS	Slot 22	Ch. 6	I:22/6	RAS Pump 730 Fail	1				Fail
V-751		PLC-RPS	Slot 22	Ch. 7	I:22/7	RAS Flow to Aeration Basin #1 1 Valve in Remote	1				In Remote
V-755		PLC-RPS	Slot 22	Ch. 8	I:22/8	RAS Flow to Primary Effluent Splitter Box Valve In Remote	1				In Remote
V-757		PLC-RPS	Slot 22	Ch. 9	I:22/9	RAS Flow to Aeration Basin #2 Valve In Remote	1				In Remote
		PLC-RPS	Slot 22	Ch. 10	I:22/10	UV Bank #1 Operating	1				Operating
		PLC-RPS	Slot 22	Ch. 11	I:22/11	UV Bank #1 Alarm	1				Alarm
		PLC-RPS	Slot 22	Ch. 12	I:22/12	UV Bank #2 Operating	1				Operating
		PLC-RPS	Slot 22	Ch. 13	I:22/13	UV Bank #2 Alarm	1				Alarm
		PLC-RPS	Slot 22	Ch. 14	I:22/14	UV Bank #3 Operating	1				Operating
		PLC-RPS	Slot 22	Ch. 15	I:22/15	UV Bank #3 Alarm	1				Alarm
Slot 23 – Digital Input											
		PLC-RPS	Slot 23	Ch. 0	I:23/0	UV Bank #4 Operating	1				Operating
		PLC-RPS	Slot 23	Ch. 1	I:23/1	UV Bank #4 Alarm	1				Alarm
		PLC-RPS	Slot 23	Ch. 2	I:23/2	UV Bank #1 In Auto	1				In Auto
		PLC-RPS	Slot 23	Ch. 3	I:23/3	UV Bank #2 In Auto	1				In Auto
		PLC-RPS	Slot 23	Ch. 4	I:23/4	UV Bank #3 In Auto	1				In Auto
		PLC-RPS	Slot 23	Ch. 5	I:23/5	UV Bank #4 In Auto	1				In Auto
	LSHH-705	PLC-RPS	Slot 23	Ch. 6	I:23/6	WAS Wetwell Level High High	1				Level High High
	LSL-704	PLC-RPS	Slot 23	Ch. 7	I:23/7	WAS Wetwell Level Low Water Cut-Off	1				Low Water Cut-Off
	LY-105	PLC-RPS	Slot 23	Ch. 8	I:23/8	WAS Storage Tanks Low Water Cut-Off	1				Low Water Cut-Off
V-745		PLC-RPS	Slot 23	Ch. 9	I:23/9	WAS Flow to Thickened WAS Storage Tank Valve	1				In Remote
		PLC-RPS	Slot 23	Ch. 10	I:23/10	Final Clarifier #1 Running	1				Running
		PLC-RPS	Slot 23	Ch. 11	I:23/11	Final Clarifier #1 Fail	1				Fail
		PLC-RPS	Slot 23	Ch. 12	I:23/12	Final Clarifier #2 Running	1				Running
		PLC-RPS	Slot 23	Ch. 13	I:23/13	Final Clarifier #2 Fail	1				Fail
		PLC-RPS	Slot 23	Ch. 14	I:23/14	Final Clarifier #3 Fail	1				Fail
		PLC-RPS	Slot 23	Ch. 15	I:23/15	Final Clarifier #3 Running	1				Running
Slot 24 – Digital Input											
		PLC-RPS	Slot 24	Ch. 0	I:24/0	Final Clarifier #1 High Torque Alarm	1				Alarm
		PLC-RPS	Slot 24	Ch. 1	I:24/1	Final Clarifier #2 High Torque Alarm	1				Alarm
		PLC-RPS	Slot 24	Ch. 2	I:24/2	Final Clarifier #3 High Torque Alarm	1				Alarm
		PLC-RPS	Slot 24	Ch. 3	I:24/3	NPW Pump 1 Remote Status	1				Remote Status
		PLC-RPS	Slot 24	Ch. 4	I:24/4	NPW Pump 1 Run Status	1				Run Status
		PLC-RPS	Slot 24	Ch. 5	I:24/5	NPW Pump 1 Fail Status	1				Fail Status
		PLC-RPS	Slot 24	Ch. 6	I:24/6	NPW Pump 2 Remote Status	1				Remote Status
		PLC-RPS	Slot 24	Ch. 7	I:24/7	NPW Pump 2 Run Status	1				Run Status
		PLC-RPS	Slot 24	Ch. 8	I:24/8	NPW Pump 2 Fail Status	1				Fail Status

Equipment Tag #	Instrument Tag #	PLC	Slot	Channel	Address	Equipment Signal	DI	DO	AI	AO	Signal Detail
		PLC-RPS	Slot 24	Ch. 9	I:24/9	Effluent Chlorine Alarm	1				Alarm
		PLC-RPS	Slot 24	Ch. 10	I:24/10	Effluent Sulfur Dioxide Alarm	1				Alarm
		PLC-RPS	Slot 24	Ch. 11	I:24/11	SPARE	1				SPARE
		PLC-RPS	Slot 24	Ch. 12	I:24/12	SPARE	1				SPARE
		PLC-RPS	Slot 24	Ch. 13	I:24/13	SPARE	1				SPARE
		PLC-RPS	Slot 24	Ch. 14	I:24/14	SPARE	1				SPARE
		PLC-RPS	Slot 24	Ch. 15	I:24/15	SPARE	1				SPARE
Slot 25 -Slot Filler											
		PLC-GRT	Slot 25	N/A	N/A	Slot Filler (No I/O)					Slot Filler
Slot 26 -Slot Filler											
		PLC-GRT	Slot 25	N/A	N/A	Slot Filler (No I/O)					Slot Filler
Slot 27 -Digital Output											
BL-610		PLC-RPS	Slot 27	Ch. 0	O:27/0	Blower #1 Start CMD		1			Start CMD
BL-620		PLC-RPS	Slot 27	Ch. 1	O:27/1	Blower #2 Start CMD		1			Start CMD
BL-630		PLC-RPS	Slot 27	Ch. 2	O:27/2	Blower #3 Start CMD		1			Start CMD
BL-640		PLC-RPS	Slot 27	Ch. 3	O:27/3	Blower #4 Start CMD		1			Start CMD
BL-650		PLC-RPS	Slot 27	Ch. 4	O:27/4	Blower #5 Start CMD		1			Start CMD
WAS-P-740		PLC-RPS	Slot 27	Ch. 5	O:27/5	WAS Pump 740 Run CMD		1			Run CMD
P-710		PLC-RPS	Slot 27	Ch. 6	O:27/6	RAS Pump 710 Run CMD		1			Run CMD
P-720		PLC-RPS	Slot 27	Ch. 7	O:27/7	RAS Pump 720 Run CMD		1			Run CMD
P-730		PLC-RPS	Slot 27	Ch. 8	O:27/8	RAS Pump 730 Run CMD		1			Run CMD
		PLC-RPS	Slot 27	Ch. 9	O:27/9	NPW Pump 1 Start/Stop Command		1			Start/Stop Command
		PLC-RPS	Slot 27	Ch. 10	O:27/10	NPW Pump 2 Start/Stop Command		1			Start/Stop Command
		PLC-RPS	Slot 27	Ch. 11	O:27/11	SPARE		1			SPARE
		PLC-RPS	Slot 27	Ch. 12	O:27/12	SPARE		1			SPARE
		PLC-RPS	Slot 27	Ch. 13	O:27/13	SPARE		1			SPARE
		PLC-RPS	Slot 27	Ch. 14	O:27/14	SPARE		1			SPARE
		PLC-RPS	Slot 27	Ch. 15	O:27/15	SPARE		1			SPARE
Slot 28 -Slot Filler											
		PLC-GRT	Slot 28	N/A	N/A	Slot Filler (No I/O)					Slot Filler
Slot 29 -Slot Filler											
		PLC-GRT	Slot 29	N/A	N/A	Slot Filler (No I/O)					Slot Filler

Schedule 4 – PLC-SHF

The following table lists I/O details for the Solids Handling Facility PLC.

Equipment Tag #	Instrument Tag #	PLC	Slot	Channel	Address	Equipment Signal	DI	DO	AI	AO	Signal Detail
Slot 1 – Analog Input											
	FIT-119-1	PLC-SHF	Slot 1	Ch. 0	I:1.0	Blending Tank Feed Pump #1 Flow			1		Flow 0-70 GPM
	FIT-119-2	PLC-SHF	Slot 1	Ch. 1	I:1.1	Blending Tank Feed Pump #2 Flow			1		Flow 0-70 GPM
		PLC-SHF	Slot 1	Ch. 2	I:1.2	Blending Tank Feed Pump #3 Flow			1		Flow 0-70 GPM
	FIT-120-1	PLC-SHF	Slot 1	Ch. 3	I:1.3	Belt Filter Press #1 Flow			1		Flow 0-160 GPM
	FIT-120-2	PLC-SHF	Slot 1	Ch. 4	I:1.4	Belt Filter Press #2 Flow			1		Flow 0-160 GPM
	LIT-117	PLC-SHF	Slot 1	Ch. 5	I:1.5	KMN04 Tank Level			1		Level 0-8 FT
	WIT-501	PLC-SHF	Slot 1	Ch. 6	I:1.6	Polymer Storage Tank Weight			1		Tank Weight TBD
	LIT-832	PLC-SHF	Slot 1	Ch. 7	I:1.7	Primary Sludge Storage Tank Level			1		0-15.5 FT
Slot 2 – Analog Input											
	LIT-852	PLC-SHF	Slot 2	Ch. 0	I:2.0	TWAS Storage Tank Level			1		0-15.5 FT
	LIT-872	PLC-SHF	Slot 2	Ch. 1	I:2.1	Sludge Blending Tank Level			1		0-5 FT
P-840		PLC-SHF	Slot 2	Ch. 2	I:2.2	Primary Storage Tank Pump #840 Speed Indication			1		50-100% Full Speed
	FIT-832	PLC-SHF	Slot 2	Ch. 3	I:2.3	Septage Return Flow			1		0-400 GPM
	LIT-102	PLC-SHF	Slot 2	Ch. 4	I:2.4	Septage Receiving Basin Level			1		0-10 FT
	PIT-134	PLC-SHF	Slot 2	Ch. 5	I:2.5	Septage Pumps Discharge Pressure			1		0-100 PSI
V-130		PLC-SHF	Slot 2	Ch. 6	I:2.6	Septage Recirculation Valve Position			1		0-100% Full Open
V-133		PLC-SHF	Slot 2	Ch. 7	I:2.7	Septage Return Flow Control Valve Position			1		0-100% Full Open
Slot 3 – Analog Input											
P-860		PLC-SHF	Slot 3	Ch. 0	I:3.0	TWAS Storage Tank Pump #860 Speed Indication			1		50-100% Full Speed
	PIT-001	PLC-SHF	Slot 3	Ch. 1	I:3.1	NPW System NPW-PIT-001 Discharge Pressure			1		0-150 psi
		PLC-SHF	Slot 3	Ch. 2	I:3.2	SPARE			1		SPARE
		PLC-SHF	Slot 3	Ch. 3	I:3.3	SPARE			1		SPARE
		PLC-SHF	Slot 3	Ch. 4	I:3.4	SPARE			1		SPARE
		PLC-SHF	Slot 3	Ch. 5	I:3.5	SPARE			1		SPARE
		PLC-SHF	Slot 3	Ch. 6	I:3.6	SPARE			1		SPARE
		PLC-SHF	Slot 3	Ch. 7	I:3.7	SPARE			1		SPARE
Slot 4 – Slot Filler											
		PLC-SHF	Slot 4	N/A	N/A	Slot Filler (No I/O)					Slot Filler
Slot 5 – Analog Output											
P-510		PLC-SHF	Slot 5	Ch. 0	O:5.0	Polymer Feeder Blender 510 Feed Rate Control				1	0-100% Full Speed
P-510		PLC-SHF	Slot 5	Ch. 1	O:5.1	Polymer Feeder Blender 510 Feed Ratio Control				1	0-100%
P-520		PLC-SHF	Slot 5	Ch. 2	O:5.2	Polymer Feeder Blender 520 Feed Rate Control				1	0-100% Full Speed
P-520		PLC-SHF	Slot 5	Ch. 3	O:5.3	Polymer Feeder Blender 520 Feed Ratio Control				1	0-100%

Equipment Tag #	Instrument Tag #	PLC	Slot	Channel	Address	Equipment Signal	DI	DO	AI	AO	Signal Detail
Slot 6 – Analog Output											
P-840		PLC-SHF	Slot 6	Ch. 0	O:6.0	Primary Storage Tank Pump #840 Control Speed				1	50-100% Speed
V-130		PLC-SHF	Slot 6	Ch. 1	O:6.1	Septage Recirculation Valve Position Control				1	0-100% Full Open
V-133		PLC-SHF	Slot 6	Ch. 2	O:6.2	Septage Return Flow Control Valve Position Control				1	Position Control
P-860		PLC-SHF	Slot 6	Ch. 3	O:6.3	TWAS Storage Tank Pump #860 Speed Control				1	50-100% Full Open
Slot 7 – Analog Output											
		PLC-SHF	Slot 7	Ch. 0	O:7.0	SPARE				1	SPARE
		PLC-SHF	Slot 7	Ch. 1	O:7.1	SPARE				1	SPARE
		PLC-SHF	Slot 7	Ch. 2	O:7.2	SPARE				1	SPARE
		PLC-SHF	Slot 7	Ch. 3	O:7.3	SPARE				1	SPARE
Slot 8 – Filler Slot											
		PLC-SHF	Slot 8	N/A	N/A	Slot Filler (No I/O)					Slot Filler
Slot 9 – Filler Slot											
		PLC-SHF	Slot 9	N/A	N/A	Slot Filler (No I/O)					Slot Filler
Slot 10 – Digital Input											
P-120		PLC-SHF	Slot 10	Ch. 0	I:10/0	Septage Pump 120 Running	1				Running
P-120		PLC-SHF	Slot 10	Ch. 1	I:10/1	Septage Pump 120 Fail	1				Fail
P-120		PLC-SHF	Slot 10	Ch. 2	I:10/2	Septage Pump 120 In Remote	1				In Remote
P-110		PLC-SHF	Slot 10	Ch. 3	I:10/3	Septage Pump 110 Running	1				Running
P-110		PLC-SHF	Slot 10	Ch. 4	I:10/4	Septage Pump 110 Fail	1				Fail
P-110		PLC-SHF	Slot 10	Ch. 5	I:10/5	Septage Pump 110 In Remote	1				In Remote
TWAS-MX-850*		PLC-SHF	Slot 10	Ch. 6	I:10/6	TWAS Storage Tank Mixer #850 Running	1				Running
TWAS-MX-850*		PLC-SHF	Slot 10	Ch. 7	I:10/7	TWAS Storage Tank Mixer #850 Fail	1				Fail
TWAS-MX-850*		PLC-SHF	Slot 10	Ch. 8	I:10/8	TWAS Storage Tank Mixer #850 In Auto	1				In Auto
MX-830*		PLC-SHF	Slot 10	Ch. 9	I:10/9	Primary Storage Tank Mixer #830 Running	1				Running
MX-830*		PLC-SHF	Slot 10	Ch. 10	I:10/10	Primary Storage Tank Mixer #830 Fail	1				Fail
MX-830*		PLC-SHF	Slot 10	Ch. 11	I:10/11	Primary Storage Tank Mixer #830 In Auto	1				In Auto
MX-501		PLC-SHF	Slot 10	Ch. 12	I:10/12	Polymer Mixer 501 In Remote	1				In Remote
MX-501		PLC-SHF	Slot 10	Ch. 13	I:10/13	Polymer Mixer 501 Running	1				Running
P-510(A/B)		PLC-SHF	Slot 10	Ch. 14	I:10/14	Polymer Feeder/Blender 510 In Remote	1				In Remote
P-510(A/B)		PLC-SHF	Slot 10	Ch. 15	I:10/15	Polymer Feeder/Blender 510 Fail	1				Fail
Slot 11 – Digital Input											
P-510(A/B)		PLC-SHF	Slot 11	Ch. 0	I:11/0	Polymer Feeder/Blender 510 Running	1				Running
P-520(A/B)		PLC-SHF	Slot 11	Ch. 1	I:11/1	Water Booster Pump 520 Discharge Pressure Low	1				Pressure Low
P-520(A/B)		PLC-SHF	Slot 11	Ch. 2	I:11/2	Polymer Feeder/Blender 520 In Remote	1				In Remote
P-520(A/B)		PLC-SHF	Slot 11	Ch. 3	I:11/3	Polymer Feeder/Blender 520 Fail	1				Fail
P-520(A/B)		PLC-SHF	Slot 11	Ch. 4	I:11/4	Polymer Feeder/Blender 520 Running	1				Running
P-540		PLC-SHF	Slot 11	Ch. 5	I:11/5	Water Booster Pump 540 Discharge Pressure Low	1				Pressure Low

Equipment Tag #	Instrument Tag #	PLC	Slot	Channel	Address	Equipment Signal	DI	DO	AI	AO	Signal Detail
GRD-833*		PLC-SHF	Slot 11	Ch. 6	I:11/6	Sludge Grinder #833 Running	1				Running
GRD-833*		PLC-SHF	Slot 11	Ch. 7	I:11/7	Sludge Grinder #833 Fail	1				Fail
P-840		PLC-SHF	Slot 11	Ch. 8	I:11/8	Primary Storage Tank Pump 840 Running	1				Running
P-840		PLC-SHF	Slot 11	Ch. 9	I:11/9	Primary Storage Tank Pump 840 Fail	1				Fail
P-840		PLC-SHF	Slot 11	Ch. 10	I:11/10	Primary Storage Tank Pump 840 In Auto	1				In Auto
		PLC-SHF	Slot 11	Ch. 11	I:11/11	Septage Authorized by Card Reader System	1				Card Reader System
	LSHH-103	PLC-SHF	Slot 11	Ch. 12	I:11/12	Septage Basin Level High-High Alarm	1				High-High Alarm
	LSLL-104	PLC-SHF	Slot 11	Ch. 13	I:11/13	Septage Basin Level Low-Low Alarm	1				Low-Low Alarm
V-101		PLC-SHF	Slot 11	Ch. 14	I:11/14	Septage Receiving Valve In Remote	1				In Remote
V-101		PLC-SHF	Slot 11	Ch. 15	I:11/15	Septage Receiving Valve Closed	1				Closed
Slot 12 – Digital Input											
V-101		PLC-SHF	Slot 12	Ch. 0	I:12/0	Septage Receiving Valve Open	1				Open
V-130		PLC-SHF	Slot 12	Ch. 1	I:12/1	Recirculation Valve In Remote	1				In Remote
V-131		PLC-SHF	Slot 12	Ch. 2	I:12/2	Septage Return Isolation In Remote	1				In Remote
V-131		PLC-SHF	Slot 12	Ch. 3	I:12/3	Septage Return Isolation Closed	1				Closed
V-131		PLC-SHF	Slot 12	Ch. 4	I:12/4	Septage Return Isolation Open	1				Open
V-133		PLC-SHF	Slot 12	Ch. 5	I:12/5	Septage Return Flow Control Valve In Remote	1				In Remote
	ZSO-100	PLC-SHF	Slot 12	Ch. 6	I:12/6	Septage Receiving Complete	1				Receiving Complete
BFP-1		PLC-SHF	Slot 12	Ch. 7	I:12/7	Dewatering Belt Press #1 Running	1				Run=0 Off=1
BFP-1		PLC-SHF	Slot 12	Ch. 8	I:12/8	Dewatering Belt Press #1 Alarm	1				Alarm
BFP-2		PLC-SHF	Slot 12	Ch. 9	I:12/9	Dewatering Belt Press #2 Running	1				Run=0 Off=1
BFP-2		PLC-SHF	Slot 12	Ch. 10	I:12/10	Dewatering Belt Press #2 Alarm	1				Alarm
BFP-3		PLC-SHF	Slot 12	Ch. 11	I:12/11	Dewatering Belt Press #3 Running	1				Run=0 Off=1
BFP-3		PLC-SHF	Slot 12	Ch. 12	I:12/12	Dewatering Belt Press #3 Alarm	1				Alarm
		PLC-SHF	Slot 12	Ch. 13	I:12/13	KMNO4 Metering Pump #1 Running	1				Running
		PLC-SHF	Slot 12	Ch. 14	I:12/14	KMNO4 Metering Pump #1 Fail	1				Fail
		PLC-SHF	Slot 12	Ch. 15	I:12/15	KMNO4 Metering Pump #2 Running	1				Running
Slot 13 – Digital Input											
		PLC-SHF	Slot 13	Ch. 0	I:13/0	KMNO4 Metering Pump #2 Fail	1				Fail
		PLC-SHF	Slot 13	Ch. 1	I:13/1	Dewatering Polymer Metering Pump #1A Running	1				Running
		PLC-SHF	Slot 13	Ch. 2	I:13/2	Dewatering Polymer Metering Pump #1A Fail	1				Fail
		PLC-SHF	Slot 13	Ch. 3	I:13/3	Dewatering Polymer Metering Pump #1B Running	1				Running
		PLC-SHF	Slot 13	Ch. 4	I:13/4	Dewatering Polymer Metering Pump #1B Fail	1				Fail
		PLC-SHF	Slot 13	Ch. 5	I:13/5	Dewatering Polymer Metering Pump #2A Running	1				Running
		PLC-SHF	Slot 13	Ch. 6	I:13/6	Dewatering Polymer Metering Pump #2A Fail	1				Fail
		PLC-SHF	Slot 13	Ch. 7	I:13/7	Dewatering Polymer Metering Pump #2B Running	1				Running
		PLC-SHF	Slot 13	Ch. 8	I:13/8	Dewatering Polymer Metering Pump #2B Fail	1				Fail
		PLC-SHF	Slot 13	Ch. 9	I:13/9	Sludge Blending Tank Mixer #870 Running	1				Running

Equipment Tag #	Instrument Tag #	PLC	Slot	Channel	Address	Equipment Signal	DI	DO	AI	AO	Signal Detail
		PLC-SHF	Slot 13	Ch. 10	I:13/10	Sludge Blending Tank Mixer #870 Fail	1				Fail
		PLC-SHF	Slot 13	Ch. 11	I:13/11	Sludge Blending Tank Mixer #870 Auto In	1				In Auto
		PLC-SHF	Slot 13	Ch. 12	I:13/12	TWAS Storage Tank Pump #860 Running	1				Running
		PLC-SHF	Slot 13	Ch. 13	I:13/13	TWAS Storage Tank Pump #860 Fail	1				Fail
		PLC-SHF	Slot 13	Ch. 14	I:13/14	TWAS Storage Tank Pump #860 Auto In	1				In Auto
		PLC-SHF	Slot 13	Ch. 15	I:13/15	Sludge Handling Facility HVAC Alarm	1				Alarm
Slot 14 -Digital Input											
		PLC-SHF	Slot 14	Ch. 0	I:14/0	Dewatering Control Panel #1 Operating	1				Operating
		PLC-SHF	Slot 14	Ch. 1	I:14/1	Dewatering Control Panel #1 Alarm	1				Alarm
		PLC-SHF	Slot 14	Ch. 2	I:14/2	Dewatering Control Panel #2 Operating	1				Operating
		PLC-SHF	Slot 14	Ch. 3	I:14/3	Dewatering Control Panel #2 Alarm	1				Alarm
		PLC-SHF	Slot 14	Ch. 4	I:14/4	Sludge Facility Air Compressor #812 Alarm	1				Alarm
		PLC-SHF	Slot 14	Ch. 5	I:14/5	Sludge Facility Air Compressor #822 Alarm	1				Alarm
		PLC-SHF	Slot 14	Ch. 6	I:14/6	Primary Sludge Storage Tank Pump P840 Seal Leak	1				Seal Leak
		PLC-SHF	Slot 14	Ch. 7	I:14/7	Primary Sludge Storage Tank Pump P840 Overtemp	1				Overtemp
		PLC-SHF	Slot 14	Ch. 8	I:14/8	Primary Sludge Storage Tank Pump P860 Seal Leak	1				Seal Leak
		PLC-SHF	Slot 14	Ch. 9	I:14/9	Primary Sludge Storage Tank Pump P860 Overtemp	1				Overtemp
		PLC-SHF	Slot 14	Ch. 10	I:14/10	Thickened WAS Storage Tank Pump P860 Overtemp	1				Overtemp
		PLC-SHF	Slot 14	Ch. 11	I:14/11	SPARE	1				SPARE
		PLC-SHF	Slot 14	Ch. 12	I:14/12	SPARE	1				SPARE
		PLC-SHF	Slot 14	Ch. 13	I:14/13	SPARE	1				SPARE
		PLC-SHF	Slot 14	Ch. 14	I:14/14	SPARE	1				SPARE
		PLC-SHF	Slot 14	Ch. 15	I:14/15	SPARE	1				SPARE
Slot 15 – Digital Input											
		PLC-SHF	Slot 15	Ch. 0	I:15/0	SPARE	1				SPARE
		PLC-SHF	Slot 15	Ch. 1	I:15/1	SPARE	1				SPARE
		PLC-SHF	Slot 15	Ch. 2	I:15/2	SPARE	1				SPARE
		PLC-SHF	Slot 15	Ch. 3	I:15/3	SPARE	1				SPARE
		PLC-SHF	Slot 15	Ch. 4	I:15/4	SPARE	1				SPARE
		PLC-SHF	Slot 15	Ch. 5	I:15/5	SPARE	1				SPARE
		PLC-SHF	Slot 15	Ch. 6	I:15/6	SPARE	1				SPARE
		PLC-SHF	Slot 15	Ch. 7	I:15/7	SPARE	1				SPARE
		PLC-SHF	Slot 15	Ch. 8	I:15/8	SPARE	1				SPARE
		PLC-SHF	Slot 15	Ch. 9	I:15/9	SPARE	1				SPARE
		PLC-SHF	Slot 15	Ch. 10	I:15/10	SPARE	1				SPARE
		PLC-SHF	Slot 15	Ch. 11	I:15/11	SPARE	1				SPARE
		PLC-SHF	Slot 15	Ch. 12	I:15/12	SPARE	1				SPARE
		PLC-SHF	Slot 15	Ch. 13	I:15/13	SPARE	1				SPARE

Equipment Tag #	Instrument Tag #	PLC	Slot	Channel	Address	Equipment Signal	DI	DO	AI	AO	Signal Detail
		PLC-SHF	Slot 15	Ch. 14	I:15/14	SPARE	1				SPARE
		PLC-SHF	Slot 15	Ch. 15	I:15/15	SPARE	1				SPARE
Slot 16 – Digital Input											
		PLC-SHF	Slot 16	N/A	N/A	Slot Filler (No I/O)					Slot Filler
Slot 17 – Digital Output											
		PLC-SHF	Slot 17	Ch. 0	O:17/0	Septage Pump 110 Run CMD		1			Run CMD
		PLC-SHF	Slot 17	Ch. 1	O:17/1	Septage Pump 120 Run CMD		1			Run CMD
		PLC-SHF	Slot 17	Ch. 2	O:17/2	Primary Storage Tank Mixer #830 Run CMD		1			Run CMD
		PLC-SHF	Slot 17	Ch. 3	O:17/3	Thickened WAS Storage Tank Mixer 850 Run CMD		1			Run CMD
		PLC-SHF	Slot 17	Ch. 4	O:17/4	Polymer Mixer 501 Run CMD		1			Run CMD
		PLC-SHF	Slot 17	Ch. 5	O:17/5	Polymer Feeder Blender 510 Run CMD		1			Run CMD
		PLC-SHF	Slot 17	Ch. 6	O:17/6	Polymer Feeder Blender 520 Run CMD		1			Run CMD
		PLC-SHF	Slot 17	Ch. 7	O:17/7	Primary Storage Tank Pump #840 Run CMD		1			Run CMD
		PLC-SHF	Slot 17	Ch. 8	O:17/8	Septage Receiving Valve Open CMD		1			Open CMD
		PLC-SHF	Slot 17	Ch. 9	O:17/9	Septage Receiving Valve Close CMD		1			Close CMD
		PLC-SHF	Slot 17	Ch. 10	O:17/10	Septage Return Isolation Valve Open CMD		1			Open CMD
		PLC-SHF	Slot 17	Ch. 11	O:17/11	Septage Return Isolation Valve Close CMD		1			Close CMD
		PLC-SHF	Slot 17	Ch. 12	O:17/12	Blending Tank Feed Pump #1 Run CMD 1		1			Run CMD
		PLC-SHF	Slot 17	Ch. 13	O:17/13	Blending Tank Feed Pump #2 Run CMD 2		1			Run CMD
		PLC-SHF	Slot 17	Ch. 14	O:17/14	Blending Tank Feed Pump #3 Run CMD 3		1			Run CMD
		PLC-SHF	Slot 17	Ch. 15	O:17/15	Belt Filter Press #4 Start CMD		1			Start CMD
Slot 18 – Digital Input											
		PLC-SHF	Slot 18	Ch. 0	O:18/0	Belt Filter Press #5 Start CMD		1			Start CMD
		PLC-SHF	Slot 18	Ch. 1	O:18/1	Sludge Blending Tank Mixer #870 Start CMD		1			Start CMD
		PLC-SHF	Slot 18	Ch. 2	O:18/2	Thickened WAS Storage Tank Pump #860 Start CMD		1			Start CMD
		PLC-SHF	Slot 18	Ch. 3	O:18/3	SPARE		1			SPARE
		PLC-SHF	Slot 18	Ch. 4	O:18/4	SPARE		1			SPARE
		PLC-SHF	Slot 18	Ch. 5	O:18/5	SPARE		1			SPARE
		PLC-SHF	Slot 18	Ch. 6	O:18/6	SPARE		1			SPARE
		PLC-SHF	Slot 18	Ch. 7	O:18/7	SPARE		1			SPARE
		PLC-SHF	Slot 18	Ch. 8	O:18/8	SPARE		1			SPARE
		PLC-SHF	Slot 18	Ch. 9	O:18/9	SPARE		1			SPARE
		PLC-SHF	Slot 18	Ch. 10	O:18/10	SPARE		1			SPARE
		PLC-SHF	Slot 18	Ch. 11	O:18/11	SPARE		1			SPARE
		PLC-SHF	Slot 18	Ch. 12	O:18/12	SPARE		1			SPARE
		PLC-SHF	Slot 18	Ch. 13	O:18/13	SPARE		1			SPARE
		PLC-SHF	Slot 18	Ch. 14	O:18/14	SPARE		1			SPARE
		PLC-SHF	Slot 18	Ch. 15	O:18/15	SPARE		1			SPARE

Equipment Tag #	Instrument Tag #	PLC	Slot	Channel	Address	Equipment Signal	DI	DO	AI	AO	Signal Detail
Slot 19 – Slot Filler											
		PLC-SHF	Slot 28	N/A	N/A	Slot Filler (No I/O)					Slot Filler

Schedule 5 – PLC-BS1

The following table lists I/O details for the Blower Structure No. 1 PLC.

Equipment Tag #	Instrument Tag #	PLC	Slot	Channel	Address	Equipment Signal	DI	DO	AI	AO	Signal Detail
Slot 1 – Digital Inputs											
V-611		PLC-BS1	Slot 1	Ch. 0	I:1/0	Blower #1 Air Valve In-Remote (Relocated)	1				In-Remote
V-613		PLC-BS1	Slot 1	Ch. 1	I:1/1	Aeration Basin #2 Air Valve In-Remote (Relocated)	1				In-Remote
V-621		PLC-BS1	Slot 1	Ch. 2	I:1/2	Blower #2 Air Valve In-Remote (Relocated)	1				In-Remote
V-623		PLC-BS1	Slot 1	Ch. 3	I:1/3	Aeration Basin #1 Air Valve In-Remote (Relocated)	1				In-Remote
V-631		PLC-BS1	Slot 1	Ch. 4	I:1/4	Blower #3 Air Valve In-Remote (Relocated)	1				In-Remote
		PLC-BS1	Slot 1	Ch. 5	I:1/5	SPARE					
		PLC-BS1	Slot 1	Ch. 6	I:1/6	SPARE					
		PLC-BS1	Slot 1	Ch. 7	I:1/7	SPARE					
		PLC-BS1	Slot 1	Ch. 8	I:1/8	SPARE					
		PLC-BS1	Slot 1	Ch. 9	I:1/9	SPARE					
		PLC-BS1	Slot 1	Ch. 10	I:1/10	SPARE					
		PLC-BS1	Slot 1	Ch. 11	I:1/11	SPARE					
		PLC-BS1	Slot 1	Ch. 12	I:1/12	SPARE					
		PLC-BS1	Slot 1	Ch. 13	I:1/13	SPARE					
		PLC-BS1	Slot 1	Ch. 14	I:1/14	SPARE					
		PLC-BS1	Slot 1	Ch. 15	I:1/15	SPARE					
Slot 2 – Digital Outputs											
		PLC-BS1	Slot 2	Ch. 0	O:2/0	SPARE					
		PLC-BS1	Slot 2	Ch. 1	O:2/1	SPARE					
		PLC-BS1	Slot 2	Ch. 2	O:2/2	SPARE					
		PLC-BS1	Slot 2	Ch. 3	O:2/3	SPARE					
		PLC-BS1	Slot 2	Ch. 4	O:2/4	SPARE					
		PLC-BS1	Slot 2	Ch. 5	O:2/5	SPARE					

Equipment Tag #	Instrument Tag #	PLC	Slot	Channel	Address	Equipment Signal	DI	DO	AI	AO	Signal Detail
		PLC-BS1	Slot 2	Ch. 6	O:2/6	SPARE					
		PLC-BS1	Slot 2	Ch. 7	O:2/7	SPARE					
		PLC-BS1	Slot 2	Ch. 8	O:2/8	SPARE					
		PLC-BS1	Slot 2	Ch. 9	O:2/9	SPARE					
		PLC-BS1	Slot 2	Ch. 10	O:2/10	SPARE					
		PLC-BS1	Slot 2	Ch. 11	O:2/11	SPARE					
		PLC-BS1	Slot 2	Ch. 12	O:2/12	SPARE					
		PLC-BS1	Slot 2	Ch. 13	O:2/13	SPARE					
		PLC-BS1	Slot 2	Ch. 14	O:2/14	SPARE					
		PLC-BS1	Slot 2	Ch. 15	O:2/15	SPARE					
Slot 3 – Analog Inputs											
	FIT-601	PLC-BS1	Slot 3	Ch. 0	I:3.0	Aeration Basin #2 Air Flow (Relocated from PLC-RPS)			1		0-2500 SCFM
	FIT-602	PLC-BS1	Slot 3	Ch. 1	I:3.1	Aeration Basin #1 Air Flow (Relocated from PLC-RPS)			1		0-2500 SCFM
V-611		PLC-BS1	Slot 3	Ch. 2	I:3.2	Blower #1 Air Valve Position Indication (Relocated)			1		0-100% Full Open
V-613		PLC-BS1	Slot 3	Ch. 3	I:3.3	Aeration Basin #2 Air Valve Position Indication (Relocated)			1		0-100% Full Open
V-621		PLC-BS1	Slot 3	Ch. 4	I:3.4	Blower #2 Air Valve Position Indication (Relocated)			1		0-100% Full Open
V-623		PLC-BS1	Slot 3	Ch. 5	I:3.5	Aeration Basin #1 Air Valve Position Indication (Relocated)			1		0-100% Full Open
V-631		PLC-BS1	Slot 3	Ch. 6	I:3.6	Blower #3 Air Valve Position Indication (Relocated)			1		0-100% Full Open
	AIT-604	PLC-BS1	Slot 3	Ch. 7	I:3.7	Aeration Basin #2 Dissolved Oxygen (Relocated)			1		0-20 PPM
Slot 4 – Analog Inputs											
	AIT-605	PLC-BS1	Slot 4	Ch. 0	I:4.0	Aeration Basin #1 Dissolved Oxygen (Relocated)			1		0-20 PPM
	AIT-681	PLC-BS1	Slot 4	Ch. 1	I:4.1	Primary Effluent Splitter Box pH #1 (Relocated)			1		0-14 pH
	AIT-682	PLC-BS1	Slot 4	Ch. 2	I:4.2	Primary Effluent Splitter Box pH #2 (Relocated)			1		0-14 pH
	AIT-683	PLC-BS1	Slot 4	Ch. 3	I:4.3	Primary Effluent Slitter Box pH #3 (Relocated)			1		0-14 pH
	FIT-612	PLC-BS1	Slot 4	Ch. 4	I:4.4	Blower No. 1 Air Flow			1		0-2000CFM
	FIT-622	PLC-BS1	Slot 4	Ch. 5	I:4.5	Blower No. 2 Air Flow			1		0-2000CFM
	FIT-632	PLC-BS1	Slot 4	Ch. 6	I:4.6	Blower No. 3 Air Flow			1		0-2000CFM
	PIT-600	PLC-BS1	Slot 4	Ch. 7	I:4.7	Aeration Blowers Discharge Header Pressure (Relocated)			1		0-300 psi
Slot 5 – Analog Inputs											
		PLC-BS1	Slot 5	Ch. 0	I:5.0	SPARE					
		PLC-BS1	Slot 5	Ch. 1	I:5.1	SPARE					
		PLC-BS1	Slot 5	Ch. 2	I:5.2	SPARE					
		PLC-BS1	Slot 5	Ch. 3	I:5.3	SPARE					
		PLC-BS1	Slot 5	Ch. 4	I:5.4	SPARE					
		PLC-BS1	Slot 5	Ch. 5	I:5.5	SPARE					
		PLC-BS1	Slot 5	Ch. 6	I:5.6	SPARE					
		PLC-BS1	Slot 5	Ch. 7	I:5.7	SPARE					

Equipment Tag #	Instrument Tag #	PLC	Slot	Channel	Address	Equipment Signal	DI	DO	AI	AO	Signal Detail
Slot 6 – Analog Outputs											
V-611		PLC-BS1	Slot 6	Ch. 0	O:6.0	Blower #1 Air Valve Position Control (Relocated)				1	0-100% Full Close
V-613		PLC-BS1	Slot 6	Ch. 1	O:6.1	Aeration Basin #2 Air Valve Position Control (Relocated)				1	0-100% Full Close
V-621		PLC-BS1	Slot 6	Ch. 2	O:6.2	Blower #2 Air Valve Position Control (Relocated)				1	0-100% Full Close
V-623		PLC-BS1	Slot 6	Ch. 3	O:6.3	Aeration Basin #1 Air Valve Position Control (Relocated)				1	0-100% Full Close
V-631		PLC-BS1	Slot 6	Ch. 4	O:6.4	Blower #3 Air Valve Position Control (Relocated)				1	0-100% Full Close
		PLC-BS1	Slot 6	Ch. 5	O:6.5	SPARE					
		PLC-BS1	Slot 6	Ch. 6	O:6.6	SPARE					
		PLC-BS1	Slot 6	Ch. 7	O:6.7	SPARE					

Schedule 6 – MAN-PLC-NPW

The following table lists I/O details for the Manufacturer's Non Potable Water PLC.

Note: This table only shows the added signal to this PLC. CONTRACTOR not responsible for providing any additional IO cards to this existing PLC.

Equipment Tag #	Instrument Tag #	PLC	Slot	Channel	Address	Equipment Signal	DI	DO	AI	AO	Signal Detail
Slot X – Analog Inputs											
	LIT-696	MAN-PLC-NPW	Slot X	Ch. Y	N/A	Final Clarifier No. 3 Sludge Blanket Level			1		Level

PART 3 - EXECUTION

Not Used.

-END-

SECTION 13492 – SCADA SYSTEM - TESTING AND COMMISSIONING

PART 1 - GENERAL

1.01 Summary

A. Testing requirements of SCADA System in the factory and in the field.

B. Related Sections

1. Section 13400 – Measurement and Control Instrumentation
2. Section 13482 – SCADA and Control Systems – I/O List

1.02 Submittals

A. In addition to submittal requirements of Section 13400, submit the following in accordance with Section 01300:

1. Test Results:
   a. Pass/fail status of all digital I/O
   b. Results of analog I/O testing
2. Miscellaneous:
   a. Detailed step-by-step in-factory and field test procedure at least 3 weeks in advance of scheduled test date. Include sign-off sheets and punch list forms and description of configurations to be tested.
   b. Complete inventory of equipment to be tested at factory including make, model, and serial number. Label each piece of equipment.
   c. Preventive maintenance schedule
   d. Repair Report Forms
   e. Spares and Consumables Report

PART 2 - SERVICES

2.01 Preparation

A. In-Factory Testing Aids and Equipment:

1. Provide following documents.
   a. One copy of submittals applicable to equipment to be tested
   b. One copy of Drawings and Specifications, with Addenda and Change Orders
   c. One master copy of test procedure
   d. Complete inventory of equipment to be tested including make, model, and serial number

B. Meet following criteria prior to start of test:

1. Complete submittals and resolve disputes, if any
2. Engineer review of test procedure

3. Include PLC processor, PLC network interface, and HMIs/SCADA System in testing
4. Coordinate test date agreeable to each party

C. Schedule:

1. At end of test, meet to review list of deficiencies. Engineer or Owner will indicate those items which must be corrected prior to shipment.
2. Confirm, in writing, times and dates two weeks before tests.

2.02 In-Factory Inspection and PLC I/O Testing

A. In-Factory inspection and testing shall be performed at site of panel fabrication.

B. SCADA System PLC shall pass in-factory inspection and testing prior to shipment to job site.

C. In-Factory Inspection

1. In-Factory inspection will verify following in accordance with approved submittals:
   a. Panel dimensions
   b. Equipment layout
   c. Wiring
   d. Wire and terminal identification
   e. UPS placement
2. Verify proper access to equipment for maintenance.
3. Verify proper access to field wire termination points.
4. Inspect for neatness of wiring and wire harness construction.

D. In-Factory Testing and Demonstration (CP-BS1).

1. PLC programming software will be provided by OWNER.
2. Test as follows:
   a. Verify equipment and manuals against inventory lists
   b. Run hardware diagnostics
   c. Testing of all input and output (I/O) signals at terminal strip used for field terminations
      1) Test change of state for all discrete inputs
      2) Test analog inputs at 0, 4, 12, and 20 mA DC
      3) Manipulate PLC data table or use forces to test response of all discrete output signals
      4) Manipulate PLC data table to test response of all analog output signals at 4, 12, and 20 mA DC
3. Correct any deficiencies discovered prior to shipment to job-site.

E. Documentation

1. Prepare in-factory inspection and testing sign-off document. Document shall include following as a minimum:
   a. Project description and number

b. Company name for PLC supplier, Owner, and Engineer
c. Section labeled “In-Factory Inspection”, with listing of items to be inspected as described above
    1) For each item, include area for initials of PLC supplier and Engineer representative indicating passing of inspection
    2) Include area for handwritten notes of any corrections required
d. Section labeled “In-Factory Testing”, with listing of items to be tested as described above
    1) Include separate line for each I/O point to be tested
    2) For each item include area for PLC supplier to indicate PASS or FAIL and to enter initials of tester
    3) Include area for Owner and Engineer to indicate passing of tests
    4) Include area for handwritten notes of any corrections required

2.03 Field I/O and Software Testing

A. General:

1. Field testing is intended to check installation of the SCADA System PLC’s in addition to providing a diagnostic check of field equipment and wiring.
2. Field testing shall make use of operator workstation that is to be used for running the equipment. Provide any configuration required to establish Ethernet communications with the SCADA System PLC.
3. Testing shall begin after SCADA System PLC has been installed and all terminations are complete.
4. Use PLC configuration utilized for In-Factory Testing.

B. Field I/O Testing:

1. Run hardware diagnostics.
2. Testing of all input and output (I/O) signals by activation or injection of signal at field device.
    a. Digital input signals:
        1) For all equipment run signals, test by on/off operation of equipment. If operation of equipment is deemed inadvisable by Owner or PLC supplier due to potential process upset, inaccessibility of generating device, hazard to personnel or other factors, test by jumpering of motor starter auxiliary contact or other source of run signal.
        2) For all alarm or status signals, test by activation of device generating alarm. If generation of alarm is deemed inadvisable by Owner or PLC supplier due to potential process upset, inaccessibility of generating device, hazard to personnel or other factors, test by jumpering of alarm contact at nearest accessible location to generating device.
        3) For signals designated as spare, test by jumpering of signal at SCADA System PLC panel field termination point.
        4) Demonstrate change of state in PLC data table.
    b. Analog input signals:
        1) Verify impedance capabilities of transmitting device has not been exceeded by installation of SCADA System PLC.

2) Disconnect transmitting device and inject 0, 4, 12, and 20 mA DC into loop.
3) Demonstrate proper response to various signals in PLC data table.
4) Verify proper response of other devices in analog loop to various signals.
5) For signals designated as spare, test by injection of signal at SCADA System PLC panel field termination point.

c. Digital output signals:
1) Manipulate PLC data table or use forces to test response of all discrete output signals.
2) Verify proper response of other devices in loop to signals.
3) For signals designated as spare, test by checking signal at SCADA System PLC panel field termination point.

d. Analog output signals:
1) Verify impedance capabilities of analog outputs are not exceeded.
2) Generate 4, 12, and 20 mA DC signals for all analog outputs through PLC data table.
3) Verify proper response of other devices in analog loop to various signals. Verify proper loop current through measurement.
4) For signals designated as spare, test by measuring of signal at SCADA System PLC panel field termination point.

C. Documentation

1. Prepare field testing sign-off document. Document shall include following as a minimum:
a. Project description and number.
b. Company name for Owner, PLC supplier, and Engineer.
c. Include separate line for each I/O point to be tested.
d. For each item include area for PLC supplier to indicate PASS or FAIL and to enter initials of tester.
e. Include area for Owner and Engineer to indicate passing of tests.
f. Include area for handwritten notes of any corrections required.

D. Problem field devices or wiring.

1. Provide written documentation of any problems encountered with Owner's existing field devices or wiring during testing.

PART 3 - EXECUTION

3.01 Performance

A. Test PLC's consistent with Drawings and Specifications.

B. Refer to Section 13482 for information on ranges, signal functions, set-points, initial values, and activation points.

-END-

DIVISION 16 – ELECTRICAL

SECTION 16000 - BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.01 The Requirement

A. The Contractor shall furnish all labor, materials, tools, and equipment, and perform all work and services necessary for, or incidental to the furnishing and installation of all electrical work as shown on the Drawings and as specified in accordance with the provisions of the Contract Documents and completely coordinate with the work of other trades involved in the general construction. Although such work is not specifically shown or specified, all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation shall be furnished and installed as part of this work. The Contractor shall obtain approved Shop Drawings showing wiring diagrams, connection diagrams, roughing-in and hook up details for all equipment and comply therewith. All electrical work shall be complete and left in operating condition in accordance with the intent of the Drawings and the Specifications for the electrical work.

B. Where the word "Contractor" appears in these Technical Specifications it shall be construed to mean the Electrical Contractor.

C. CONTRACTOR SHALL REFERENCE THE FUNCTIONAL DESCRIPTIONS AND OTHER REQUIREMENTS FOUND IN 13400 – INSTRUMENT AND CONTROLS FOR ADDITIONAL REQUIREMENTS PERTAINING TO WORK UNDER THIS CONTRACT. THE FUNCTIONAL DESCRIPTIONS REFERENCED HEREIN SHALL BE CONSIDERED AS PART OF THE WORK REQUIRED UNDER THIS CONTRACT. THE PROGRAMMING OF PLC's WILL BE PROVIDED BY THE OWNER. CONTRACTOR IS RESPONSIBLE FOR COORDINATING WITH THE SYSTEMS INTEGRATOR AND OTHER SUPPLIERS FOR CONNECTIONS REQUIRED BY THE SCADA SYSTEM HARDWARE. THE PROGRAMMING BY OWNER WILL BE BASED ON THE CONTROL DESCRIPTIONS REFERRED TO IN SECTION 13400, THE CONTRACTOR IS RESPONSIBLE FOR PROVIDING WIRING AND TERMINATIONS PER THESE DESCRIPTIONS AND AS SHOWN ON THE CONTRACT DRAWINGS.

D. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL INTERCONNECTING DEVICES, CONDUIT, WIRE, AND APPURTENANCES NOT FURNISHED BY OTHERS BUT REQUIRED FOR THE OPERATION OF EQUIPMENT AS DESCRIBED IN THE FUNCTIONAL DESCRIPTIONS WHETHER SPECIFICALLY SHOWN ON THE DRAWINGS OR NOT. THE CONTRACTOR SHALL COORDINATE WITH THE PROVIDER OF DIVISION 13 EQUIPMENT AND CONTROLS REQUIREMENTS.

E. The scope of work for this project primarily includes, but is not limited to, the following:

1. Procurement and installation of (3) Variable Frequency Drives located in the Influent Lift Station and (3) Variable Frequency Drives located in the Return Pump Station.
2. Procurement and installation of sludge blanket level transmitters and supporting equipment, conduit and wiring for (2) Primary Clarifiers and (3), Final Clarifiers.
3. Procurement and installation of air flow meters and transmitters and their supporting equipment, conduit and wiring for (5) Aeration Blowers.
4. Procurement and installation of control panel CP-BS1.
5. Procurement and installation of junction boxes and related equipment at Final Clarifier No. 1 and Final Clarifier No. 2.
6. All conduit, wire and other supporting devices and equipment associated with the scope set forth in Division 13.
7. Procurement and installation of new nameplates, panel schedules and other identifying items for locations re-named under this project. (Primary Clarifier 1 and 2; Aeration Basin 1, 2 and 3;

F. Maintaining the operation of these facilities during the duration of the construction period is essential and required. The Contractor shall furnish and install temporary equipment as required to maintain facility operation. Reference Section 01550 of the Specifications for construction sequencing and specific operational constraint information.

G. All electrical equipment shall conform to the applicable NEMA specifications. All electrical equipment shall be properly identified in accordance with these Specifications and Contract Drawings. Nameplates shall be engraved high pressure plastic laminate, black with white lettering 120/208 or 120/240V equipment, and red with white lettering for 277/480 or 480V equipment. The nameplates shall be attached to the equipment cabinets with two (2) stainless steel sheet metal screws for nameplates up to 2-inch wide. For nameplates over 2-inch wide, four (4) stainless steel sheet metal screws shall be used, one (1) in each corner of the nameplate. All equipment shall be labeled in the manner described, or in an equally approved manner.

H. All materials, equipment, sizes and capacities of electrical equipment incorporated in the project shall conform to the latest requirements of the current National Electric Code (NEC), the National Electrical Manufacturer's Association (NEMA), the State and local electrical codes, and to applicable rules and regulations of the local electrical utility serving the project.

I. All material and equipment must be the product of an established and reputable manufacturer; must be new and of first class construction; must be designed and guaranteed to perform the service required; and must bear the label of approval of the Underwriters Laboratories, Inc., where such approval is available for the product of the listed manufacturer as approved by the Engineer.

J. When a specified or indicated item has been superseded or is no longer available, the manufacturer's latest equivalent type or model of material or equipment as approved by the Engineer shall be furnished and installed at no additional cost to the Owner.

K. Where the Contractor's selection of equipment of specified manufacturers or additionally approved manufacturers requires changes or additions to the system design, the Contractor shall be responsible in all respects for the modifications to all system designs, subject to approval of the Engineer. The Contractor's bid shall include all costs for all work of the Contract for all trades made necessary by such changes, additions or modifications or resulting from any approved substitution.

L. Furnish and install all stands, racks, brackets, supports and similar equipment required to properly serve the equipment which is furnished under this Contract, or equipment otherwise specified or indicated on the Drawings.

1.02 Drawings

A. Conduits and wiring are shown diagrammatically only, and the layout does not necessarily show the total number of conduits for the circuits required, nor are the locations of indicated runs intended to show the actual routing of conduits. The Contractor shall furnish, install, and place in satisfactory condition ready for operation, all conduits, cables and all other material needed for the complete lighting, power, and other electrical systems shown or indicated in the Contract Documents. Additional conduits and the required wiring shall be installed by the Contractor for wherever needed to complete the installation of the specific equipment furnished, at no additional cost to the Owner.

1.03 Equipment Location

A. The Drawings show the general location of feeders, transformers, outlets, conduits, and circuit arrangements. Because of the small scale of the Drawings, it is not possible to indicate all of the details involved. The Contractor shall carefully investigate the structural and finish conditions affecting all of their work and shall arrange such work accordingly; furnishing such fittings, junction boxes and accessories as may be required to meet such conditions. The Contractor shall refer to the entire Drawing set to verify openings, special surfaces, and location of other equipment, or other special equipment prior to roughing-in for panels, switches, and other outlets. **The Contractor shall verify all equipment dimensions to ensure that proposed equipment will fit properly in spaces indicated.**

1.04 Local Conditions

A. The Contractor shall examine the site and become familiar with conditions affecting the work. They shall investigate, determine and verify locations of any overhead or buried utilities on or near the site and shall determine such locations in conjunction with all public and/or private utility companies and with all authorities having jurisdiction. All costs, both temporary and permanent, to connect all utilities shall

be included in the Bid. The Contractor shall be responsible for scheduling and coordinating with the local utility for temporary and permanent services.

B. The Contractor shall relocate all duct banks, lighting fixtures, receptacles, switches, boxes and other electrical equipment as necessary to facilitate the Work included in this project at no additional cost to the Owner.

C. The Contractor is responsible for ensuring all electric utility equipment and construction installed by the Contractor is furnished and installed in accordance with the electric utility's design specifications and requirements. The Contractor is fully responsible for coordinating their scope of work with the electric utility. Any additional required electric utility construction or equipment not specified herein or shown on the Drawings shall be supplied by the Contractor at no additional cost to the Owner.

1.05 Submittals

A. The Contractor shall submit to the Engineer Shop Drawings of all electrical materials, apparatus, appliances, equipment and miscellaneous devices shown or specified and shall be in accordance with the requirements of the General Conditions and Section 01300, Submittals.

B. Shop Drawings shall be sufficiently complete in detail to enable the Engineer to determine compliance with Contract requirements. Details and information shown shall include but are not necessarily limited to the following:

1. Performance characteristics.
2. Physical sizes.
3. Material and equipment specifications, and construction and methods of fabrication details.
4. Compliance with standards (e.g. UL, NEMA), rules, regulations, and codes.
5. Accessories.
6. Complete wiring diagrams showing circuit designations as shown on the Drawings. A complete wiring diagram shall be submitted for each controller furnished.
7. Complete product data sheets for all components of the specified equipment.
8. Electrical ratings (voltage, current, KVA, phase, etc.)
9. Weights of components parts and assembled unit weights.
10. **Complete assembly, layout, and installation drawings with clearly marked dimensions.**

C. Partial, incomplete or illegible submittals will be returned to the Contractor without review for resubmittal.

D. Shop Drawings will be approved only to the extent of the information shown. Approval of an item of equipment shall not be construed to mean approval for components of that item for which Contractor has provided no information.

E. Each submittal shall be complete in all respects, incorporating all information and data listed herein and all additional information required for evaluation of the proposed equipment's specification section.

F. Each submittal shall be identified by the applicable specification section.

1.06 Applicable Codes and Requirements

A. Conformance

1. All work, equipment and materials furnished shall conform with the existing rules, requirements and specifications of the Insurance Rating Organization having jurisdiction, the serving electrical utility company, the latest edition of the National Electrical Code (NEC), the National Electric Manufacturers Association (NEMA), the Institute of Electrical and Electronic Engineers (IEEE), the Insulated Power Cable Engineers Association (IPCEA), the American Society of Testing Materials (ASTM), the American National Standards Institute (ANSI), the requirements of the Occupational Safety Hazards Act (OSHA) and all other applicable Federal, State and local laws and/or ordinances.
2. All material and equipment shall bear the inspection labels of Underwriters Laboratories, Inc., if the material and equipment is of the class inspected by said laboratories.
3. All work shall be in accordance with local codes.

B. Nonconformance

1. Any paragraph of requirements in these Specifications, or Drawings, deviating from the rules, requirements and Specifications of the above organizations shall be invalid and their (the above organizations) requirements shall hold precedent thereto. The Contractor shall be held responsible for adherence to all rules, requirements and specifications as set forth above. Any additional work or material necessary for adherence will not be allowed as an extra but shall be included in the Bid Price. Ignorance of any rule, requirement or Specification shall not be allowed as an excuse for nonconformity. Acceptance by the Engineer does not relieve the Contractor from the expense involved for the correction of any errors which may exist in the drawings submitted or in the satisfactory operation of any equipment.

C. Certification

1. Upon completion of the work, the Contractor shall obtain certificate(s) of inspection and approval from the National Board of Fire Underwriters or similar inspection organization having jurisdiction and shall deliver same to the Engineer and the Owner.

1.07 Permits and Inspections

A. The Contractor shall reference the General Conditions and Section 01010, Summary of Work.

1.08 Tests

A. Upon completion of the installation, the Contractor shall perform tests for operation, load (Phase) balance, overloads and short circuits. Tests shall be made with and to the satisfaction of the Owner and Engineer.

B. The Contractor shall perform all field tests and shall provide all labor, equipment and incidentals required for testing and shall pay for electric power required for the tests. All defective material and workmanship disclosed shall be corrected by the Contractor at no cost to the Owner. The Contractor shall show by demonstration in service that all circuits and devices are in good operating condition. Test shall be such that each item of control equipment will function not less than five (5) times in a row with no failures in between.

C. The grounding system shall be tested to ensure continuity and compliance with the requirement that ground resistances do not exceed 5 ohms when measured by a megohmeter or equivalent device. Ground resistance measurements of each grounding electrode shall be taken and certified by the Contractor. Upon completion of the Project, the Contractor shall submit to the Engineer the measured ground resistance of each ground rod and grounding system, indicating the location of the rod and grounding system as well as the resistance and soil conditions at the time the measurements were made. Ground resistance measurements shall be made in normally dry weather not less than 48 hours after rainfall and with the ground under test isolated from other grounds. Ground resistance shall also be measured from each piece of equipment to the grounding electrode. Reference Section 16170, Grounding and Bonding, for additional requirements.

D. Each lighting and power distribution panelboard shall be tested with main circuit breaker disconnected from the feeder, branches connected, branch circuit breakers closed, all fixtures in place and permanently connected, lamps removed or omitted from the fixtures and all wall switches closed.

E. Testing (Insulation Resistance Test) of all incoming and outgoing cables for switchgears, distribution and power panels, motor control centers and similar equipment shall be done after the cables are in place and just prior to final terminations. All data shall be recorded, as per Exhibit "A", attached to the end of this Section.

F. The Contractor shall furnish all equipment and personnel as required for testing of electrical equipment.

G. Feeder circuits shall be tested with the feeder conductors disconnected from the supplied equipment. Each individual power circuit shall be tested at the panel, motor control center or other similar equipment with the power equipment connected for proper operation.

H. Megohmmeter tests of the insulation resistance of rotating machines and power feeders shall be conducted. The results will be accepted when the megger shows

the insulation resistance to be not less than one megohm per 100 volts at 10°C using a 1,000-volt megger.

I. All transformers shall be Megohmmeter tested in accordance with the manufacturer's recommendations.

1.09 Documentation

A. Required Documentation

The work requirements of this Section are in addition to and do not supersede testing and adjusting specified in other portions of the Contract Documents. The Contractor shall submit to the Engineer test records and reports for all testing.

1.10 Field Test of Equipment

A. The equipment to be tested shall include, but not be limited to, the following:

- Instrumentation disconnects
- Conduit and wire
- Variable frequency drives
- Circuit breakers
- Instrumentation as described in Division 13

B. Refer to each specific specification section for detailed field tests.

1.11 Final Field Test of System

A. The Contractor shall complete the installation and testing of the electrical installation at least one (1) week prior to the start-up and testing of all other equipment. During the period between the completion of electrical installation and the start-up and testing of all other equipment, the Contractor shall make all components of the Work available as it is completed for their use in performing Preliminary and Final Field Tests.

B. Before each test commences, the Contractor shall submit a detailed test procedure, test engineer resumé, manpower and scheduling information for approval by the Engineer. In addition, the Contractor shall furnish detailed test procedures for any of their equipment required as part of the field tests of other systems.

C. The Contractor shall perform an infrared inspection to locate and correct all heating problems associated with electrical equipment. The infrared inspection shall apply to new and existing equipment that has been modified.

1.12 Schedules and Plant Operations

A. Since the testing required in 1.10 above shall require that certain pieces of equipment be taken out of service, all testing procedures and schedules must be submitted to the Engineer for review and approval one month prior to any work

beginning. When testing has been scheduled, the Engineer must be notified forty-eight hours prior to any work to allow time for load switching and/or alternation of equipment. In addition, all testing that requires temporary shutdown of plant equipment must be coordinated with the Owner/Engineer so as not to affect proper plant operations.

B. At the end of the workday, all equipment shall be back in place and ready for immediate use should a plant emergency arise. In addition, should an emergency condition occur during testing, at the request of the Owner, the equipment shall be placed back in service immediately and turned over to plant personnel.

C. In the event of accidental shutdown of plant equipment, the Contractor shall notify plant personnel immediately to allow for an orderly restart of affected equipment.

1.13 Materials Handling

A. Materials arriving on the job site shall be stored in such a manner as to keep material free of rust and dirt, and so as to keep material properly aligned and true to shape. Rusty, dirty or misaligned material shall be rejected. Electrical conduit shall be stored to provide protection from the weather and accidental damage. Rigid non-metallic conduit shall be stored on even supports and in locations not subject to direct sun rays or excessive heat. Cables shall be sealed, stored and handled carefully to avoid damage to the outer covering or insulation and damage from moisture and weather. Adequate protection shall be required at all times for electrical equipment and accessories until installed and accepted. Materials damaged during shipment, storage, installation or testing shall be replaced or repaired in a manner meeting with the approval of the Engineer. The Contractor shall store equipment and materials in accordance with Section 01550, Plant Operations During Construction.

PART 2 - PRODUCTS

2.01 Product Requirements

A. Unless otherwise indicated, the materials to be provided under this Specification shall be the products of manufacturers regularly engaged in the production of all such items and shall be the manufacturer's latest design. The products shall conform to the applicable standards of UL and NEMA, unless specified otherwise. International Electrotechnical Commission (IEC) standards <u>are not</u> recognized. Equipment designed, manufactured and labeled in compliance with IEC standards is not acceptable.

B. All items of the same type or ratings shall be identical. This shall be further understood to include products with the accessories indicated.

C. All equipment and materials shall be new unless indicated or specified otherwise.

D. The Contractor shall submit proof if requested by the Engineer that the materials, appliances, equipment or devices that they provide under this Contract meet the

requirements of Underwriters Laboratories, Inc., in regard to fire and casualty hazards. The label of or listing by the Underwriters Laboratories, Inc., will be accepted as conforming with this requirement.

2.02 Substitutions

A. Any reference in the Specifications or on the Drawings to any article, service, product, material, fixture or item of equipment by name, make or catalog number shall be interpreted as establishing the type, function and standard of quality and shall not be construed as limiting competition.

2.03 Concrete

A. The Contractor shall furnish all concrete required for the installation of all electrical work, Concrete shall be Class A unless otherwise specified, and in complete conformance with the applicable requirements of Division 3 of the Specifications.

B. The Contractor shall provide concrete equipment pads for all free-standing electrical apparatus and equipment located on floors or slabs that are existing or provided by others. The Contractor shall provide all necessary anchor bolts, channel iron sills, etc. The exact location and dimensions shall be coordinated for each piece of equipment well in advance of the scheduled placing of these pads. Equipment pads shall be 4 inches high unless otherwise indicated on the Drawings. Pads shall be reinforced with steel wire mesh and shall have dowel rods inserted into the floor for anchorage.

C. The Contractor shall provide concrete foundations for all free-standing electrical apparatus and equipment located outdoors or where floors or slabs are not existing or provided by others. The Contractor shall provide all necessary anchor bolts, channel iron sills, etc. The location and dimensions shall be coordinated for each piece of equipment well in advance of the scheduled placing of the foundations. Equipment foundations shall be constructed as detailed on the Drawings or if not detailed on the Drawings shall be 6 inches thick minimum reinforced with #4 bars at 12-inch centers each way placed mid-depth. Concrete shall extend 6 inches minimum beyond the extreme of the equipment base and be placed on a compacted stone bed (#57 stone or ABC) 6 inches thick minimum.

D. Concrete and reinforcing steel shall meet the appropriate requirements of Division 3 of the Specifications.

PART 3 - EXECUTION

3.01 Cutting and Patching

A. Coordination

1. The work shall be coordinated between all trades to avoid delays and unnecessary cutting, channeling and drilling. Sleeves shall be placed in concrete for passage of conduit wherever possible.

B. Damage

1. The Contractor shall perform all chasing, channeling, drilling and patching necessary to the proper execution of their Contract. Any damage to the building or any equipment shall be repaired by qualified mechanics of the trades involved at the Contractor's expense. If, in the Engineer's judgment, the repair of damaged equipment would not be satisfactory, then the Contractor shall replace damaged equipment at their own expense.

3.02 Excavation and Backfilling

A. The Contractor shall perform all excavation and backfill required for the installation of all electrical work. All excavation and backfilling shall be in complete accordance with the applicable requirements of Division 2.

3.03 Corrosion Protection

A. Wherever dissimilar metals, except conduit and conduit fittings, come into contact, the Contractor shall isolate these metals as required with neoprene washers, nine (9) mil polyethylene tape, or gaskets.

-END-

SECTION 16111 – CONDUIT

PART 1 - GENERAL

1.01 The Requirement

A. Under this Section, the Contractor shall furnish and install all conduits and conduit fittings to complete the installation of all electrically operated equipment as specified herein and as required.

B. The Drawings indicate the general location of conduits both exposed and concealed; however, the Contractor shall install these conduits in such a manner to avoid all interferences.

C. Reference Section 16000, Basic Electrical Requirements.

1.02 Testing

A. All tests shall be performed in accordance with the requirements of the General Conditions and Division 1. The following tests are required:

1. Witnessed shop tests
   a. None required.
2. Field tests
   a. Field testing shall be done in accordance with the requirements specified in the General Conditions, Division 1 and Section 16000, Basic Electrical Requirements.
   b. All conduit shall be tested to ensure continuity and the absence of obstructions by pulling through each conduit a swab followed by a mandrel 85% of the conduit inside diameter. After testing, all conduits shall be capped after installation of suitable pulling tape.

1.03 Submittals

A. In accordance with the procedures and requirements set forth in the General Conditions and Section 01300, Submittals, the Contractor shall obtain from the equipment manufacturer and submit shop drawings. Each submittal shall be identified by the applicable Specification section.

1.04 Shop Drawings

A. Each submittal shall be complete in all respects, incorporating all information and data listed herein and all additional information required for evaluation of the proposed equipment's compliance with the Contract Documents.

B. Partial, incomplete or illegible submittals will be returned to the Contractor without review for resubmittal.

C. Shop drawings shall include but not be limited to equipment specifications and product data sheets identifying all materials used and methods of fabrication.

PART 2 - PRODUCTS

2.01 Manufacturers

A. The material covered by this Specification is intended to be standard material of proven performance as manufactured by reputable concerns. Material shall be fabricated, constructed and installed in accordance with the best practices of the trade, and shall operate satisfactorily when installed as specified herein and shown on the Drawings.

2.02 Conduits

A. Unless specified otherwise herein, or indicated on the Drawings, all conduits shall be rigid Aluminum. Minimum size conduit shall be 3/4 inch unless specifically indicated otherwise on the Drawings. Unless specified otherwise herein or indicated on the Drawings, all underground conduits shall be PVC Schedule 40, minimum size 1 inch. The Contractor, at their option, for ease of installation to accommodate saddle size, may increase the size of encased conduits to 2-inch. However, no combining of circuits/conductors will be permitted in these larger conduits.

1. All components of the conduit system shall be of the same material of construction. Aluminum conduit systems shall include fittings, couplings, connectors and other components compatible with and approved for such systems. Coated conduit systems shall include factory coated fittings couplings, connectors and other components compatible with and approved for coated conduit systems.
2. Reference the "Conduit Uses" portion of this specification for additional information regarding conduit.

B. Rigid Aluminum Conduit

1. Aluminum or conduits shall be rigid type, heavy wall. Rigid metallic conduits shall be as manufactured by Allied Tube and Conduit Corporation, Wheatland Tube Company, Jones & Laughlin Steel Company or equal.
2. Each length of conduit shall be shipped with a coupling on one end and a color-coded thread protector at the other end.

3. include connections between stubs in concrete and generator sets or variable frequency drives. All other applications shall be submitted for approval to the engineer.

C. Liquid-Tight Flexible Metal Conduit

1. Liquid-tight flexible conduit (LFMC) shall be galvanized steel, single strip, with a copper strip interwoven and suitable as a grounding means. LFMC shall be UL listed. LFMC shall have an extruded moisture and oil-proof PVC jacket. LFMC shall be Liquatite Type "LA" as manufactured by Electri-Flex, "Ultratite" Type UL"Ultralite" as manufactured by Alflex Corporation, Type "A" as manufactured by Anaconda or equal.

2. Watertight connectors shall be used with liquid-tight flexible metal conduit on both ends.
3. LFMC shall be used to connect all vibrating equipment installed outdoors, in wet or damp areas, and other applications as directed by the Engineer. Examples of acceptable conditions (if unavoidable) include connections between stubs in concrete and generator sets or variable frequency drives. All other applications shall be submitted for approval to the engineer.

D. Rigid Nonmetallic Conduit

1. Rigid nonmetallic conduit shall be Schedule 40 polyvinyl chloride (PVC), 90°C, UL rated and shall conform to NEMA TC-2. Fittings and conduit bodies shall conform to NEMA TC3.
2. Rigid non-metallic conduit shall be as manufactured by Carlon, Triangle Conduit and Cable, Cantex, Inc. or equal.

E. PVC Coated Metallic Conduit

1. PVC coated rigid steel conduit shall be furnished and installed as specified herein and indicated on the Drawings. The product shall be rigid galvanized steel conduit covered with a bonded 40 mil (minimum) thickness PVC jacket and coated inside with urethane. The conduit shall comply with NEMA RN-1 and shall be "Plasti-Bond Red" as manufactured by Robroy Industries, "OCAL-Blue" as manufactured by Ocal, Inc., Perma-Cote Supreme by Perma-Cote Industries or equal.

F. Conduit Fittings

1. Fittings for rigid metal conduit, rigid nonmetallic conduit and liquid-tight flexible metal conduit shall conform to UL 467 and UL 514 as applicable.
2. Set screw or indenter type connectors shall not be used. Fittings for conduit installed in wet locations and underground shall provide a watertight joint. Fittings for rigid conduit shall be threaded.
3. Fittings or bushings shall be installed in easily accessible locations.
4. Where exposed conduits pass across structural expansion joints, approved weatherproof telescopic type expansion fittings shall be used. Fittings shall be OZ/GEDNEY Type AX, or equal, watertight, permit a movement up to 4 inches and shall be equipped with approved bonding jumpers around or through each fitting. Bonding jumpers shall be Appleton, Crouse-Hinds, OZ/Gedney or equal.
5. Where embedded conduits pass through expansion joints, approved watertight, concrete-tight, deflection/expansion fittings shall be used. Fittings shall compensate for movement of ¾-inch from the normal in all directions. Fittings shall be OZ/GEDNEY Type DX or equal.
6. Where embedded conduits pass through structural expansion joints, approved watertight, concrete-tight, deflection/expansion fittings shall be used. Fittings shall compensate for movement of ¾-inch from the normal in all directions. Fittings shall be OZ/GEDNEY Type DX, or equal.
7. Conduit fittings ("condulets") shall be used on exposed conduit work for lighting and power outlets, convenience outlets, changes in direction of conduit runs and breaking around beams. "Condulets" shall be cast ferrous alloy, galvanized or

cadmium plated, as manufactured by Crouse-Hinds, OZ/Gedney, Appleton Company or equal. Coated fittings and boxes shall be used with coated conduit in all chemically aggressive areas or where called for on the Drawings. Covers shall be of a design suitable for the purpose intended. In damp areas, the outside condulets shall be made watertight. Install all condulets with the covers accessible. Use proper tools to assemble conduit system to prevent injury to the plastic covering. No damage to the covering shall be permitted.

8. Conduit fittings shall be cast type of non-ferrous metal or malleable iron thoroughly coated inside and outside with metallic zinc or cadmium after all machining has been completed. Cast fittings shall be provided with heavy threaded hubs to fit the conduit required. Covers shall be of the same material as the fittings to which they are attached and shall be screwed on with rubber or neoprene gaskets between the covers and fittings. Cast fittings 1-1/2 inches and above shall be of the "mogul" type. Provide fittings of the "deep" type.
9. Coated fittings shall be used with coated conduit. All conduit nipples, elbows, couplings, boxes, fittings, unions, expansion joints, connectors, bushing and other components of the raceway system shall be factory coated to maintain the corrosion-resistant integrity of the conduit system. The coated conduit and its respective components shall all be provided by the same manufacturer. Coated conduit shall be used in all areas specified herein or indicated on the Drawings.
10. Conduit seals shall be Type EYS as manufactured by Crouse-Hinds, Appleton equivalent, OZ/Gedney equivalent or equal.

PART 3 - EXECUTION

3.01 Conduit and Fittings

A. Unless otherwise specified herein or indicated on the Drawings, the minimum size conduit shall be 1 inch for exposed work and 1 inch for conduit encased in concrete or mortar.

B. Conduit home runs for some circuits are not necessarily indicated on the Drawings; however, the circuit numbers are shown or are in the panel schedules. Conduit shall be furnished and installed for these lighting circuits and shall be installed as required to suit field conditions, subject to review and acceptance by the Engineer.

C. Conduit shall be installed concealed unless otherwise indicated or specified. Conduit may be run exposed on walls only where concealing is not practical, or at the direction of the Engineer.

D. Where exposed, maintain a minimum distance of 6 inches from parallel runs of flues or water pipes. Conduit runs shall be installed in such locations as to avoid steam or hot water pipes. A minimum separation of 12 inches shall be maintained where conduit crosses or parallels hot water or steam pipes.

E. For floor mounted equipment, conduit may be run overhead and dropped down, where underfloor installation is not practical. Groups of conduits shall be uniformly spaced in straight runs and at turns. Conduit shall be cut with a hacksaw or an approved conduit-cutting machine and reamed after threading to remove all burrs.

Securely fasten conduit to outlets, junction and pull boxes to effect firm electrical contact. Join conduit with approved couplings. Conduits shall be freed from all obstructions.

F. Empty (spare) conduit systems shall be furnished and installed as indicated on the Drawings and shall have pull wires installed. The pull wire shall be No. 14 AWG zinc-coated steel, or of plastic material, having not less than 200 pound tensile strength. Not less than 12 inches of slack shall be left at each end of the pull wire.

G. Each piece of conduit installed shall be free from blisters or other defects. Each piece installed shall be cut square, taper reamed and a coat of sealing compound applied to threads. Threads on conduits shall be painted with a conducting compound prior to making up in a fitting. Conduit connections shall be made with standard coupling and the ends of the conduit shall butt tightly into the couplings. In exposed work only, where standard coupling cannot be used, only Erickson couplings are permitted, or as otherwise acceptable to the Engineer.

H. Conduit threaded in the field shall be of standard sizes and lengths.

I. All bends shall be made with standard factory conduit elbows or field bent elbows. Field bending of conduit shall be done using tools approved for the purpose. Heating of conduit to facilitate bending is prohibited. Field bends shall be not less than the same radius than a standard factory conduit elbow. Bends with kinks shall not be acceptable.

J. The equivalent number of 90° bends in a single conduit run are limited to the following:

1. Runs in excess of 300 feet: 0
2. Runs of 300 feet to 201 feet: 1
3. Runs of 200 feet to 101 feet: 2
4. Runs of 100 feet and less: 3

K. All conduit for fiber optic cable shall have a minimum bending radius of 16 inches and be no less than 2 inches in diameter. Final bending radius shall be determined by the fiber optic cable manufacturer.

L. Unless otherwise specified herein, indicated on the Drawings or required by the NEC, conduit shall be supported every 8 feet and shall be installed parallel with or perpendicular to walls, structural members or intersections of vertical planes and ceilings with right angle turns consisting of fittings or symmetrical bends. Conduits shall be supported within 1 foot of all changes in direction. Supports shall be approved pipe straps, wall brackets, hangers or ceiling trapeze. All fasteners, clamps, straps and anchors shall be stainless steel. The use of perforated strap hangers or Mineralac conduit hangers are prohibited. Perforated strap hangers shall not be used. In no case shall conduit be supported or fastened to another pipe or installed to prevent the removal of other pipe for repairs. Fastenings shall be by expansion bolts on concrete; by machine screws, welded threaded studs or spring-tension clamps on steel work. Explosive-drive equipment may be used to make connections where the use of this equipment complies with safety regulations.

Wooden plugs inserted in masonry and the use of nails as fastening media are prohibited. Threaded C-clamps may be used on rigid steel conduit only. Conduits or pipe straps shall not be welded to steel.

M. The load applied to fasteners shall not exceed 1/4 of the proof test load. Fasteners attached to concrete ceilings shall be vibration and shock resistant. Holes cut to a depth of more than 1-1/2 inches in reinforced concrete beams or to a depth of more than 3/4 inch in concrete joints shall not cut the main reinforcing bars. Holes not used shall be filled. Spring steel fasteners may only be used to support lighting branch circuit conduits to structural steel members. Conduits shall be fastened to all sheet metal boxes and cabinets with two (2) locknuts where required by the National Electrical Code to insure adequate bonding for grounding. Where insulated bushings are used, or where bushings cannot be secured firmly to the box or enclosure, a bonding jumper shall be installed to maintain suitable grounding continuity. Locknuts shall be the type with sharp edges for digging into the wall of metal enclosures. Bushings shall be installed on the ends of all conduits and shall be of the insulating type where required by the National Electrical Code.

N. Conduit installed in concrete floor slabs or walls shall be located so as not to affect the designed structural strength of the slabs. Conduit shall be installed within the middle one-third of the concrete slab except where necessary to not disturb the reinforcement. The outside diameter of conduit shall not exceed one-third of the slab thickness, and conduits shall be spaced no closer than three (3) diameters except at cabinet locations. Curved portions of bends shall not be visible above the finish slab. Where embedded conduits cross expansion joints, suitable watertight expansion fittings and bonding jumpers shall be provided. Conduit larger than 1-inch trade size shall be parallel with or at right angles to the main reinforcement. When at right angles to the reinforcement, the conduit shall be close to one of the supports of the slab. Conduits shall not be stacked more than two (2) diameters high in floor slabs.

O. Install polyvinyl chloride (PVC) coated steel conduits when entering or exiting concrete except under electrical equipment where the conduit is not subject to physical abuse. Extend stub-ups at least 12 inches above and below grade or finish floor. Conduits extending through the concrete floor shall be installed using straight runs (for vertical penetrations) or factory elbows (for conduits installed within the slab) of PVC coated rigid steel conduit.

P. All conduit extending through the floor behind panels or into control centers or similar equipment may be PVC Schedule 40 and shall extend a minimum of 6 inches above the floor elevations, where practicable, with no couplings at floor elevations.

Q. Unless specifically identified on the Drawings as "Direct Buried," all conduits in the earth, including conduits below slabs-on-grade, shall be installed per the standard details. Joints in conduit shall be staggered so as not to occur side by side. Rigid non-metallic (PVC) conduit shall be connected to PVC coated rigid steel conduit at the point where it leaves the ground, with the transition to metal conduit occurring inside the concrete encasement or when exiting the ground.

R. No more than three (3) 90 degree bends will be allowed in any one conduit run. Where more bends are necessary, a condulet or pull box shall be installed. All sizes shall have machine bends. Joints in threaded conduit shall be made up watertight with the appropriate pipe thread sealant or compound applied to male threads only; all field joints shall be cut square, reamed smooth and properly threaded to receive couplings. No running threads are permitted. All conduit ends at switch and outlet boxes shall be fitted with an approved locknut and bushing forming an approved tight bond with box when screwed up tightly in place.

S. Conduits stubbed up through concrete floors for connections to freestanding equipment and for future equipment shall be provided with an adjustable top or coupling threaded inside for plugs, set flush with the finished floor. Wiring shall be extended in rigid metal conduit to equipment except that, where required, flexible metal conduit may be used 6 inches above the floor. Screwdriver operated threaded flush plugs shall be installed in conduits from which no equipment connections are made.

T. Where outlets are shown near identified equipment furnished by this or other Contractors, it is the intent of the Specifications and Drawings that the outlet be located at the equipment to be served. The Contractor shall coordinate the location of these outlets to be near the final location of the equipment served whether placed correctly or incorrectly on the Drawings. Changes in outlet locations required to serve the equipment furnished by other Contractors on the Project shall be brought to the attention of the Engineer.

U. Conduit shall be protected immediately after installation by installing flat non-corrosive metallic discs and steel bushings, designed for this purpose, at each end. Discs shall not be removed until it is necessary to clean the conduit and install the conductors. Before the conductors are installed, insulated bushings shall be installed at each end of the conduit.

V. Where "all-thread" nipples are used between fittings and electrical equipment, they shall be so installed that no threads are exposed.

W. Connections from rigid conduit to motors and other vibrating equipment, limit switches, solenoid valves, level controls and similar equipment, shall be made with short lengths of liquid-tight flexible metal conduit. These conduits shall be installed in accordance with the NEC and shall be furnished and installed with appropriate connectors with devices which will provide an excellent electrical connection between the equipment and the rigid conduit for the flow of ground current. Flexible metal conduit and liquid-tight flexible metal conduit length shall be five feet (5 feet), maximum.

X. Flexible metal conduit or liquid-tight flexible metal conduit installed between rigid metal conduit and motor terminal box and/or any other apparatus shall have a green insulated grounding conductor running through flexible conduit. This conductor shall be terminated to the nearest pull box, motor terminal box, or any other apparatus ground terminal.

Y. All threaded ends of conduits shall be coated with an approved conducting compound as manufactured by Thomas & Betts, or equal prior to making up the joint.

Z. Conduits installed within or underneath floor slabs, underground direct-buried or concrete encased conduits, and all conduits installed in areas subject to liquid inadvertently entering the conduit system shall be sealed or plugged at both ends in accordance with NEC Article 300-5(g). This requirement applies to both conduits containing conductors and "spare" conduits. Where practicable, the interior of the conduit shall be sealed as well as around the conductors by using conduit sealing bushings: Type CSB as manufactured by O/Z Gedney, or equal. Where the conduit fill does not allow the use of these bushings, the conduits shall be tightly caulked or plugged.

AA. Conduit passing through the walls and floors of buildings below grade shall be installed with appropriate watertight fittings to prevent the entrance of ground water around the periphery of the conduits. For vertical conduit penetrations through openings in concrete floors, the fittings shall be Type FSK Floor Seals as manufactured by OZ/Gedney. For conduit penetrations through openings in concrete walls, the fittings shall be Type WSK Thruwall seals as manufactured by OZ Gedney. Conduits shall be sloped away from the buildings toward splice boxes, handholes and/or manholes to provide drainage away from the building wall.

Conduits passing through sleeves in interior walls and floors shall be tightly caulked.

BB. Weatherproof, insulated throat "Meyers" hubs shall be used on all conduit entries to boxes and devices without integral hubs in process areas to maintain NEMA 4X integrity. The Contractor shall furnish and install "Meyers" hubs on all conduit entries into non-cast enclosures such as metallic or non-metallic control panels, control component enclosures, wireways, pull boxes, junction boxes, control stations and similar type equipment when this type of equipment is located in process areas requiring NEMA 4X integrity. This specified requirement for "Meyers" hubs does not apply to any area of the plant facilities where NEMA 4X integrity is not required.

CC. The use of two (2) locknuts and a grounding bushing shall be required at all conduit terminations where hub type fittings are not required, such as electrical rooms, control rooms and office areas.

DD. Conduit installation shall be arranged to minimize cleaning. No horizontal runs of conduit will be permitted in brick or masonry walls.

EE. Install non-metallic conduits in accordance with manufacturer's instructions where specified herein or indicated on the Drawings.

FF. Join non-metallic conduit using cement as recommended by the manufacturer. Clean and wipe non-metallic conduit dry before joining. Apply full even coat of cement to entire area inserted in fitting.

GG. Use proper installation tools approved for the purpose to assemble coated conduit systems to prevent damage to the covering and maintain the corrosion-resistant integrity of the conduit system. No damage to the covering is permitted.

3.02 Conduit Uses and Applications

A. No PVC conduit shall be installed exposed unless specifically accepted in writing by the Engineer. Where PVC conduit is allowed to be installed exposed, the conduit shall be Schedule 80 as required by the NEC. Reference Article 300-5(d) of the NEC.

B. PVC Schedule 40 conduit shall be furnished and installed in concrete slabs (for slab-on-grade construction) and in walls when the conduit is shown to be encased. Rigid steel conduit shall be installed in all elevated slabs when the conduits are shown to be encased.

C. All instrumentation wire and cable for analog signals shall be installed in rigid steel conduit or PVC coated rigid steel conduit to suit the application. This applies to all conduit installations including exposed, concealed in concrete encasement and all other applications.

D. PVC coated rigid steel conduit shall be furnished and installed, where conduit exits concrete, as specified.

E. Aluminum conduit shall be used where conduit is exposed in all outdoor locations.

F. Other conduit uses not specifically listed above shall be brought to the attention of Engineer for a decision.

-END-

SECTION 16118 - UNDERGROUND DUCTS AND HANDHOLES

PART 1 - GENERAL

1.01 The Requirement

A. The Contractor shall furnish and install underground duct systems, electric manholes, and electric handholes as specified herein and as shown on the Drawings. The work shall be complete and shall include excavation, concrete construction, backfilling and all materials, items and components required for a complete system.

B. The provisions of this Division are applicable to all underground conduit work. All work shall be coordinated with that of the various utility companies and other Contractors. The Contractor shall adhere to all utility company requirements.

C. Reference Section 16000, Basic Electrical Requirements and Section 16111, Conduit.

1.02 Testing

A. The following tests are required:

1. Witnessed shop tests
   a. None required.
2. Field tests
   a. Field tests for all completed duct systems shall consist of pulling a swab through each conduit followed by a mandrel equal in size to 85% of the conduit inside diameter.
   b. After testing, all conduits shall be capped after installation of a suitable pulling tape. All field tests shall be witnessed by the Engineer.

1.03 Submittals

A. Each submittal shall be identified by the applicable Specification Section.

1.04 Shop Drawings

A. Each submittal shall be complete in all respects, incorporating all information and data listed herein and all additional information required for evaluation of the proposed equipment's compliance with the Contract Documents.

B. Partial, incomplete, or illegible submittals will be returned to the Contractor without review for resubmittal.

C. Shop drawings shall include but not be limited to, the following:

1. Equipment specifications and product data sheets.
2. Outline and dimensional drawings including detailed sections of the manholes and/or handholes.

3. Materials specifications and structural calculations for the manholes sealed by a Professional Engineer in the State of Indiana.

1.05 Identification

A. Each electric manhole and handhole cover shall be lettered with the word “Electric”, the manhole or handhole identification number (e.g. MH-1, HH-1, etc.), manufacturer's name or trademark and such other information as the manufacturer may consider necessary, or as specified, for complete identification.

PART 2 - PRODUCTS

2.01 Manufacturers

A. The material covered by this Specification is intended to be standard material of proven performance as manufactured by reputable concerns. Material shall be fabricated, constructed and installed in accordance with the best practices of the trade, and shall operate satisfactorily when installed as specified herein and shown on the Drawings.

2.02 Duct System

A. Underground duct system shall consist of parallel runs of Schedule 40 PVC conduit or rigid galvanized steel conduit encased in native soil with no stones in open areas, unless otherwise specified herein or indicated on the Drawings.

B. Nonmetallic conduit joints shall be made with standard Schedule 40 PVC Couplings and PVC solvent cement of the same manufacturer as the conduit. All PVC conduit shall be supplied by the same manufacturer. All joints shall be staggered, installed in accordance with the manufacturer’s recommendations, and made watertight.

C. All conduit elbows 3” and larger shall be rigid steel conduit.

D. Provide at least 24” separation between all power conduits containing voltages between 120V and 480V and signal conduits.

PART 3 - EXECUTION

3.01 General

A. The underground duct system, manholes, and handholes shall be installed as specified herein, indicated on the Drawings, and in accordance with manufacturers’ instructions.

3.02 Duct System

A. All underground conduit shall be installed per standard details. Conduit duct bank elevations at the handholes shall be maintained as shown on the Drawings.

Where deviation is necessary to clear unforeseen obstacles, the elevations may be changed after authorization by the Engineer.

B. Slope all conduits continuously away from structures and buildings with a minimum slope of 3” per 100’ unless otherwise indicated on the Drawings.

C. Care shall be exercised during excavation from the duct banks to prevent digging too deep. Backfilling of low spots with earth fill will not be permitted unless thoroughly compacted and acceptable to the Engineer.

D. Care shall be exercised, and temporary plugs shall be installed during installation to prevent the entrance of concrete, mortar, or other large particles of matter into the conduit systems. Manufactured spacers shall be utilized to support conduit during the pouring of concrete to prevent movement and misalignment of the conduits.

E. Large radius elbows, 36” minimum, shall be used for all 90-degree conduit bends in the duct system. Conduits shall be sealed as specified in Section 16111.

F. Construct concrete-encased conduits connecting to underground structures to have a flared section adjacent to the manhole to provide shear strength. Construct underground structures to provide shear strength. Construct underground structures to provide for keying the concrete encasement of the duct line into the wall of the structure. Use vibrators when this portion of the encasement is poured to ensure a seal between the encasement and the wall of the structure.

G. Six (6) inches above all duct banks, the Contractor shall furnish and install a six (6) inch wide yellow plastic electrical hazard tape. Tapes shall be 0.009 inch polyethylene and shall have a continuous two line message in bold black letter. Top line shall indicate “CAUTION CAUTION”. Second line shall indicate “ELECTRIC LINE BURIED BELOW.”

H. The Contractor shall perform all earthwork including excavation, backfill, bedding, compaction, shoring and bracing, grading and restoration of surfaces and seeded areas disturbed during the execution of the work.

-END-

SECTION 16123 - BUILDING WIRE AND CABLE

PART 1 - GENERAL

1.01 The Requirement

A. The Contractor shall furnish, install, connect, test and place in satisfactory operating condition, ready for service, all cables and wires indicated on the Drawings and as specified herein or required for proper operation of the installation, with the exception of internal wiring provided by electrical equipment manufacturers. The work of connecting cables to equipment, machinery, and devices shall be considered a part of this Section. All hardware, junction boxes, bolts, clamps, insulators and fittings required for the installation of cable and wire systems shall be furnished and installed by the Contractor.

B. The Contractor shall submit Shop Drawings and other material required to substantiate conformance with the requirements set forth on the Drawings and in Section 16000, Basic Electrical Requirements, and Section 01300, Submittals. Shop drawings shall include, but not be limited to, detailed specifications and product data sheets for the power, control and instrumentation cable required for this project.

C. The wire and cable to be furnished and installed for this project shall be the product of manufacturers who have been in the business of manufacturing wire and cable for a minimum of ten (10) years.

D. Reference Section 16000, Basic Electrical Requirements and Section 13455, SCADA Local Area Network *

1.02 Testing

A. All testing shall be performed in accordance with the requirements of the General Conditions and Division 1. The following tests are required:

1. Witness Shop Tests
   a. Not required.
2. Shop Test
   a. Prior to the first shipment of each size of power, control, and instrumentation cable to be furnished and installed under this Contract, samples of each size of cable shall be subjected to complete physical and electrical factory production tests at the manufacturer's plant. Other cable and wiring shall be tested in accordance with the applicable ICEA Standards. Six copies of certified test data sheets shall be submitted to the Engineer for approval prior to installation at the site. Subsequent shipment of each size of wire shall be covered by certificates of compliance which shall list Contractor's name, point of delivery, reel numbers, size of wire, length of wire and date of shipment. Certificates shall attest that the wires and cables comply with specification requirements and that those wires and cables are equal in every respect to wires and cables which have been successfully tested.

b. All test data or certificates shall be submitted.

3. Field Tests
   a. Field testing shall be done in accordance with the requirements specified in the General Conditions, Division 1, and Section 16000, Basic Electrical Requirements.
   b. After installation, all wires and cables shall be tested for insulation levels and continuity. Insulation resistance between conductors of the same circuit and between conductor and ground shall be tested. Testing for insulation levels shall be as follows:
      1) For 600V power and control cable, apply 1,000 VDC from a Megaohmeter for all 600V wires and cables installed in lighting, control, power, indication, alarm and motor feeder circuits. Testing for continuity shall be "test light" or "buzzer".
      2) 600V instrumentation signal cable shall be tested from conductor to conductor, conductor to shield, and conductor to ground using a Simpson No. 260 volt-ohmmeter or approved equal. The resistance value shall be 200 Megaohms or greater.

B. Low voltage wires and cables shall be tested before being connected to motors, devices or terminal blocks.

C. Voltage tests shall be made successively between each conductor of a circuit and all other conductors of the circuit grounded.

D. If tests reveal defects or deficiencies, the Contractor shall make the necessary repairs or shall replace the cable as directed by the Engineer, without additional cost to the Owner.

E. All tests shall be made by and at the expense of the Contractor who shall supply all testing equipment.

1.03 Submittals

A. In accordance with the procedures and requirements set forth in the General Conditions and Section 01300, Submittals, the Contractor shall obtain from the wire and cable manufacturer and submit the following:

1. Shop Drawings
2. Reports of Certified Shop and Field Tests
3. Wiring Identification Methods

B. Each submittal shall be identified by the applicable specification section.

1.04 Shop Drawings

A. Each submittal shall be complete in all respects, incorporating all information and data listed herein and all additional information required for evaluation of the proposed material's compliance with the Contract Documents.

B. Partial, incomplete or illegible Submittals will be returned to the Contractor without review for resubmittal.

C. Shop drawings shall include but not be limited to:

1. Product data sheets.
2. Cable pulling calculations.
3. Wiring identification methods and materials.

1.05 Identification

A. Each cable shall be identified as specified in Part 3, Execution, of this Specification.

1.06 Cable Pulling Lubricants (Necessary if non-lubricated wire is used)

A. The Contractor shall submit a list with a minimum of four manufacturer's standard lubricants which may be used interchangeably for each type of lubricant required. Lubricant shall be non-hardening type.

1.07 Cable Pull Calculations

A. The Contractor shall submit cable pulling calculations. These calculations, to be performed by a currently registered professional engineer in the State of Indiana, shall define pulling tension and sidewall loading (sidewall bearing pressure values) for all installations of 600VAC, #1/0 conductors and larger greater than 200 feet in length. Calculations for straight horizontal installations of 600VAC, #1/0 conductors and larger greater than 200 feet are not required.

PART 2 - PRODUCTS

2.01 Manufacturers

A. The wire and cable covered by this Specification is intended to be standard equipment of proven performance as manufactured by the Okonite Company, Rome Cable Corporation, Southwire Company or equal. Wire and cable shall be designed, constructed and installed in accordance with the best practices of the trade, and shall operate satisfactorily when installed as specified herein and shown on the Drawings. Only one manufacturer for each wire and cable type shall be permitted.

2.02 600 Volt Power Wire and Cable

A. 600 volt cable and wire shall consist of stranded, copper conductor with insulation rated THHN, 90°C for dry locations THWN, 75°C for wet locations.

B. Conductors shall be tin or alloy coated (if available), stranded copper per ASTM-B8 and B-33, and Class B or C stranding contingent on the size unless otherwise specified. Minimum size wire shall be No. 12 AWG.

C. Uncoated conductors shall only be allowed if specifically accepted by the Engineer.

D. 600 volt individual power wire and cable shall be Okoseal-N as manufactured by the Okonite Company, Rome Cable Corporation equivalent, Southwire Company equivalent or equal. Multi-conductor power cables shall be Okoseal-N Type TC Cable as manufactured by the Okonite Company, Rome Cable Corporation equivalent, Southwire Company equivalent or equal.

2.03 600 Volt Control Cable

A. 600 volt control cable shall consist of stranded, copper conductor with insulation rated THHN, 90°C for dry locations and THWN, 75°C for wet locations. The individual conductors of the multiple conductor cable shall be color coded for proper identification. Color coding shall be equal to ICEA S-68-514, Table K-1. Cables shall meet requirements of IEEE-383.

B. Conductors shall be tin or alloy coated (if available), stranded copper per ASTM B-8 and B-33 and Class B or C stranding contingent on the size unless otherwise specified. Minimum wire size shall be No. 14 AWG.

C. Uncoated conductors shall only be allowed if specifically accepted by the Engineer.

D. 600 volt individual conductor control wire shall be Okoseal-N as manufactured by the Okonite Company, Rome Cable Corporation equivalent, Southwire Company equivalent, or equal. Multi-conductor control cable shall be Okoseal-N Type TC Cable as manufactured by the Okonite Company, Rome Cable Corporation equivalent, Southwire Company equivalent or equal.

2.04 Lighting and Receptacle Wire and Cable

A. The lighting and receptacle branch circuit wire shall consist of stranded, copper conductors with insulation rated THHN, 90°C for dry locations and THWN, 75°C for wet locations.

B. Conductors shall be tin or alloy coated (if available), stranded copper per ASTM-B8 and B-33 and Class B or C stranding contingent on the size unless otherwise specified. Minimum size wire shall be No. 12 AWG.

C. Uncoated conductors shall only be allowed if specifically accepted by the Engineer.

D. Lighting and receptacle cables and wire shall be Okoseal-N as manufactured by the Okonite Company, Rome Cable Corporation equivalent, Southwire Company equivalent or equal.

2.05 Instrumentation Cable

A. The instrumentation cable for analog signals shall be single, shielded, twisted pairs or triads with 600 volt insulation and shall have a 90°C insulation rating.

B. Conductors shall be tin or alloy coated (if available), soft, annealed copper, stranded per ASTM-B8, Class B stranding unless otherwise specified. Minimum size wire shall be No. 16 AWG.

C. The instrumentation cable shall be Okoseal-N Type P-OS for single pair or triad applications and Okoseal-N Type SP-OS for multiple pair or triad applications as manufactured by the Okonite Company, Rome Cable Corporation equivalent, Southwire Company equivalent or equal.

2.06 Enhanced CAT6 UTP Cable

A. 4 pair Category 6 cables to conform to TIA/EIA 568A Commercial Building Telecommunications Cabling Standard, Horizontal Cable Section, and UL LAN Certification and Follow-up Program. Cables shall be marked as UL verified Category 6.

2.07 UTP Patch Cords for Equipment Enclosures

A. Provide Category 6 Modular Patch Cords as follows:

1. Power sum rated.
2. Patch cords shall not exceed 3 feet in length unless specifically required for application.
3. Conform to the requirements of EIA/TIA 568B Commercial Building Telecommunications Cabling Standard, Horizontal Cabling Section, and UL LAN Certification and Follow-up Program.
4. Equipped with molded 8 pin modular connector (RJ45, 8x8) on each end and conform to the length(s) specified on the detailed drawing.
5. Round, and 24-AWG copper, stranded conductors, tightly twisted into individual pairs.
6. Built-in exclusion features to prevent accidental polarity reversals and split pairs.

B. UL Verified for EIA/TIA 568B Electrical Performance

C. UL and c (UL) Listed for Fire Safety

D. ISO 9001 Certified Manufacturer

E. Austel Approved

F. FCC Compliant

G. Lucent Technologies, Panduit, or equal.

PART 3 - EXECUTION

3.01 600V Cable Installation

A. The cable and wires shall be installed as specified herein and shown on the Drawings.

B. The cables shall be terminated in accordance with the cable and/or termination product manufacturer's instructions for the particular type of cable.

C. To minimize oxidation and corrosion, wire and cable shall be terminated using an oxide-inhibiting joint compound recommended for "copper-to-copper" connections. The compound shall be Penetrox E as manufactured by Burndy Electrical, or equal.

D. Splices shall not be allowed in the underground manhole and handhole systems. If splices are required, the Contractor shall obtain approval in writing from the Engineer prior to splicing. Splicing materials shall be barrel type butt splice connectors and heat shrink tubing as manufactured by 3M, Ideal, or equal.

E. **No splicing of instrumentation cable is allowed.** The use of screw-on wire connectors (wire nuts) for power or control wiring will only be permitted if specifically accepted by the Engineer.

F. All wiring runs shall be continuous from protective device to load. Deviation from this statement is only permitted if specifically accepted by the engineer.

G. Wire and Cable Sizes

1. The sizes of wire and cable shall be as shown on the Drawings, or if not shown, as approved by the Engineer. If required due to field routing, the size of conductors and respective conduit shall be increased so that the voltage drop does not exceed 2-1/2%.
2. Minimum wire size within control panels, motor control centers, switchboards and similar equipment shall be No. 12 AWG for power and No. 14 AWG for control.

H. Number of Wires

1. The number of wires indicated on the Drawings for the various control, indication and metering circuits were determined for general schemes of control and for particular indication and metering systems.
2. The actual number of wires installed for each circuit shall, in no case, be less than the number required; however, the Contractor shall add as many wires as may be required for control and indication of the actual equipment selected for installation at no additional cost to the Owner. The addition of conductors shall be coordinated with and approved by the Engineer to avoid violations of the NEC regarding conduit fill.
3. All spare field conductors shall be terminated on the terminal blocks mounted within the equipment.

I. Wiring Identification

1. All wiring shall be identified at each termination, shall have a unique wire number, and shall be labeled at both ends. Wire numbers shall correspond with the equipment terminal wire numbers as indicated in the accepted Shop Drawings. Where no wire numbers are indicated, the Contractor shall advise the Engineer in writing prior to assigning wire numbers. Wire numbers shall not be duplicated.
2. In addition to color coding, for all 1-phase and 3-phase systems, identify each cable (single or multi-conductor) and conductor at each end, in each manhole,

pullbox, cable tray, or other component of the raceway system. This identification is applicable to all power, control, alarm, signal, instrumentation cables and conductors.

3. Identify each cable (single or multi-conductor) and groups or bundles of individual single conductors in each manhole, pullbox, cable tray or other component of the raceway system with circuit identification markers. Implement a "from-to" cable/conductor bundle tagging system as part of this identification effort.
4. For instrumentation wiring, the Contractor shall provide, on the Shop Drawings, a schedule indicating the wire number, color code (if applicable), origin and destination devices and terminals.
5. Wire identification shall be accomplished through the use of a portable printer and white, polyolefin wire marking sleeves. The wire identification system shall be a "Bradymarker" XC Plus Printer with "Bradysleeve" wire marking sleeves, Panduit equivalent, Seton equivalent or equal.
6. The Contractor shall submit a written description outlining their intended method of wiring identification and supporting information (i.e., product data sheets, etc.) identifying the materials to be used. The Contractor shall meet with the Owner and the Engineer to come to an agreement regarding wire identification prior to the installation of any wiring.

J. Cable Identification Tags

1. The Contractor shall furnish all labor and materials and affix in a permanent way to each cable in manholes, cable compartments and vaults, junction boxes, pull boxes and points of termination, a bronze metal tag, 1/2-inch in diameter, with a 1/8-inch diameter hole, with copper wire through the hole, the cable identification number approved by the Engineer. The tag shall be attached to the cable by twisting the ends of the copper wires. All cables shall be tagged with its full ID number immediately after it has been pulled.

K. Cable Installation

1. All interior cable not protected by a compartment enclosure shall be run in conduit.

L. Wiring Supplies

1. Only electrical wiring supplies manufactured under high standards of production and meeting the approval of the Engineer shall be used.
2. Rubber insulating tape shall be in accordance with ASTM Des. D119. Friction tape shall be in accordance with ASTM Des. D69.

M. Training of Cable

1. The Contractor shall furnish all labor and material required to train cables around cable vaults within buildings and in manholes and handholes in the outdoor underground duct system. Sufficient length of cable shall be provided in each handhole, manhole, and vault so that the cable can be trained and racked in an approved manner. Instrumentation cable shall be racked separate from all other

AC and DC wiring to maintain the required separation specified herein. In training or racking, the radius of bend of any cable shall be not less than the manufacturer's recommendation. All manhole cables shall be arc and fire-proofed. The training shall be done in such a manner as to minimize chaffing.

N. Connections at Control Panels, Limit Switches, and Similar Devices

1. Where stranded wires are terminated at panels and/or devices, connections shall be made by solderless lug, crimp type ferrule or solder dipped.
2. Where enclosure sizes and sizes of terminals at limit switches, solenoid valves, float switches, pressure switches, temperature switches and other devices make 7-strand, No. 12 AWG, wire terminations impractical, the Contractor shall terminate external circuits in an adjacent junction box of proper size and complete with terminal strips and shall install No. 14 AWG stranded wires from the device to the junction box in a conduit. The #12 AWG field wiring shall also be terminated in the same junction box to complete the circuit.

O. Pulling Temperature

1. Cable shall not be flexed or pulled when the temperature of the insulation or of the jacket is such that damage will occur due to low temperature embrittlement. When cable will be pulled with an ambient temperature within a three day period prior to pulling of 40°F or lower, cable reels shall be stored during the three day period prior to pulling in a protected storage area with an ambient temperature not lower than 55°F and pulling shall be completed during the work day for which the cable is removed from the protected storage.

P. Color Coding

1. Conductor insulation shall be color coded as follows:
   a. 480V AC Power
      Phase A - BROWN
      Phase B - ORANGE
      Phase C - YELLOW
      Neutral – WHITE
   b. 120/208V or 120/240V AC Power
      Phase A - BLACK
      Phase B - RED
      Phase C - BLUE
      Neutral - WHITE
   c. DC Power
      Positive Lead - RED
      Negative Lead - BLACK
   d. DC Control
      All wiring - BLUE
   e. 120VAC Control
      Single conductor 120 VAC control wire shall be RED except for a wire entering a motor control center compartment or control panel which is an interlock. This conductor shall be color coded YELLOW.

f. 24VAC Control
All wiring - ORANGE
g. Equipment Grounding Conductor
All wiring - GREEN

2. Conductors No. 2 AWG and smaller shall be factory color coded with a separate color for each phase and neutral, which shall be used consistently throughout the system. Larger cables shall be coded by the use of colored tape.

3.02 Instrumentation Cable Installation

A. The Contractor shall install all cable or conductors used for instrumentation wiring (4-20 mA DC, etc.) in rigid galvanized steel or PVC coated rigid galvanized steel conduit. The use of asbestos cement or plastic conduit will not be permitted. Analog signal wires shall exclusively occupy these conduits. No other wiring for AC or digital DC circuits shall be installed in these conduits.

B. All shielding shall be continuous and shall be grounded in accordance with the instrumentation equipment manufacturer's recommendations, as approved.

C. A raceway containing instrumentation cable shall be installed to provide the following clearances:

1. Raceway installed parallel to raceway conductors energized at 480 through 208 volts shall be 18 inches and 208/120 volts shall be 12 inches.
2. Raceway installed at right angles to conductors energized at 480 volts or 120/208 volts shall be 6 inches.

D. Where practical, raceways containing instrumentation cable shall cross raceway containing conductors of other systems at right angles.

E. Where instrumentation cables are installed in panels, manholes, handholes and other locations, the Contractor shall arrange wiring to provide maximum clearance between these cables and other conductors. Instrumentation cables shall not be installed in same bundle with conductors of other circuits.

F. Grounding of cable shield shall be accomplished at one point only unless otherwise required by instrumentation system's manufacturer.

G. Additional pullboxes shall be furnished and installed for ease of cable pulling and the cable manufacturer's recommended conduit fill factor shall be followed. Where required for specifically directed by the Engineer, the Contractor shall moisture seal the cables at all connections with OZ Gedney Type "CSB", or equal, sealing bushings.

H. Special instrument cable shall be as specified or recommended by the vendor of the equipment or instruments requiring such wiring. Installation, storage, terminations, etc. shall be per manufacturer's recommendations.

I. All cable, insulation and jacket shall have adequate strength to allow for it to be pulled through the conduit systems. Sufficient conductors shall be installed to

provide space and serve future equipment where shown and specified. All conductors shall be color coded and all wires shall be suitably tagged with permanent markers at each end.

3.03 Schedules

A. The conduit and wire schedules on the Drawings list conduit size, wire size, type and number required.

B. All conduits and wiring shall be furnished and installed under this Contract.

C. The definition of the term conduit shall include all types of raceways used on this project.

D. In all cases where the word “install” or “installed” refers to conduit, it shall mean install all conduit, raceways, fittings, supports, boxes and appurtenances. In addition, it shall include all grounding and bonding. Pull cords are to be pulled upon completion of each raceway.

E. In all cases where the word “install” or “installed” refers to cable, it shall include pulling the cable and testing the cable for insulation resistance, continuity and absence from grounds, as well as terminating all conductors and testing for proper connection.

F. The conduit and wire schedules do not indicate all of the conduit and wire required for the project. The Contractor is advised to refer to these Specifications and Drawings for the additional conduit and wire requirements. All lighting, receptacle and control circuits may require field routing by the Contractor.

G. Conduits leaving or entering a building or structure may be shown in a different arrangement as compared to the duct bank. The Contractor shall arrange conduits penetrating the building based on field conditions. The Drawings are not meant to represent actual conduit arrangements required. Furthermore, spare conduits from duct banks into buildings or structures are required and shall be furnished and installed based on field conditions and Engineer approval.

H. Certain runs of underground duct banks are not detailed, such as site lighting home runs, but all underground ducts shall comply with the requirements of these Specifications.

-END-

SECTION 16130 – OUTLET AND JUNCTION BOXES

PART 1 - GENERAL

1.01 The Requirement

A. The Contractor shall furnish and install junction boxes and outlet boxes for wiring devices of the type and at the locations as specified herein and as shown on the Drawings or as required. As a rule, provide junction boxes in all runs of greater than 100’ in length. For other lengths, provide boxes as required for splicing, pulling, or as specified in Section 16111, Conduit.

B. Reference Section 16000, Basic Electrical Requirements, Section 16111, Conduit, Section 16123, Building Wire and Cable, Section 16141, Wiring Devices and Section 16190, Supporting Devices.

1.02 Testing

A. All tests shall be performed in accordance with the requirements of the General Conditions and Division 1. The following tests are required:

1. Witnessed Shop Tests
   a. None required.
2. Field Tests
   a. All field testing shall be done in accordance with the General Conditions, Division 1, and Section 16000, Basic Electrical Requirements.

1.03 Submittals

A. In accordance with the procedures and requirements set forth in the General Conditions and Section 01300, Submittals, the Contractor shall obtain from the equipment manufacturer and submit shop drawings. Each submittal shall be identified by the applicable specification section.

1.04 Shop Drawings

A. Each submittal shall be complete in all respects, incorporating all information and data listed herein and all additional information required for evaluation of the proposed equipment's compliance with the Contract Documents.

B. Partial, incomplete or illegible submittals will be returned to the Contractor without review for resubmittal.

C. Shop drawings shall include, but not be limited to:

1. Product data sheets.
2. Product dimensional drawings.

1.05 Supplies and Spare Parts

A. The Contractor shall furnish 10% (minimum of 1) spare box for each type of receptacle, switch and plug furnished and installed for this project and 10% (minimum of 1) spare junction box for each type of junction box furnished in this project.

B. Spare parts lists, included with the shop drawing submittal, shall indicate specific sizes, quantities and part numbers of the items to be furnished. Terms such as "1 lot of packing material" are not acceptable.

C. Parts shall be completely identified with a numerical system to facilitate parts inventory control and stocking. Each part shall be properly identified by a separate number. Those parts which are identical for more than one size shall have the same parts number.

1.06 Identification

A. Each junction box shall be identified with the equipment item number, manufacturer's name or trademark, and such other information as the manufacturer may consider necessary, or as specified, for complete identification.

PART 2 - PRODUCTS

2.01 Manufacturers

A. The equipment covered by these Specifications is intended to be standard equipment of proven performance as manufactured by reputable concerns. Equipment shall be designed, constructed and installed in accordance with the best practices of the trade, and shall operate satisfactorily when installed as shown on the Drawings.

B. The Contractor shall use the products of a single manufacturer for each type of box.

2.02 Junction Boxes

A. Junction and pull boxes shall be properly sized for the application, considering future expansion and location.

B. Junction and pull boxes shall be constructed with screw covers, without knockouts except where required for installation and of materials for specified areas as follows:

1. In dry, dust free conditions: Galvanized steel in finished areas, aluminum in unfinished areas.
2. In damp or wet conditions: Gasketed steel cover in finished areas and NEMA 4 construction with gasketed cast aluminum cover in unfinished areas.
3. In exterior locations: Cast malleable iron type with threaded hubs and vellunoid gasket.
4. In corrosive conditions and all chemical rooms: NEMA 4X non-metallic construction with gasketed cover.

2.03 Outlet Boxes

A. Outlet boxes shall be properly sized to fit the corresponding wiring device.

B. Outlet boxes shall be constructed of NEC gauge galvanized steel for flush mount, and NEC gauge cast aluminum for devices and fixtures on exposed conduit on walls. Provide removable covers attached with round head silicon bronze machine screws.

2.04 Supports

A. Support boxes independently of conduits entering them by means of bolts, rod hangers, or other suitable means coated in zinc chromate primer and in accordance with Section 16190, Supporting Devices.

PART 3 - EXECUTION

3.01 Installation and Procedures

A. Outlet Boxes

1. Set box square and true with building surfaces.
2. Secure box firmly to building structure.
3. Verify location of outlets and switches in finished rooms. In centering outlets and locating boxes, allow for overhead pipes, ducts and mechanical equipment, variations in fireproofing and plastering, windows, etc.
4. Maintain symmetry of all outlets as closely as possible.
5. Locate light switches on the latch side of the door.
6. Protect devices on outlets in locations where outlets are subject to injury.
7. Cap all outlets not used with blank covers.

B. Junction and Pull Boxes

1. Install pull boxes wherever necessary to facilitate pulling of wire and as indicated.
2. Locate junction and pull boxes in a finished space so not exposed unless otherwise approved. Reroute conduit or make other arrangements for concealment as approved.
3. Covers shall be easily accessible.
4. Splicing boxes for fixtures recessed in hung ceilings shall be accessible through openings created by removal of fixtures.

C. Switch boxes shall be of unit construction and of sizes as required to adequately house the number of switches required. No sectional type switch boxes shall be permitted.

D. All outlet boxes shall be set true and plumb and shall be flush against the finished wall surfaces.

E. All devices shall be flush-mounted in finished areas unless otherwise noted. The Contractor shall determine the proper position of every outlet box and relocate any

outlet without additional cost to the Owner if any are incorrectly or improperly located.

F. In all areas where thermal or acoustic insulation is applied to the ceiling or walls, outlet boxes shall be set to finish flush with the finished surface of the insulation.

G. When indicated height would place any of the equipment at an unsuitable location such as at a molding or break in wall finish, the Engineer shall determine final location.

H. For the below-named items mounting heights from finish floor, or finish grade to top is applicable. Mounting heights shall be as follows, unless otherwise specified herein, indicated on the Drawings or required by the Americans with Disability Act (ADA):

1. Single-pole light switches, 48 inches.
2. Duplex receptacles in dry areas, 16 inches
3. Duplex receptacles in pump rooms, 48 inches

-END-

SECTION 16190 - SUPPORTING DEVICES

PART 1 - GENERAL

1.01 The Requirement

A. The Contractor shall furnish and install structural steel supports for mounting and installing all electrical, lighting, alarm systems, instrumentation and communications equipment furnished under this Contract.

B. Equipment shall be installed strictly in accordance with recommendations of the manufacturer and best practices of the trade resulting in a complete, operable and safe installation. The Contractor shall obtain written installation manuals from the equipment manufacturer prior to installation.

C. Reference Section 16000, Basic Electrical Requirements.

1.02 Submittals

A. In accordance with the procedures and requirements set forth in the General Conditions and Section 01300, Submittals, the Contractor shall obtain from the equipment manufacturer and submit shop drawings. Each submittal shall be identified by the applicable Specification section.

1.03 Shop Drawings

A. Each submittal shall be complete in all respects, incorporating all information and data listed herein and all additional information required for evaluation of the proposed equipment's compliance with the Contract Documents.

B. Partial, incomplete, or illegible submittals will be returned to the Contractor without review for resubmittal.

C. Shop drawings shall include but not be limited to:

1. Equipment specifications and product data sheets.
2. Complete assembly, layout, installation and foundation drawings with clearly marked dimensions of the equipment to be supported and the supporting equipment itself as planned to be installed in addition to floors and ceilings where applicable.

PART 2 - PRODUCTS

2.01 Manufacturers

A. The equipment covered by this Specification is intended to be standard equipment of proven performance as manufactured by reputable concerns. Equipment shall be designed, constructed and installed in accordance with the best practices of the trade and shall operate satisfactorily when installed as shown on the Drawings.

2.02 Materials

A. Materials used in accordance with this Section shall be as specified herein.

PART 3 - EXECUTION

3.01 Installation

A. Concrete or Masonry Inserts

1. The Contractor shall be responsible for the furnishing and installation of all conduit sleeves, anchor bolts, masonry inserts and similar devices required for installation of equipment furnished under this Contract.
2. If a time delay for the arrival of any special inserts or equipment drawings, etc. occurs, the Contractor may, if permitted by the Engineer, make arrangements for providing approved recesses and openings in the concrete or masonry and, upon subsequent installation, the Contractor shall be responsible for filling in such recesses and openings. Any additional costs that may be incurred by this procedure shall be borne by the Contractor.
3. The Contractor shall furnish leveling steel channels for all switchgear, switchboards, motor control centers, and similar equipment. The leveling steel channels shall be provided for installation in the equipment supporting pads. Coordination of the installation of these channels with the concrete pad is essential and required. Pad height shall be as required to maintain coverage of the reinforcement bars while not exceeding the maximum mounting heights requirements of the NEC.

B. Support Fastening and Locations

1. All equipment fastenings to columns, steel beams, and trusses shall be by beam clamps or welded. No holes shall be drilled in the steel. Where supports or hangers are required for heavy electrical equipment units exceeding fifty pounds, a registered professional engineer shall check the steel. Where required, additional sections shall be provided for a safe installation. Supports and hangers shall be PVC coated as required to suit the application and shall be compatible with the balance of the installation.
2. All holes in hung ceilings for support rods, conduits and other equipment shall be made adjacent to bars where possible to facilitate removal of ceiling panels.
3. For interior dry areas, a bracket and channel type support of zinc chromated galvanized steel construction shall be provided wherever required for the support of starters, switches, panels and miscellaneous equipment.
4. For outdoor service or in indoor damp/wet process areas, the support system shall be made of either Type 304 stainless steel, PVC coated rigid galvanized steel or aluminum. The materials of construction shall be coordinated with the process/chemical area in which the support system will be installed.
5. All hardware (bolts, nuts, washers, etc.) shall be Type 304 stainless steel.
6. All supports shall be rigidly bolted together and braced to make a substantial supporting framework. Where possible, control equipment shall be grouped together and mounted on a single framework. Wherever this occurs, a provision

shall be made for ready access to the wiring for connections to the equipment by means of boxes with screw covers.

7. Aluminum support members shall not be installed in direct contact with concrete. Stainless steel or non-metallic "spacers" shall be used to prevent contact of aluminum with concrete.
8. Actual designs for supporting framework should take the nature of a picture frame of channels and bracket with a plate for mounting the components. The Contractor is responsible for the design of supporting structure; They shall submit design details to the Engineer for acceptance before proceeding with the fabrication.
9. Wherever dissimilar metals come into contact, the Contractor shall isolate these metals as required with neoprene washers, nine (9) mil polyethylene tape or gaskets.

C. Mounting Heights

1. Unless explicitly called out in the drawings or individual equipment specifications, all electrical equipment and enclosures containing electrical equipment shall be mounted at reasonable heights such that they are able to be worked on and interacted with.
   a. Floor mounted equipment shall be configured and mounted such that the equipment, at its highest point, is no greater than 84” from the finished level where the operator/electrician will be interacting with it.
   b. Wall and rack mounted equipment shall be configured and mounted such that the geometrical center of the equipment face be located between 36” and 60”, and the top edge be located no greater than 84”, above the finished level where the operator/electrician will be interacting with it.
2. In no circumstances shall the mounting height requirements set forth above overrule those delineated in the NEC regarding the mounting heights of electrical disconnecting means.
3. Clearly note requests for exceptions to these requirements on the shop drawing submittals or in a request for information (RFI).

-END-

SECTION 16195 – ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.01 The Requirement

A. All electrical equipment shall be properly identified in accordance with these Specifications and the Contract Drawings. All switchgear, switchboards, motor control centers, variable frequency drives, lighting and distribution panelboards, combination starters, control panels, pull/junction boxes, enclosures, disconnect switches, control stations and similar equipment shall be identified in the manner described, or in an equally approved manner.

B. The types of electrical identification specified in this section include, but are not limited to, the following:

1. Exposed conduit color banding.
2. Operational instructions and warnings.
3. Danger signs.
4. Equipment/system identification signs.
5. Nameplates.

1.02 Signs

A. "DANGER-HIGH-VOLTAGE" signs shall be securely mounted on the entry doors of all electrical rooms.

1.03 Lettering and Graphics

A. The Contractor shall coordinate names, abbreviations and other designations used in the electrical identification work with the corresponding designations shown, specified or scheduled. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturers or as required for proper identification and operation/maintenance of the electrical systems and equipment.

1.04 Submittals

A. In accordance with the procedures and requirements set forth in the General Conditions and Section 01300, Submittals, the Contractor shall obtain from the equipment manufacturer and submit shop drawings. Each submittal shall be identified by the applicable specification section.

1.05 Shop Drawings

A. Each submittal shall be complete in all respects, incorporating all information and data listed herein and all additional information required for evaluation of the proposed equipment's compliance with the Contract Documents.

B. Partial, incomplete or illegible submittals will be returned to the Contractor without review for resubmittal.

C. Shop drawings shall include but not be limited to:

1. Equipment specifications and product data sheets.

PART 2 - PRODUCTS

2.01 Manufactures

A. The material covered by these Specifications is intended to be standard material of proven performance as manufactured by reputable concerns. Material shall be fabricated, constructed and installed in accordance with the best practices of the trade, and shall operate satisfactorily when installed as specified herein and shown on the Drawings.

2.02 Nameplates

A. Nameplates shall be engraved, high pressure plastic laminate, black with white lettering.

2.03 High Voltage Signs

A. Standard "DANGER" signs shall be of baked enamel finish on 20 gage steel; of standard red, black and white graphics; 14 inches by 10 inches size except where 10 inches by 7 inches is the largest size which can be applied where needed, and except where a larger size is needed for adequate vision.

2.04 Conduit Markers

A. All conduits shall be labeled in accordance with the conduit and wire schedules. Color coded conduit markers shall be standard preprinted, flexible permanent, plastic sheet conduit markers, extending 360 degrees around conduits; designed for attachment to conduit by adhesive. Lettering shall indicate the conduit number as indicated in the conduit schedule. Provide 8 inch minimum length for 2 inch and smaller conduit and 12 inch length larger than 2 inch conduit.

PART 3 - EXECUTION

3.01 Nameplates

A. Nameplates shall be attached to the equipment enclosures with (2) two stainless steel sheet metal screws for nameplates up to 2-inches wide. For nameplates over 2-inches wide, four (4) stainless steel sheet metal screws shall be used, one (1) in each corner of the nameplate. The utilization of adhesives is not permitted.

3.02 Conduit Identification

A. Where electrical conduit is exposed in spaces with exposed mechanical piping which is identified by a color-coded method, apply color-coded identification on the electrical conduit in a manner similar to the piping identification. Except as otherwise indicated, use orange as the coded color for conduit marker backgrounds. Conduit identification shall be made after the conduit has been painted.

3.03 Operational Identification and Warnings

A. Wherever reasonably required to ensure safe and efficient operation and maintenance of the electrical systems and electrically connected mechanical systems and general systems and equipment, including prevention of misuse of electrical facilities by unauthorized personnel, install plastic signs or similar equivalent identification, instruction, or warnings on switches, outlets and other controls, devices, and covers or electrical enclosures. Where detailed instructions or explanations are needed, provide plasticized tags with clearly written messages adequate for the intended purposes. Signs shall be attached as specified above for nameplates.

3.04 Power Source Identification

A. After installation of all field equipment (i.e., valves, motors, fans, unit heaters, instruments etc.) install nameplates at each power termination for the field equipment. Nameplate data shall include equipment designation (tag number), power source (MCC number, panelboard etc.), circuit number, conduit number from schedule and voltage/phase.

B. Contractor to coordinate with the Engineer and the Owner regarding exact nameplate placement during construction.

C. Nameplates shall be as specified herein.

-END-

SECTION 16495 - VARIABLE FREQUENCY DRIVES

PART 1 - GENERAL

1.01 The Requirement

A. The Contractor shall furnish, install, connect, test and place in satisfactory operating condition all variable frequency drives (VFD's) and their pump control panel enclosures as specified herein and indicated on the Drawings.

B. Reference Section 16000, Basic Electrical Requirements and Section 16195, Electrical Identification.

C. ABB ACQ580-01 with ethernet card shall be the only acceptable manufacturer.

1.02 Testing

A. All tests shall be performed in accordance with the requirements of the General Conditions and Division 1. The following tests are required:

1. Witnessed Shop Tests
   a. The VFD's specified in this Section shall be witness shop tested and inspected in accordance with the equipment manufacturer's standard procedures. The testing and inspection procedures shall demonstrate that the equipment tested conforms to the requirements specified and shall be approved by the Engineer. At least 10 days notice shall be given the Engineer prior to such tests and inspection dates.
   b. Factory test the complete variable frequency drive system in accordance with IEEE and NEMA standards with these Specifications. In addition, the variable frequency drive system shall be tested for efficiency as defined in this Specification and for operational integrity during output short circuit conditions. Short circuit test shall demonstrate that the equipment will successfully protect against and survive a minimum of three (3) successfully repeated phase-to-phase short circuits at the drive output terminals.
   c. Variable frequency drive system components, including power transistors, GTOs, SCRs, IGBT's, diodes shall be 100 percent inspected and tested, including temperature cycling and inspected and tested including temperature cycling and ambient high temperature of 65 degrees Celsius load testing. All integrated circuits shall be inspected, pass/fail tested, temperature cycled and ambient high temperature tested. Small components, including small signal semiconductors, resistors, capacitors, diodes etc. shall be lot sampled and tested for functionality. Test printed circuit boards under a temperature cycled 20-hour load test and functionally bench test prior to unit installation. Inspect all final assemblies and test at full load with application of line-to-line and line-to-ground bolted faults. The variable frequency drive system shall electrically trip offline under these conditions without device failure.
   d. After the specified inspections and tests have been successfully completed, the variable frequency drive system shall undergo an 8-hour burn-in test.

Burn system in at 100 percent inductive or motor load for 40 hours without an unscheduled shutdown.

2. Certified Shop Tests and Reports
   a. Submit description of proposed testing methods, procedures and apparatus.
   b. Submit notarized and certified copies of all test reports.
   c. Submit factory bench-test data to indicate that the manufacturer's proposed equipment has been tested in the specified arrangement and found to achieve specified accuracy.
3. Field Tests
   a. Field tests shall be performed in accordance with requirements specified in the General Conditions, Division 1, and Section 16000, Basic Electrical Requirements.

B. Authorized representatives of the Owner shall be allowed free access to the shop at all times while work is in progress for the purpose of inspection, witnessing of tests and obtaining information on the progress of the work. The Owner shall give the Contractor 72 hours prior notice.

C. Acceptance of a shop test does not relieve Contractor from requirements to meet field installation tests under specified operating conditions, nor does the inspection relieve the Contractor of responsibilities.

D. The Contractor shall successfully complete acceptance test procedures on the assembled drive system that demonstrate compliance with the requirements of this Specification. The test plan shall be submitted for acceptance at least 30 days prior to the planned test date.

E. Drive system shall not be shipped from the manufacturing and assembly facility until the acceptance tests are completed and the acceptance tests are completed and the results approved by the test representative.

F. Tests shall be witnessed by a representative of the Engineer. Variable frequency drive manufacturer shall notify the Engineer 2 weeks in advance and shall provide testing procedures to the Engineer 4 weeks prior to actual testing. Failure of a test shall result in rejection of the equipment until performance is in compliance with these Specifications.

G. Certification on materials and records of shop tests necessary for the inspector to verify that the requirements of the Specifications are met, shall be made available to the inspector.

H. Submit signed and dated certification that all of the factory inspection and testing procedures described herein have been successfully performed by the Contractor prior to shipment.

1.03 Submittals

A. In accordance with the procedures and requirements set forth in General Conditions and Section 01300, Submittals, the Contractor shall obtain from the equipment manufacturer and submit the following:

1. Shop Drawings
2. Harmonic Study Report
3. Programming Guides/Manuals
4. Operation and Maintenance Manuals
5. Spare Parts List
6. Special Tools List
7. Shop Test Plan
8. Reports of Certified Shop and Field Tests

B. Each submittal shall be identified by the applicable specification section.

1.04 Shop Drawings

A. Each submittal shall be complete in all respects, incorporating all information and data listed herein and all additional information required for evaluation of the proposed equipment's compliance with the Contract Documents.

B. Partial, incomplete or illegible submittals will be returned to the Contractor without review for resubmittal.

C. Drawings submitted by the manufacturer shall be complete and documented to provide the Owner with operations and maintenance capabilities.

D. Shop drawings for each VFD shall include but not be limited to:

1. Layout drawings of the variable frequency drive system that include all cabinet or enclosure dimensions, access details and weights.
2. Layout drawings of panels or enclosures showing size, arrangement, color and nameplates. Drawings shall include the physical arrangement of door mounted devices located on the variable frequency drive enclosure. Sufficient detail shall be provided for locating conduit stub-ups. General "catalog data sheet" layout drawings which are not specific to the systems specified herein are not acceptable.
3. Schematic and interconnection wiring diagrams of all electrical work, including terminal blocks and identification numbers, wire numbers and wire colors. These drawings shall be circuit specific for each motor-load combination (e.g. WAS pumps, equalization blowers, backwash pumps, raw water pumps, etc.). Indicate all devices, regardless of their physical location, on these diagrams. Specific equipment names consistent with the Drawings shall appear on each respective diagram.
4. Complete single line diagrams indicating all devices comprising the variable frequency drive system including, but not limited to, circuit breakers, motor circuit protectors, contactors, instrument transformers, meters, relays, timers, control devices and other equipment comprising the complete system. Electrical

ratings of all equipment and devices shall be clearly indicated on these single line diagrams.

5. Complete Bills of Material and catalog data sheets for all equipment and devices comprising the variable frequency drive system.
6. A complete list of recommended spare parts, including item descriptions, recommended quantities and unit costs. The recommended list should be based on a maintenance plan where the Owner will remove and replace failed items to the lowest replaceable module/component level.
7. Control and layout drawings shall be submitted in AutoCAD format on CDROM in addition to the hard copies.

E. The shop drawing information shall be completed and organized in such a way that the Engineer can determine if the requirements of these Specifications are being met. Copies of technical bulletins, technical data sheets from "Soft Cover" catalogs, and similar information which is "highlighted" or somehow identifies the specific equipment items the Contractor intends to provide are to provide are acceptable and shall be submitted.

F. Prior to completion and final acceptance of the project, the Contractor shall furnish and install "as-built" wiring diagrams for each VFD and bypass starter. These final drawings shall be plastic laminated and securely placed inside each VFD and starter door and included in the O&M manuals.

G. Product Data shall include, but not be limited to:

1. Functional diagrams that identify major system functional blocks and interfaces.
2. Special requirements or restrictions of the motor-load combination that may result from operation on the variable frequency drive system.

H. Programming Guides and Manuals shall be submitted. If the variable frequency drive systems require computer software or configuration, provide copies of all programming guides/manuals. Flow charts and listings of software developed shall be submitted to the Engineer. Submit final flow charts and program listings no later than 6 weeks prior to factory testing of the system.

1.05 Operations and Maintenance Manuals

A. The Contractor shall submit operation and maintenance manuals in accordance with the procedures and requirements set forth in the General Conditions, Section 01300, Submittals and Section 11000, Equipment - General Provisions.

B. Operation and Maintenance Manuals shall also be provided in electronic format on CDROM.

1.06 Tools, Supplies, and Spare Parts

A. The VFD's and accessories shall be furnished with all special tools necessary to disassemble, service, repair and adjust the equipment. All spare parts as recommended by the equipment manufacturer shall be furnished by the Contractor to the Owner.

B. The Contractor shall furnish the following spare parts:

1. A keypad for each type of VFD provided, two minimum.
2. A spare set of fuses for each type used.
3. 25% spare terminal blocks of each type, 5 spare minimum.
4. 1 spare 24V power supply for each location (2 total)
5. 1 spare MiniCAS for each location (2 total)

C. The spare parts shall be packed in containers suitable for long term storage, bearing labels clearly designating the contents and the pieces of equipment for which they are intended.

D. Spare parts shall be delivered at the same time as the equipment to which they pertain. The Contractor shall properly store and safeguard such spare parts until completion of the Work, at which time they shall be delivered to the Owner.

E. Spare parts lists, included with the shop drawing submittal shall indicate specific sizes, quantities, and part numbers of the items to be furnished. Terms such as "1 lot of packing material" are not acceptable.

F. Parts shall be completely identified with a numerical system to facilitate parts inventory control and stocking. Each part shall be properly identified by a separate number. Those parts which are identical for more than one size, shall have the same parts number.

1.07 Services of Manufacturer's Representative

A. The Contractor shall provide the services of a qualified manufacturer's technical representative who shall adequately supervise the installation and testing of all equipment furnished under this Contract and instruct the Contractor's personnel and the Owner's operating personnel in its maintenance and operation as outlined in the General Conditions, Division 1, and Section 11000, Equipment General Provisions. The services of the manufacturer's representative shall be provided for a period of not less than as follows:

1. Two trips of one (1) working day during installation and start-up/configuration of the equipment.
2. One trip of one (1) working day after acceptance of the equipment.
3. One trip of one (1) working day during the warranty period.

B. Any additional time required to achieve successful installation and operation shall be at the expense of the Contractor. The manufacturer's representative shall sign in and out at the office of the Resident representative on each day they are at the project.

1.08 Identification

A. Each VFD shall be identified by the circuit number and equipment name as indicated on the Drawings. A nameplate shall be securely affixed in a conspicuous

place on each VFD. Nameplates shall be as specified in Section 16195, Electrical - Identification.

1.09 Training

A. The Contractor shall provide training for Owner personnel. Training shall be conducted by the manufacturer's factory trained specialists who shall instruct Owner personnel in operation and maintenance of all equipment provided under this Section.

B. **Provide the services of an experienced, factory trained technician or service engineer of the variable frequency drive manufacturer at the jobsite for minimum of 1 day for training of Owner personnel, beginning at a date mutually agreeable to the Contractor and the Owner.** The technician shall be on duty at the site for at least 8 hours per day and shall be available 24 hours per day when required to advise concerning special problems with equipment and systems.

C. **Include in the bid the training of personnel in the operation and maintenance of each furnished variable frequency drive pump control system.** For the purpose of this training section of the Specifications, a system is by definition a group of pumps or equipment which all serve a common function (e.g., equalization blowers, raw water pumps etc.). Training shall include at least one session for 5 designated employees for each system.

1.10 Warranty

A. Contractor shall warrant that the material and workmanship of all components and the operation of the variable frequency drive system and auxiliary equipment is in accordance with the latest design practices and meets the requirements of this Specification.

B. Warranty work shall include, but not be limited to, the following:

1. Replace components found to be faulty and make changes in equipment arrangement or adjustments necessary to meet the equipment or functional requirements or this Specification.
2. Warranty shall include system rewiring and substitution and rebuilt or additional equipment required during trial operation or subsequent operation of the unit during the period of this warranty.
3. Warranty shall be in effect for a period of 24 months following final acceptance of the system.

PART 2 - PRODUCTS

2.01 Manufacturers

A. The equipment covered by this Specification is intended to be standard equipment of proven performance. Equipment shall be designed, constructed and installed in

accordance with the best practices of the trade and shall operate satisfactorily when installed as shown on the Drawings.

B. The Contractor shall obtain the VFD's from one manufacturer who shall also manufacture the enclosure and major equipment components. The manufacturer shall have a minimum of five years experience in the manufacture of similar units and shall have a general distribution to the electrical trade. Subcontracting of wiring will not be acceptable.

C. Motor control circuits shall be wired in accordance with the requirements specified herein or indicated on the Drawings. Where not indicated, the control circuits shall be standard three-wire "start-stop" and the Contractor shall furnish wiring accordingly.

D. Variable frequency drive manufacturer shall be responsible for the successful application and operation of the entire drive and control system serving the motor and driven equipment. This includes the responsibility for obtaining all load, torque, speed and performance requirements from the respective sources and integrating these into a variable frequency drive system that fulfills the requirements of this Specification.

E. The Contractor and variable frequency drive system manufacturer are cautioned regarding the review and compliance with the total Contract Documents. Typical examples are circuit breakers, motor circuit protectors, magnetic starters, relays, timers, control and instrumentation products, pilot devices including pushbuttons, selector switches and pilot lights, enclosures, conduit, disconnect switches, terminal boxes and other equipment.

F. Variable Frequency drives shall be ABB ACQ series.

2.02 Product Requirements

A. Variable speed drives shall be adjustable frequency, adjustable voltage, pulse width modulated (PWM) design. The units shall be microprocessor controlled, fully digitally programmable, and capable of precise and repeatable speed regulation of three phase 480 volt AC NEMA Design B induction motors. Variable frequency drives for other than NEMA Design B induction motors (e.g. NEMA Design C) shall be coordinated with the requirements of that respective load.

B. Drive units shall perform continuous self diagnostics as well as load and drive self check on startup.

C. All drives shall have permanently mounted programming and display modules. These modules shall provide programming access to all drive parameters, display all fault codes to assist with diagnostics and provide a display of output speed in percent or load.

D. This specification describes variable speed motor control which includes the design, fabrication, testing, installation and support requirements for variable frequency

drive systems for 3-phase, squirrel cage rotor, induction motors driving pumps or other equipment.

E. Each variable frequency drive is to be a complete alternating current electric drive system including hardware, software, technical data and spare parts necessary to accomplish variable speed operation of an induction motor and load combination in accordance with the requirements as indicated on the Drawings and as described in these Specifications. Contractor shall refer to Section 13400 of the Specifications for a functional control description of each variable frequency drive system.

F. Variable frequency drive system manufacturer shall be responsible for the design and performance of the entire drive system and shall either manufacture all items of equipment or supply them using coordinated specifications furnished to the original equipment manufacturers to insure compatibility and performance in accordance with this Specification. Variable frequency drive manufacturer shall coordinate with suppliers of the drive motors and driven equipment. Motors shall be as specified in throughout specific equipment Sections of the Specifications.

G. Variable frequency drive system shall be suitable for operation as part of a 480 VAC, 3-phase, 60 Hertz power distribution system. The complete variable frequency drive system shall withstand the mechanical forces exerted during short circuit conditions when connected directly to a power source having available fault current of 32,000 amperes symmetrical at rated voltage.

H. The variable frequency drive system shall be suitable to operate, at times, on a limited power source engine-generator set. The system shall be provided with equipment and devices to prevent waveform distortion as specified herein.

I. Provide control and sequence logic as specified herein and indicated on the Drawings. Control and sequence logic shall be designed such that the motor-load combination can be operated in the manual mode upon control and sequence logic failure, including all necessary personnel and equipment safety interlocks.

J. Design each variable frequency drive motor drive speed control system so that through simple programming by either factory engineers or Owner's trained operating personnel, specific control and protection functions can be attained.

2.03 Design Requirements

A. Each variable frequency drive system shall meet the requirements of this Specification without derating any of the induction motor operating parameters including service factor and nameplate horsepower. The variable frequency drive system manufacturer shall specifically identify special requirements or restrictions of the motor-load combination that may result from operation on the variable frequency drive system.

B. The variable frequency drive shall consist of a LCL filter, a AC to DC 6 pulse rectifier, a direct current link, a motor-side IGBT converter, and a common mode filter. The motor-side IGBT converter shall convert the direct current voltage into an alternating current voltage at a frequency which shall be proportional to the desired

speed. This alternating current voltage and frequency shall both vary simultaneously at a constant "Volts-Per-Hertz" ratio to operate the induction motor at the desired speed.

C. Variable frequency drive shall operate from fixed frequency power supply and convert this input power into variable speed induction motor shaft power as required by this Specification.

D. Provide each variable frequency drive with a motor circuit protector as indicated on the Drawings which shall be padlockable. Provide each 200 HP variable frequency drive with 5% line reactors at the input, and all others with 3%. Include the necessary drive controllers and output contactors to accomplish the intended control of the variable frequency drive system.

E. The drive shall operate the motor and produce full rated nameplate horsepower at the motor output shaft without exceeding motor nameplate full load current and with the motor not exceeding rated total temperature not including the additional temperature increment that constitutes the motor service factor. Motor shall retain its service factor when operated by the variable frequency drive.

F. The overall drive system efficiency shall be a minimum of 95 percent when operating the specified motor-load combination at rated voltage, frequency and current.

1. This efficiency shall be calculated as follows:

$$\text{Efficiency (\%)} = \frac{\text{Power (Load)}}{\text{Power (Supply)}} \times 100$$

G. Power (Load) is the total 3-phase power delivered to the motor, measured at the output terminals of the drive system, including output filters or transformers. Power (Supply) is the total electrical power delivered to the drive system, measured at the input terminals of the variable frequency drive including input filters, line reactors, isolation transformers or other harmonic distortion suppression equipment. Include power input required for auxiliary equipment (e.g., controls, fans, air conditioning, pumps) for complete system operating in this Power (Supply) total.

H. Variable frequency drive shall provide smooth, stepless changes in motor speed and acceleration over the entire operating speed range from minimum to maximum speed (revolutions per minute). The variable frequency drive shall be provided with maximum and minimum frequency limits.

I. Variable frequency drive system to maintain a desired output frequency (setpoint) with a steady state accuracy of 0.5 percent of rated frequency of 60 Hertz for a 24 hour period.

J. Variable frequency drive to have an automatic current limit feature to control motor currents during startup and provide a "soft start" torque profile for the motor-load combination. The variable frequency drive shall also limit current due to motor winding or motor lead phase-to-phase short circuit or phase-to-ground short circuit. The current limit protection setting shall be field adjustable.

K. Variable frequency drive shall be furnished with programmable electronic overload and torque limits.

L. Drive system shall achieve a desired output frequency (setpoint) with a repeatability of 0.1 percent of rated frequency of 60 Hertz.

M. Drive system to be capable of operating the specified load continuously at any speed within the operating speed range of 10 percent to 100 percent of rated speed. The minimum and maximum continuous operating speeds shall each be adjustable within this speed range. The variable frequency drive shall provide for field adjustment of these setpoints.

N. Drive system controls to be microprocessor-based and have controlled linear acceleration capability to ramp up the speed, revolutions per minute, of the motor-load combination from the minimum selected operating speed to the maximum selected operating speed in a minimum of 30 seconds. Provide two (2) field-adjustable speed setpoints for the variable frequency drive to skip equipment resonant frequencies. Provide controlled linear deceleration capability. The acceleration and deceleration time limits shall be field adjustable to values up to 120 seconds.

O. Voltage or current unbalance between phases of the variable frequency drive output voltage shall not exceed 3 percent of the instantaneous values. The variable frequency drive system shall continuously monitor the output voltages and generate an alarm condition when the unbalance exceeds 3 percent. The system shall detect and generate a separate alarm for loss of any output phase voltage (single phasing). Phase unbalance shall be as defined by NEMA Standard MG-1.

P. Variable frequency drive system to operate continuously without interruption of service or damage to equipment during transient input voltage variations of plus or minus 10 percent for a duration of 15 cycles. Unacceptable voltage fluctuations on the supply bus shall cause under or overvoltage protection to trip and remove supply voltage from the drive system. Variable frequency drive output voltage regulation shall be plus or minus 2 percent.

Q. The variable frequency drive system shall be furnished with line surge protection.

R. The Contractor shall size variable frequency drive system and components to provide, indefinitely, motor load current equal to 110 percent of the motor nameplate full load current.

S. The Contractor is fully responsible for the review of the mechanical specifications to determine specified motor speed, horsepower and full load amperes. This information is available in the applicable mechanical specifications for each pump, drive, conveyor, blower etc. Reference the Table of Contents.

T. The audible noise (sound pressure) level of a motor when operated from no load to full load with the variable frequency drive described herein shall not increase more than 5 decibels (dbA), at 5 feet in any direction from the motor, above its noise level when operated from a utility power source without the variable frequency drive.

2.04 Operating Conditions

A. The following operating conditions are applicable for all equipment of this Specification.

1. Humidity: 0-95 percent.
2. Ambient Temperature: Minus 20 degrees Celsius to plus 50 degrees Celsius.
3. Altitude: up to 3,300 feet
4. Power Supply: 480 volts, 3-phase, 60 Hertz.
5. Available Short Circuit Duty: as specified herein.

2.05 Pump Control Panel

A. The Pump Control Panel shall be assembled, tested and listed by a panel shop meeting U.L. Standard 698A for industrial control panels related to hazardous (classified) locations.

B. Control and operation shall be from a radar level transmitter located in the wet well. There shall also be a secondary control system consisting of a four-float operating system completely redundant and hardwired in the event of a pump controller malfunction. Install the floats as per the Engineer's Drawings or as suggested by the Manufacturer.

C. Contractor shall also provide the wiring of the level transmitter and floats between the wet well and the control panel.

D. The Contractor shall install the Control Panel as indicated on the Contract Drawings. All equipment shall be mounted in a NEMA 4X 316 stainless steel enclosure at the Return Pump Station and NEMA 12 painted or powder coated steel at the Influent Lift Station.

a. Enclosures shall be force ventilated, dead-front, with front accessibility. Design enclosures for both bottom and top entry of cables. Design variable frequency drive system so that rear cabinet access is not required for operations, maintenance, and repair tasks. Other enclosure requirements are:
   1) Treat metal surfaces and structural parts by phosphatizing prior to painting.
   2) Apply a gun-metal gray undercoat to enclosures which is equal to zinc chromate.
   3) Finish exterior of the enclosures in ANSI-61 gray enamel or furnish in a color to match the complete line-up of equipment as indicated on the Drawings and accepted by the Engineer.
   4) The doors shall have full length piano type hinges.
   5) Brace each door to prevent sag when fully open.
b. The Contractor shall reference the Drawings for anticipated maximum dimensions of the VFDs.
c. Furnish each variable frequency drive system with the control switches, alarm lights and indicators as specified herein and as indicated on the Drawings. Furnish main circuit breakers with an external operating handle

interlocked with the door so that the door cannot be opened unless the disconnect is in the OFF position. Power supply to the motor from the variable frequency drive shall be capable of being positively locked in the OFF position. The disconnect shall be interlocked so that equipment cannot be energized when the door is open.

d. Electrical bus, including ground bus, shall be tin-plated copper. Power and control wiring shall be copper, color coded and identified in accordance with these Specifications.
e. Equipment shall be of modular construction allowing normal maintenance and repair to be done with ordinary hand tools. Design and install power electronic component assemblies so that, where practicable, components can be individually removed and replaced.

E. Available power is 480 volt, 3 phase, 3 wire. Control power shall be 120 volt supplied from an accessory circuit breaker mounted inside the control panel. Control power transformer shall be sized to supply any accessory 120 volt loads internal to the control panel. A hasp and staple shall be provided for padlocking.

F. Panel heaters and corrosion inhibitors shall be furnished for condensation and corrosion control inside the panel. Panel heaters shall be of the forced air types, provided with integral thermostat control.

G. A three-pole fully rated main circuit breaker shall be provided. Operator handles shall be mounted through the inner door. The circuit breaker shall be as manufactured by Square D or equal.

H. Each pump shall have a hand-off-auto selector switch and VFD keypad mounted on the inner swing-out panel. The run lights, seal failure lights and elapsed time meters shall also be mounted on the inner swing-out panel. All switches and lights shall be corrosion resistant and be of the 30.5 MM Type, as manufactured by Eaton Cutler-Hammer, Square D, or equal.

I. A MiniCAS pump protection relay shall be provided in the panel.

J. There shall be a termination strip with box type connectors to make all power and control connections for the pumps, floats, and level transmitter. All terminals shall be marked for easy identification. A ground busbar shall be provided also.

K. These units shall be type and size with the number of poles and accessories as indicated on the Drawings or as required for the application if not otherwise indicated.

L. Provide accessory circuit breakers for 120VAC and 24VDC control wiring and devices within the control panel sized per the guidance of the NEC. Power supply and transformer shall be sized per the guidance of the NEC to meet the requirements of the circuits involved.

M. Provide individual circuit breakers for the following devices, at a minimum, that are external to the control panel.

1. Convenience Receptacle – 1P, 20A, 120V
2. Panel Heater – HACR sized to meet NEC criteria

N. Provide intrinsically safe relays and cables as required.

O. Provide 3-Phase Monitoring Relay.

P. Provide with door or motion-activated, internal LED panel lighting units. One unit shall be provided for every 3 feet of panel width.

Q. Control System

1. The pump control system shall provide the following functionality through the use of relays, coils, switches, etc.:
   a. DI:
      1) HOA Switch, Run in Hand (on swingout)
      2) Low Water Cutoff (From existing relay panel)
      3) Run command (From PLC)
   b. DO:
      1) HOA Switch, in Auto (to PLC)
      2) Running (to PLC)
      3) Fail (to PLC)
   c. AI:
      1) Speed Setpoint (from PLC)
   d. AO:
      1) Speed Feedback (to PLC)

R. Wiring

1. All wiring shall be minimum 600 volt UL Type MTW or AWM and have a current carrying capacity of not less than 125% of the full load current. The conductors shall be in complete conformity with the National Electric Code, State, Local and NEMA Electrical Standards. For ease of servicing and maintenance, all wiring shall be color coded or numbered on each end. The wire color or number shall be clearly indicated on all submittal and as-built drawings, with color indicated.
2. All control wiring shall be contained within wiring duct with covers as manufactured by Panduit or Equal. Where dimensional constraints prevent the use of wiring duct, wires shall be trained to panel components in groupings.

S. Controls and indicators to accomplish operation and maintenance shall be located on the interior panel as specified herein and indicated on the Drawings. At a minimum, each panel shall include the following:

1. Pump Running: Green
2. Controls Active (24V power supply active): Green
3. Low Water Cutoff: Amber
4. Elapsed Time Meter

5. Pump Fail: Red
6. Controls Fail (24V power supply fail OR MiniCAD fail): Red
7. Drive Fail: Red
8. Ethernet communications card.
9. Hand-Off-Auto Selector Switch (as required).
10. Alarm Reset Pushbutton.
11. 24 VDC coil pilot relay for remote run command.
12. Alarm auxiliary contacts and other devices as indicated on the Drawings and specified.

T. When operating in the automatic mode, the pump system shall shut down during a power outage. Upon restoration of normal power and after an adjustable time delay (0-2 minutes; motor has coasted to zero speed and there is no backspin), the variable frequency drive system shall automatically restart and then ramp up to speed as required by the control system. The process operator shall not be required to reset the system manually after a shutdown caused by a power outage.

U. Variable frequency drive shall be furnished with a multiple attempt restart feature.

V. Provide a motor circuit protector with shunt trip coil and current-limiting fuses for each variable frequency drive. Provide each variable frequency drive with its respective drive controller and output contactors for each motor.

W. Include in each variable frequency drive system an automatic trip feature which will open the output contactor and remove the drive output from the motor and allow it to decelerate safely. This automatic system shall trip and indicate the fault only upon the following conditions:

1. Output voltage unbalance (trip threshold field set).
2. Open phase.
3. Motor overload.
4. Motor stator winding fault (phase-to-ground, phase-to-phase).
5. Loss of input power to the variable frequency drive or unacceptable voltage variation.
6. High variable frequency drive equipment temperature.
7. Variable frequency drive system failure as determined by the manufacturer.
8. Component failure.
9. Overcurrent.
10. Undercurrent.

X. Provide variable frequency drive system with transmitted and received radio interference protection. In addition, provide protection against starting a rotating motor, both directions (coasting to zero speed and backspin). In the event that a motor automatic restart feature (catch the motor "on-the-fly") is provided in the drive controller as standard, this feature shall be capable of being disabled.

Y. Variable frequency drive design shall include on-line diagnostics, with an automatic self-check feature that will detect a variable frequency drive failure which in turn affects motor operation and generates an alarm contact output rated for 125 VDC suitable for interfacing with the control system.

1. Diagnostics shall operate a visual alarm indicator that is visible on the variable frequency drive equipment cabinets without opening the cabinet doors.
2. Diagnostics shall provide an easily readable output that will isolate a failure.
3. Provide an event and diagnostic recorder to printout in narrative English of the specific fault(s) and the sequence in which the faults occurred. An indication of the "First Out" failure is a minimum for fault sequence detection.
4. Provide a normally open dry contact for each alarm function to enable remote indication. A communication port shall be provided for possible future link to the plant control system.

Z. Provide each VFD with an Ethernet communications card.

2.06 Miscellaneous

A. Encapsulate critical components in ceramic or metal.

B. Auxiliaries, including fans, that are required for rated load operation at maximum ambient temperature, shall be 100 percent redundant. A new and unused spare replacement fan(s) or air conditioning unit(s), shipped in original carton, may be acceptable.

C. Fans may not run 100% of the time, fans should only operate when the VFD is operating or is above normal temperature range.

D. Circuit boards and electrical components shall meet the corrosion protection requirements specified in these Specifications. Varnished or epoxy encapsulated circuit boards and tropicalized contactors suitable for corrosive environments shall be furnished where the VFDs are not located in climate controlled areas.

E. Include an output dv/dt filter on the motor side of the VFD on VFDs with runs of greater than 300 feet from VFD to motor or as specified in the Drawings. Filter shall be manufactured by TCI of type V1K and shall be current rated according to the rating of the VFD. Enclosure shall be UL Type 1 for air conditioned, dry, areas (in all other areas, filter enclosure shall match the enclosure type of the VFD) or shall be as specified in the drawings.

PART 3 - EXECUTION

3.01 Installation

A. The VFD's shall be installed as shown on the Drawings and in accordance with the manufacturer's installation instructions.

B. Install VFD's to allow complete door swing required for component removal. This is specifically required where a VFD is set in the corner of a room.

C. **Include in the bid an allowance for factory-trained service personnel, other than sales representatives, to supervise field installation, inspect, make final adjustments and operational checks, make functional checks of spare parts, and prepare a final report for record purposes.** Adjust control and instrument equipment until this equipment has been field tested by the Contractor and the results of these tests have been accepted by the Engineer.

3.02 Painting

A. All metal surfaces of the pump control panelshall be thoroughly cleaned and given one prime coat of zinc chromate primer. All interior surfaces shall then be given one shop furnished coat of a lacquer of the nitro-cellulose enamel variety. All exterior surfaces shall be given three coats of the same lacquer. The color of finishing coats shall be as approved by the Engineer. Color chips shall be forwarded to the Engineer for color selection and approval prior to finish painting. The interior of the VFD enclosure shall be painted white.

B. Prior to final completion of the work, all metal surfaces of the equipment shall be cleaned thoroughly, and all scratches and abrasions shall be retouched with the same coating as used for factory finishing coats.

3.03 Substantial Completion Tasks

A. Along with other tasks the following shall be completed for each VFD:

B. Exposed surfaces shall be wiped down with non-abrasive cleaner.

C. Air filters shall be replaced.

D. Spare parts shall be neat and organized in a location of the Owner’s choosing.

-END-

JANUARY 2025

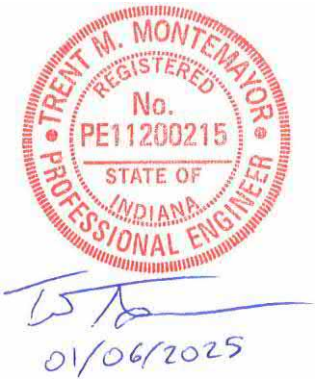
PROJECT MANUAL

CITY OF BLOOMINGTON UTILITIES

MONROE WTP IMPROVEMENTS: CHEMICAL FEED LINE REPLACEMENT AND BACKWASH SYSTEM PUMP ADDITION AND TANK REHABILITATION

W-22-4619

Bloomington, Indiana



CITY OF BLOOMINGTON UTILITIES

DONOHUE

Donohue & Associates, Inc.
101 West Ohio Street, Suite 1650
Indianapolis, IN 46204
317.267.8200 | donohue-associates.com

Donohue Project No.: 14144

PROJECT MANUAL

CITY OF BLOOMINGTON UTILITIES

MONROE WTP IMPROVEMENTS: CHEMICAL FEED LINE REPLACEMENT AND BACKWASH SYSTEM PUMP ADDITION AND TANK REHABILITATION

BLOOMINGTON, IN

Donohue & Associates
101 W. Ohio St., Suite 1650
Indianapolis, Indiana 46204
Phone: 317-267-8200
Fax: 317-267-8201

Project No. 14144

PROJECT MANUAL

CITY OF BLOOMINGTON UTILITIES

MONROE WTP IMPROVEMENTS:
CHEMICAL FEED LINE REPLACEMENT AND
BACKWASH SYSTEM PUMP ADDITION AND TANK REHABILITATION

BLOOMINGTON, INDIANA

TABLE OF CONTENTS

ADVERTISEMENT FOR BIDS

ADVERTISEMENT FOR BIDS

CITY OF BLOOMINGTON UTILITIES

MONROE WTP IMPROVEMENTS: CHEMICAL FEED LINE REPLACEMENT AND BACKWASH SYSTEM PUMP ADDITION AND TANK REHABILITATION

BLOOMINGTON, INDIANA

NOTICE IS HEREBY GIVEN THAT THE UTILITIES SERVICE BOARD OF THE CITY OF BLOOMINGTON, INDIANA, WILL RECEIVE SEALED BIDS FOR THE BELOW-DESCRIBED WORK AT THE LOCATION INDICATED.

Sealed Bids for the construction of the Monroe WTP Improvements: Chemical Feed Line Replacement and Backwash System Pump Addition and Tank Rehabilitation will be received by The City of Bloomington Utilities Department, at the 600 E. Miller Drive, Bloomington, Indiana 47401, until 4:30 p.m., Local Time on the 10th day of February 2025, at which time the Bids received will be opened and read aloud. The Project consists of constructing:

> General construction of improvements to the water treatment facility including replacement of chemical feed skids and day tanks, chemical feed lines throughout the facility, underground yard piping and pipe chase for the chemical feed lines, addition of a second backwash pump, rehabilitation of the Backwash Tank, and ancillary site, structural, electrical, and instrumentation and control improvements to facilitate the implementation of the improvements.

The Bidding Documents are on file for inspection at the office of the Director of Utilities, City of Bloomington, 600 E. Miller Dr. Bloomington, Indiana 47401. Complete digital project bidding documents are available at www.questcdn.com. You may download the digital plan documents for $40 by inputting Quest project #9449391 on the website's Project Search page. Please contact QuestCDN.com at 952-233-1632 or info@questcdn.com for assistance in free membership registration, downloading, and working with this digital project information. Paper sets of project documents will not be made available.

Neither the Owner or an engineer is responsible for the accuracy, completeness, or sufficiency of any bid documents obtained from any other source other than the sources listed herein. Obtaining these documents from any other source(s) may result in obtaining incomplete and inaccurate information. Obtaining these documents from any other source other than directly from the sources listed herein may also result in failure to receive addenda, corrections, or other revisions to the Bidding Documents that may be issued.

Each Bidder shall file with his or her sealed bid:

(1) Questionnaire Form 96 of the State Board of Accounts; including a properly executed Non-collusion Affidavit as required by the laws of the State of Indiana;
(2) a cashier's check or certified check drawn on an acceptable bank or a Bid bond equal to five (5) percent of the total amount of bid;
(3) a properly executed Trench Safety Systems Affidavit, if project may require creation of a trench of at least five (5) feet in depth;
(4) a properly executed Employee Drug Testing Program Affidavit for a public works project estimated to cost at least $150,000;
(5) a copy of the bidder's written plan for an employee drug testing program to test the employees of the bidder for drugs;
(6) a responsible bidder affidavit form:
(7) E-Verify affidavit form;

(8) Certification from the State evidencing of Bidder's authority and qualification to do business in the State of Indiana.
(9) Living wage Ordinance certification

For bids of $100,000.00 or more, the successful bidder shall furnish performance and payment bonds for one hundred percent (100%) of the contract amount prior to the execution of the contract, and said bonds shall remain in effect for a period of one (1) year after final acceptance of the work.

Each Bidder must ensure that to the greatest extent feasible, opportunities for training and employment should be given to lower income residents of the project area and purchases and/or contracts for work in connection with the project should be awarded to small business concerns which are located in, or owned in substantial part, by persons residing in the area of the project.

The City of Bloomington is an equal opportunity employer, and Bidder shall meet all requirements for equal employment under Title VII of the 1964 Civil Rights Act as amended and under the Bloomington Human Rights Ordinance, as amended.

Each Bidder for proposals over $10,000.00 shall submit and have approved by the City of Bloomington Contract Compliance Officer, Barbara McKinney, his/her written Affirmative Action Plan at least twenty-four (24) hours before the deadline for submission of bid. Each Bidder must ensure that all employees and applicants for employment are not discriminated against because of race, religion, color, sex, national origin, ancestry, disability, sexual orientation, gender identity, veteran status, or housing status. All the protected classes must be included in your Affirmative Action Plan to be acceptable. In addition to other requirements, your plan MUST include a workforce breakdown, an internal grievance procedure, a non-retaliation statement, designation of a person by name or position who is responsible for the implementation of the Plan, applicability to both applicants and employees, recruitment of minorities, equal access to training programs, and an explanation of your method of communicating the operations of your affirmative action plan to employees and prospective applicants. For Affirmative Action Plan information and approval, contact Audrey Brittingham, Contract Compliance Officer, at (812) 349-3429, 8:00 a.m. to 5:00 p.m. Monday through Friday. All other project inquiries should be directed to Daniel Hudson, City of Bloomington Utilities Engineer, at (812) 360-0672 or Daniel.Hudson@bloomington.in.gov.

In accordance with Indiana Code 4-13-18-5, each Contractor that submits a bid for a public works project that is estimated to cost $150,000 or more shall submit with his/her bid a written plan for an employee drug testing program to test the employees of the Contractor and Subcontractors for drugs.

The Utility Service Board reserves the right to waive any informality and to accept or reject any or all bids submitted. Bids may be held by the Utility Service Board for a period not-to-exceed ninety (90) days from the date of the opening of Bids for the purpose of reviewing the Bids, investigating the qualifications of the Bidders prior to awarding the contract, and awarding the contract.

Questions regarding the bid documents should be directed to Donohue & Associates attention: Kris Ransberger, PE (Telephone 317-500-4232 and email kransberger@donohue-associates.com).

WAGE RATES: Contractor shall be required to pay not less than the living wage on the Project as established by the City of Bloomington Living Wage Ordinance.

PRE-BID CONFERENCE: A pre-bid conference will be held prior to the Bid opening on January 22, 2024 at 10:00 a.m. at the Monroe Water Treatment Plant, 7470 South Shields Ridge Road, Bloomington, Indiana, to familiarize Bidders with this Project.

BID SECURITY: Bid Security in the amount of not less than 5% of the Bid shall accompany each Bid in accordance with the Instructions to Bidders.

BID WITHDRAWAL: No Bid shall be withdrawn for a period of 60 days after the scheduled opening of the bids without the consent of Owner.

Published by authority of the Utilities Service Board, City of Bloomington, Indiana

By:

Megan Parmenter, Board President

Donohue & Associates, Inc.
Indianapolis, Indiana

INSTRUCTIONS TO BIDDERS

INSTRUCTIONS TO BIDDERS

ARTICLE 1 – DEFINED TERMS

1.01 Terms used in these Instructions to Bidders have the meanings indicated in the General Conditions and Supplementary Conditions. Additional terms used in these Instructions to Bidders have the meanings indicated below:

A. *Issuing Office* – The office from which the Bidding Documents are to be issued and where the Bidding procedures are to be administered.

ARTICLE 2 – COPIES OF BIDDING DOCUMENTS

2.01 Complete sets of the Bidding Documents may be obtained for the nonrefundable payment stated in the Advertisement of Bids.

2.02 Complete sets of Bidding Documents issued by the Issuing Office, shall be used in preparing Bids; neither Owner nor Engineer assumes any responsibility for errors, omissions, or misinterpretations resulting from the use of incomplete sets of Bidding Documents or documents issued by some entity other than the Issuing Office.

2.03 Owner and Engineer, in making copies of Bidding Documents available on the above terms, do so only for the purpose of obtaining Bids for the Work and do not authorize or confer a license for any other use.

ARTICLE 3 – QUALIFICATIONS OF BIDDERS

3.01 Each Bid must contain evidence of Bidder's authority and qualification to do business in the state where the Project is located or covenant to obtain such qualification prior to award of the contract.

3.02 To demonstrate Bidder's qualifications to perform the Work, Owner may request Bidder to submit written evidence such as financial data, previous experience, present commitments, and such other data as may be called for below:

A. The address and description of the Bidder's place of business.

B. The number of years engaged in the contracting business under the present firm name, and the name of the state where incorporated.

C. A list of the property and equipment available to the Bidder for this Project to evaluate if the Bidder can complete the Work in accordance with the Bidding Documents.

D. A financial statement of the Bidder showing that the Bidder has the financial resources to meet all obligations incidental to the Work.

E. The Bidder's performance record giving the description, location, and telephone numbers of similar projects constructed by the Bidder.

F. A list of projects presently under contract, the approximate contract amount, and percent of completion of each.

G. A list of contracts, which resulted in lawsuits.

H. A list of contracts defaulted.

I. A statement of the Bidder indicating whether or not the Bidder has ever filed bankruptcy while performing Work of like nature or magnitude.

J. A list of officers of the firm who, while in the employ of the firm or the employ of previous firms, were associated with contracts which resulted in lawsuits, contracts defaulted or filed for bankruptcy.

K. The technical experience of personnel guaranteed to be employed in the responsible charge of the Work stating whether the personnel have or have not performed satisfactorily on other contracts of like nature and magnitude or comparable difficulty at similar rate of progress.

L. Subcontractor or Supplier qualification information.

M. Such additional information as will assist Owner in determining whether the Bidder is adequately prepared to fulfill the contract.

3.03 A Bidder's failure to submit required qualification information within the times indicated may disqualify Bidder from receiving an award of Contract.

3.04 No requirement in this Article 3 to submit information will prejudice the right of Owner to seek additional pertinent information regarding Bidder's qualifications.

3.05 Bidder is advised to carefully review those portions of the Bid Form requiring Bidder's representation and certifications.

3.06 The object of the request for the qualification of Bidder is not to discourage bidding or make it difficult for qualified Bidders to file Bids. Neither is it intended to discourage beginning contractors. It is intended to make it possible for Owner to have more exact information on financial ability, equipment, and experience in order to reduce the hazards involved in awarding contracts to parties who may not be qualified to perform the Work as specified.

3.07 Owner's decision as to qualification of the Bidders shall be final.

ARTICLE 4 – SITE AND OTHER AREAS; EXISTING SITE CONDITIONS; EXAMINATION OF SITE; OWNERS – SAFETY PROGRAM; OTHER WORK AT SITE

4.01 Site and Other Areas

A. The Site is identified in the Bidding Documents. By definition, the Site includes rights-of-way, easements, and other lands furnished by Owner for the use of the Contractor. Any additional lands required for temporary construction facilities, construction equipment, or storage of materials and equipment, and any access needed for such additional lands, are to be obtained and paid for by the Contractor.

4.02 Existing Site Conditions

A. Subsurface and Physical Conditions

1. The Supplementary Conditions identify:

a. Those reports known to Owner of explorations and tests of subsurface conditions at or contiguous to the Site.

b. Those drawings known to Owner of physical conditions in or relating to existing surface and subsurface structures at or contiguous to the Site (except Underground Facilities).

2. Copies of subsurface condition reports and drawings of physical conditions will be made available by Owner to any Bidder on request. Those reports and drawings are not part of the Contract Documents, but the Technical Data contained therein upon which Bidder is entitled to rely as provided in the General Conditions has been identified and established in the Supplementary Conditions. Bidder is responsible for any interpretation or conclusion Bidder draws from any Technical Data or any other data, interpretations, opinions or information contained in such reports or shown or indicated in such drawings.

B. Hazardous Environmental Condition

1. The Supplementary Conditions identify:

a. Those reports known to Owner of explorations and tests of hazardous conditions at or contiguous to the Site.

b. Those drawings known to Owner of physical conditions in or relating to existing hazardous conditions at or contiguous to the Site (except Underground Facilities).

2. Copies of Hazardous Environmental Condition reports and drawings will be made available by Owner to any Bidder on request. Those reports and drawings are not part of the Contract Documents, but the Technical Data contained therein upon which Bidder is entitled to rely as provided in the General Conditions has been identified and established in the Supplementary Conditions. Bidder is responsible for any interpretation or conclusion Bidder draws from any Technical Data or any other data, interpretations, opinions, or information contained in such reports or shown or indicated in such drawings.

C. If the Supplementary Conditions do not identify Technical Data, the default definition of Technical Data set forth in Article 1 of the General Conditions will apply.

D. Underground Facilities Information and data shown or indicated in the Bidding Documents with respect to existing Underground Facilities at or contiguous to the Site are set forth in the Contract Documents and are based upon information and data furnished to Owner and Engineer by Owners of such Underground Facilities, including Owner, or others. Owner and Engineer do not assume responsibility for the accuracy or completeness thereof.

E. Adequacy of Data: Provisions concerning responsibilities for the adequacy of data, if any, furnished to prospective Bidders with respect to subsurface conditions, or other physical conditions and Underground Facilities, and possible changes in the Bidding Documents due to differing or unanticipated conditions appear in Paragraphs 5.03, 5.04, and 5.05 of the General Conditions. Provisions concerning responsibilities for the adequacy of data, if any, furnished to prospective Bidders with respect to a Hazardous Environmental Condition at the Site, if any, and possible changes in the Contract Documents due to any Hazardous Environmental Condition uncovered or revealed at the Site which was not shown or indicated in the Drawings or Specifications or identified in the Contract Document to be within the scope of the Work appear in Paragraph 5.06 of the General Conditions.

4.03 Site Visit and Testing by Bidders

A. Bidder shall conduct the required Site visit during normal working hours, and shall not disturb any ongoing operations at the Site.

B. Bidder is not required to conduct any subsurface testing, or exhaustive investigations of Site conditions.

C. On request, and to the extent Owner has control over the Site, and schedule permitting, the Owner will provide Bidder access to the Site to conduct such additional examinations, investigations, explorations, tests, and studies, as Bidder deems necessary for submission of a Bid. Owner will not have any obligation to grant such access if doing so is not practical because of existing operations, security or safety concerns, or restraints on Owner's authority regarding the Site.

D. Bidder shall comply with all applicable Laws and Regulations relative to excavation and utility locates, obtain all permits, and comply with all terms and conditions established by Owner or Property Owners or other entities controlling the Site with respect to schedule, access, existing operations, security, liability insurance, and applicable safety programs.

E. Bidder shall fill all holes and clean up and restore the Site to its former condition upon completion of such explorations, investigations, tests, and studies.

4.04 Owner's Safety Program

A. Site visits and Work at the Site may be governed by an Owner Safety Program. As the General Conditions indicate, if an Owner Safety Program exists, it will be noted in the Supplementary Conditions.

4.05 Other Work at Site

A. Reference is made to Article 8 of the Supplementary Conditions for the identification of the general nature of other Work of which Owner is aware (if any) that is to be performed at the Site by Owner or others (such as utilities and other prime contractors) that relates to the Work contemplated by these Bidding Documents. If Owner is party to a written contract for such other Work, then on request, Owner will provide to each Bidder access to examine such contracts (other than portions thereof related to price and other confidential matters) for such other Work, if any.

ARTICLE 5 – BIDDER'S REPRESENTATIONS

5.01 It is the responsibility of each Bidder before submitting a Bid to:

A. examine and carefully study the Bidding Documents, including any Addenda, and the other related data and reference items identified in the Bidding Documents;

B. visit the Site, conduct a thorough visual examination of the Site and adjacent areas, and become familiar with and satisfy Bidder as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work;

C. become familiar with and satisfy Bidder as to all Laws and Regulations that may affect cost, progress, or performance of the Work;

D. carefully study all drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the Site (except Underground Facilities) that have been identified in the Supplementary Conditions as containing reliable Technical Data;

E. consider and correlate the information known to the Bidder information commonly known to Bidders doing business in the locality of the Site; information and observations obtained from visits to the Site; the Bidding Documents; and all examinations, investigations, explorations tests, studies, and data with respect to the effect of such information, observations and documents on (1) the cost, progress and performance of the Work; (2) the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder, including any specific means, methods, techniques, sequences and procedures of construction expressly required by the Contract Documents; and (3) Bidder's safety precautions and programs;

F. agree, based on the information and observations referred to in the preceding paragraph, that at the time of submitting its Bid that no further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of its Bid for performance of the Work at the price(s) Bid and within the times required, and in accordance with the other terms and conditions of the Bidding Documents;

G. become aware of the general nature of the Work to be performed by Owner and others at the Site that relates to the Work as indicated in the Bidding Documents;

H. promptly give Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder discovers in the Bidding Documents and confirm that the written resolution thereof by Engineer is acceptable to Bidder;

I. determine that the Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance of the Work; and

J. agree that the submission of a Bid will constitute an incontrovertible representation by Bidder that Bidder has complied with every requirement of this Article, that without exception the Bid and all prices in the Bid are: premised upon performing and furnishing the Work required by the Bidding Documents and applying any specific means, methods, techniques, sequences and procedures of construction that may be shown or indicated or expressly required by the Bidding Documents; that Bidder has given Engineer written notice of all conflicts, errors, ambiguities, and discrepancies; that Bidder has discovered in the Bidding Documents and the written resolutions thereof by Engineer are acceptable to Bidder; and that the Bidding Documents are generally sufficient to indicate and convey understanding of all Terms and Conditions for performing and furnishing the Work.

ARTICLE 6 – PRE-BID CONFERENCE

6.01 A Pre-Bid Conference will be held at the time and location stated in the Advertisement for Bids. Representatives of Owner and Engineer will be present to discuss the Project. Bidders are strongly recommended to attend and participate in the conference. Engineer will transmit to all prospective Bidders of record such Addenda as Engineer considers necessary in response to questions arising at the conference. Oral statements may not be relied upon and will not be binding or legally effective.

ARTICLE 7 – INTERPRETATIONS AND ADDENDA

7.01 All questions about the meaning or intent of the Bidding Documents are to be submitted to Engineer in writing. Interpretations or clarifications considered necessary by Engineer in response to such questions will be issued by Addenda delivered to all parties recorded by Engineer as having received the Bidding Documents. Questions received less than seven days prior to the date for opening for Bids may not be answered. Only questions answered by Addenda will be binding. Oral and other interpretations or clarifications will be without legal effect.

7.02 Addenda may be issued to clarify, correct, supplement, or change the Bidding Documents as deemed advisable by Owner or Engineer.

ARTICLE 8 – BID SECURITY

8.01 A Bid must be accompanied by Bid Security made payable to Owner in an amount of not less than 5% of Bidder's total Bid Price (determined by adding the base Bid and all Alternates) and in the form of a certified check, bank money order, or a Bid Bond (on the Form included in the Bid Documents) issued by a surety meeting the requirements of Paragraphs 6.01 of the General Conditions.

8.02 The Bid Security of the apparent Successful Bidder will be retained until Owner awards the contract to such Bidder, and such Bidder has executed the Contract Documents, furnished the required contract security and met the other conditions of the Notice of Award, whereupon the Bid Security will be released. If the Successful Bidder fails to execute and deliver the Contract Documents and furnish the required contract security within 15 days after the Notice of Award, Owner may consider Bidder to be in default, annul the Notice of Award, and the Bid security of that Bidder will be forfeited. Such forfeiture shall be Owner's exclusive remedy if Bidder defaults.

8.03 The Bid Security of other Bidders whom Owner believes to have a reasonable chance of receiving the award may be retained by Owner until the earlier of seven days after the Effective Date of the Agreement or 61 days after the Bid opening, whereupon Bid Security furnished by such Bidders will be released.

8.04 Bid Security of other Bidders whom Owner believes do not have a reasonable chance of receiving the award will be released within seven days after the Bid opening.

ARTICLE 9 – CONTRACT TIMES

9.01 The number of days within which, or the dates by which, the Work is to be substantially completed, and completed and ready for final payment are set forth in the Agreement.

ARTICLE 10 – LIQUIDATED DAMAGES

10.01 Provisions for liquidated damages, if any, for failure to timely attain Substantial Completion, or Completion of the Work in readiness for final payment are set forth in the Agreement.

ARTICLE 11 – SUBSTITUTE AND "OR EQUAL" ITEMS

11.01 The Contract for the Work, as awarded, will be on the basis of materials and equipment specified or described in the Bidding Documents without consideration during the Bidding and Contract award process of possible substitute or "or equal" items. In cases in which the Contract allows the Contractor to request that Engineer authorize the use of a substitute or "or equal" items of

material or equipment, application for such acceptance will not be considered by Engineer until after the Effective Date of the Agreement.

11.02 All prices that Bidder sets forth in its Bid shall be based on the presumption that the Contractor will furnish the materials and equipment specified or described in the Bidding Documents, as supplemented by Addenda. Any assumptions regarding the possibility of post-Bid approvals of "or equal" or substitution requests are made at Bidder's sole risk.

ARTICLE 12 – SUBCONTRACTORS, SUPPLIERS, AND OTHERS

12.01 A Bidder shall be prepared to retain specific Subcontractors, Suppliers, or other individuals or entities for the performance of the Work if required by the Bidding Documents (most commonly in the Specifications) to do so. If a prospective Bidder objects to retaining any such Subcontractor, Supplier, or other individual or entity, and the concern is not relieved by an Addendum, then the prospective Bidder should refrain from submitting a Bid.

12.02 Subsequent to the Submittal of the Bid, Owner may not require the Successful Bidder or Contractor to retain any Subcontractor, Supplier, or other individual or entity against which Contractor has reasonable objection.

12.03 Bidders shall submit with the Bid a list of proposed Subcontractors having a direct contract with the Contractor and who portions of the Work exceeds $10,000.

12.04 If requested by Owner, such list shall be accompanied by an Experience Statement with pertinent information regarding similar projects and other evidence of qualification for each such Subcontractor, Supplier, or other individual or entity. If Owner or Engineer, after due investigation has reasonable objection to any proposed Subcontractor, Supplier, individual, or entity, Owner may, before the Notice of Award is given request apparent Successful Bidder shall submit a substitute. Bidder's Bid price will be increased (or decreased) by the difference in cost occasioned by such substitution, and Owner may consider such price adjustment in evaluating Bids and making the Contract award.

12.05 If apparent Successful Bidder declines to make any such substitution, Owner may award the Contract to the next lowest Bidder that proposes to use acceptable Subcontractors, Suppliers, or other individuals, or entities. Declining to make requested substitutions will constitute grounds for forfeiture of the Bid Security of any Bidder. Any Subcontractor, Supplier, individual, or entity so listed and against which Owner or Engineer makes no written objection prior to the giving of the Notice of Award will be deemed acceptable to Owner and Engineer subject to subsequent revocation of such acceptance as provided in Paragraph 7.06 of the General Conditions.

ARTICLE 13 – PREPARATION OF BID

13.01 Only the Bid Form included with the Bidding Documents shall be used. Bidder shall not add any conditions or qualifying statements to the Bid.

13.02 All blanks on the Bid Form shall be completed by printing in ink and the Bid signed in ink. Erasures or deletions shall be initialed in ink by person signing the Bid Form. A Bid price shall be indicated for each section, Bid item, Alternate, adjustment unit price item and unit price item listed therein.

13.03 A Bid by a corporation shall be executed in the corporate name by a corporate officer (whose title must appear under the signature) accompanied by evidence of authority to sign. The corporate seal shall be affixed and attested by the secretary or an assistant secretary. The corporate address and state of incorporation shall be shown below the signature.

13.04 A Bid by a partnership shall be executed in the partnership name and signed by a partner (whose title must appear under the signature), accompanied by evidence of authority to sign. The official address of the partnership shall be shown.

13.05 A Bid by a limited liability company shall be executed in the name of the firm by a member and accompanied by evidence of authority to sign. The state of formation of the firm and the official address of the firm must be shown.

13.06 A Bid by an individual shall show the Bidder's name and official address.

13.07 A Bid by a joint venture shall be executed by each joint venturer in the manner indicated on the Bid Form. The official address of the joint venture must be shown.

13.08 Bids that are signed by an attorney-in-fact for corporations, partnerships, limited liability companies, individuals, or joint ventures shall have attached thereto a power-of-attorney evidencing authority to sign the Bid.

13.09 All names shall be typed or printed in ink below the signatures.

13.10 The Bid shall contain an acknowledgement receipt of all Addenda; the numbers of which shall be filled in on the Bid Form.

13.11 The Bid shall contain the full name, address, telephone number, and e-mail address for communications regarding the Bid.

13.12 The Bid shall contain evidence of Bidder's authority and qualifications to do business in the state where the Project is located or covenant to obtain such qualification in writing prior to award of the Contract. Bidder's state contractor license number for the state of the Project, if any, shall also be shown on the Bid Form.

13.13 Pursuant to IC 4-13-18-5, the Bidder must submit with the Bid a written plan for a program to test the Bidder's employees for drugs in accordance with the requirements of IC 4-13-18-6. A contractor that is subject to a collective bargaining agreement that establishes an employee drug testing program shall only submit a copy of the relevant part of the collective bargaining agreement establishing the program. Failure to submit a written plan for an employee drug testing program, or relevant parts of a collective bargaining agreement establishing an employee drug testing program shall result in the Bid being rejected as nonresponsive.

13.14 Prequalification or certification – For bids greater than $300,000, the "Tier 1 Contractor" employed to perform Work on the Project and any "Tier 2 Contractors" (i.e. subcontractors) whose portion of the Work will be greater than $300,000 must be qualified in accordance with IC 5-16-13-10 before performing any Work on the Project. The Bidder shall submit qualification or certification provided by the state that it and all relevant subcontractors have been qualified under IC 4-13.6-4 or IC 8-23-10 if the contract is estimated to be at least $300,000.00."

ARTICLE 14 – BASIS OF BID

14.01 Lump Sum

A. Bidders shall submit a Bid on a Lump Sum basis as set forth in the Bid Form.

B. Discrepancies between words and figures in the Bid Form will be resolved in favor of the words.

14.02 Bidders shall include a separate price for each Alternate described in the Bidding Documents as provided for in the Bid Form. The price for each Alternate will be the amount added to or deleted from the base Bid if Owner selects the Alternate. Discrepancies between words and figures in the Bid Form will be resolved in favor of the words.

14.03 The Bid Price shall include such amounts as the Bidder deems proper for overhead and profit and other expenses on account of cash allowances, if any, named in the Contract Documents as provided in Paragraph 13.02.B. of the General Conditions.

14.04 Basis of Design:

A. Unless otherwise indicated, design of this Project is based upon the material and equipment named first in the list of Supplier's in a Specification section. Engineer has performed an evaluation of other listed Supplier's material and equipment and has determined it to be equal in quality, function and performance to that of the Supplier named first. When other Supplier's are listed, Contractor may be required to make modifications or adjustments, at Contractor's expense, to coordinate the installation of the furnished material and equipment with

associated elements of Work, such as, but not limited to, piping and electrical connections, or support and mounting provisions.

B. Base Bid (Type I) Material and Equipment:

1. Bidders shall include in their Bid price the installed cost of material and equipment furnished by either Supplier A, B, or C as named on the Base Bid (Type I) Material and Equipment Schedule in the Bid Form.

2. Design of selected items of material and equipment on this Project is based upon material and equipment furnished by Supplier A as named in the Base Bid (Type I) Material and Equipment Schedule. Identified as Supplier B or C, for each scheduled item is the name of Supplier(s) whose material or equipment is considered by Engineer to be equal in quality, function and performance to that of Supplier A.

3. For each scheduled item, circle the named Supplier A, B, or C that has been included in the Bid price. Circle only one of the listed Suppliers.

4. A Substitute to Suppliers A, B, or C may be offered by a Bidder by writing in the name of the Supplier for the proposed substitute in the blank labeled "(substitute)" and the amount to be deducted from the Bid price by Change Order should the proposed substitute be acceptable to Engineer and Owner.

5. The Bid price shall be based on the installed cost of material and equipment furnished by circled Suppliers A, B, or C without consideration of substitutes listed on the Base Bid (Type I) Material and Equipment Schedule. For any item on the Schedule, if one of Suppliers A, B, or C is not circled, or if more than one of Suppliers A, B, or C are circled, the Bid price shall be based on material and equipment furnished by Supplier A without consideration of Suppliers B or C, or the substitute.

6. Requests for review of the proposed substitutes for items listed in the Base Bid (Type I) Material and Equipment Schedule will be considered only for Suppliers entered on the Bid Form.

7. Written application and supporting documentation for review of proposed substitutes shall be submitted not later than 2 days after the Effective Date of the Agreement. The procedures for submission and consideration by Engineer for determining the acceptability of substitutes are set forth in the General Conditions and Supplementary Conditions. Should the substitute not be acceptable, Contractor shall provide circled Supplier A, B, or C for the Price Bid.

8. Not more than 30 days after the Effective Date of the Agreement, Owner may select any proposed substitute in lieu of circled Suppliers A, B, or C and Bidder agrees, upon notice of selection, to furnish and install the substitute if it is determined to be acceptable by the Engineer.

ARTICLE 15 – SUBMITTAL OF BID

15.01 The Bid Form is to be completed and submitted with the Bid Security and the other documents required to be submitted under the terms of Article 7 of the Bid Form.

15.02 A Bid shall be submitted no later than the date and time prescribed and at the place indicated in the Advertisement for Bids and shall be enclosed in a plainly marked package with the Project title (and, if applicable, the designated portion of the Project for which the Bid is submitted), the name and address of Bidder, and shall be accompanied by the Bid Security and other required documents. If a Bid is sent by mail or other delivery system, the sealed envelope containing the Bid shall be enclosed in a separate package plainly marked on the outside with the notation "BID ENCLOSED".

15.03 Bids received after the date and time prescribed for the opening of Bids, or not submitted at the correct location or in the designated manner, will not be accepted and will be returned to the Bidder unopened.

ARTICLE 16 - MODIFICATION AND WITHDRAWAL OF BID

16.01 A Bid may be withdrawn by an appropriate document duly executed in the manner that a Bid must be executed and delivered to the place where Bids are to be submitted prior to the date and time for the opening of Bids. Upon receipt of such notice, the unopened Bid will be returned to the Bidder.

16.02 If a Bidder wishes to modify its Bid prior to Bid opening, Bidder must withdraw its initial Bid in the manner specified in Paragraph 16.01 and submit a new Bid prior to the date and time for the opening of Bids.

16.03 If within 24 hours after Bids are opened any Bidder files a duly signed written notice with Owner and promptly thereafter demonstrates to the reasonable satisfaction of Owner that there was a material and substantial mistake in the preparation of its Bid, that Bidder may withdraw its Bid, and the Bid security will be returned. Thereafter, if the Work is re-bid, that Bidder will be disqualified from further bidding the Work.

ARTICLE 17 – OPENING OF BIDS

17.01 Bids will be opened at the time and place indicated in the Advertisement for Bids and, unless obviously nonresponsive, read aloud publicly. An abstract of the amounts of the base Bids and major Alternates, if any, will be made available to Bidders after the opening of Bids.

ARTICLE 18 – BIDS TO REMAIN SUBJECT TO ACCEPTANCE

18.01 All Bids will remain subject to acceptance for the period of time stated in the Advertisement for Bids, but Owner may, in its sole discretion, release any Bid and return the Bid Security prior to the end of this period.

ARTICLE 19 – EVALUATION OF BIDS AND AWARD OF CONTRACT

19.01 Owner reserves the right to reject any or all Bids, including without limitation, nonconforming, nonresponsive, unbalanced, or conditional Bids. Owner will reject the Bid of any Bidder that Owner finds, after reasonable inquiry and evaluation, to not be responsible. If Bidder purports to add terms or conditions to its Bid, takes exception to any provision of the Bidding Documents, or attempts to alter the contents of the Contract Documents for purposes of the Bid, then the Owner will reject the Bid as nonresponsive. The Owner also reserves the right to waive all minor informalities not involving price, time, or changes in the Work.

19.02 More than one Bid for the same Work from an individual or entity under the same or different names will not be considered. Reasonable grounds for believing that any Bidder has an interest in more than one Bid for the Work may be cause for disqualification of that Bidder and the rejection of all Bids in which that Bidder has an interest.

19.03 Evaluation of Bids

A. In evaluating Bids, Owner will consider whether or not the Bids comply with the prescribed requirements, and such Alternates, unit prices and other data, as may be requested in the Bid Form or prior to the Notice of Award.

B. In evaluating Bidders, Owner will consider the qualifications of Bidders and may consider the qualifications and experience of Subcontractors, Suppliers, and other individuals or entities

proposed for those portions of the Work for which the identity of Subcontractors, Suppliers, and other individuals or entities must be submitted as provided in the Bidding Documents.

19.04 Owner may conduct such investigations as Owner deems necessary to establish the responsibility, qualifications, and financial ability of Bidders and any proposed Subcontractors, or Suppliers.

19.05 In evaluating Bids for the lowest Bid price, Owner will consider the Lump Sum Bid Price plus any Alternates it determines to accept or reject, if any. Owner reserves the right to accept or reject Alternates in any order or combination that it determines to be in the best interest of the Owner, taking into consideration the financial impacts and the needs of the Project. It is not the intent of the Owner to accept or reject alternates that would have changed the evaluation for the lowest Bid Price.

19.06 If Owner awards the contract for the Work, such award shall be to the responsible Bidder submitting the lowest Bid price.

ARTICLE 20 – CONTRACT SECURITY AND INSURANCE

20.01 Article 6 of the General Conditions, as may be modified by the Supplementary Conditions, sets forth Owner's requirements as to performance and payment bonds and insurance. When the Successful Bidder delivers the executed Agreement to Owner, it must be accompanied by such bonds and insurance documentation.

ARTICLE 21 – SIGNING OF AGREEMENT

21.01 When Owner gives a Notice of Award to the Successful Bidder, it will be accompanied by the required number of unexecuted counterparts of the Agreement with the other Contract Documents, which are identified in the Agreement as attached thereto. Within 15 days thereafter, Successful Bidder shall execute and deliver the required number of counterparts of the Agreement and attached documents to Owner with the required bonds and certificates or policies of insurance as required by the Supplementary Conditions. Within 10 days thereafter, Owner shall deliver one fully executed counterpart of the Agreement to the Successful Bidder and Engineer, together with printed and electronic copies of the Contract Documents as stated in the General Conditions.

ARTICLE 22 – SALES AND USE TAXES

22.01 Owner is exempt from state sales and use taxes on materials and equipment to be incorporated in the Work. Said taxes shall not be included in the Bid. Refer to Paragraph 7.10 of the Supplementary Conditions for additional information.

ARTICLE 23 – WAGE RATES

23.01 The wage rates are on file at the office of Owner and incorporated in the Project Manual.

23.02 The wage rates will be incorporated into and made a part of the Contract Documents when the Contract Documents are prepared for execution.

ARTICLE 24 – CONTRACTS TO BE ASSIGNED

24.01 The contract shall not be assigned to any other entity without written approval of the Owner.

ARTICLE 25 – DOMESTIC CONSTRUCTION PRODUCTS

25.01 Bidders shall comply with Indiana Code 5-16-8-2, requires that steel products made in the United States be used in the performance of the work on all public works projects, including this Project, by the Contractor and all subcontractors.

ARTICLE 26 – E-VERIFY CERTIFICATION

26.01 Pursuant to Indiana Code 22-5-1.7-11.1, the contractor awarded the Bid is required to enroll in and verify the work eligibility status of all its newly hired employees through the E-Verify program. The contractor who is awarded the Bid is not required to verify the work eligibility status of all its newly hired employees through the E-Verify program if the E-Verify program no longer exists.

26.02 The individual person(s) executing this Proposal, being first duly sworn, depose(s) and state(s) that the Bidder does not knowingly employ an unauthorized alien. The undersigned further affirms that, prior to entering into an agreement for this Bid, the undersigned business entity will enroll in and agrees to verify the work eligibility status of all its newly hired employees through the E-Verify program.

26.03 Pursuant to Indiana Code 22-5-1.7-11.1 the Contractor shall provide documentation that it has enrolled and is participating in the E-Verify program. Contractor is required to submit proof from the E-Verify Program that it is currently enrolled in the Program. An example of confirmation is the confirmation e-mail received from E-Verify that the Contractor has successfully enrolled in E-Verify.

END OF INSTRUCTIONS TO BIDDERS

BID FORM

BID FORM

TABLE OF CONTENTS

BID FORM

BIDDER_____
(name – typed or printed)

PROJECT IDENTIFICATION:

CITY OF BLOOMINGTON UTILITIES

MONROE WTP IMPROVEMENTS: CHEMICAL FEED LINE
REPLACEMENT AND BACKWASH SYSTEM PUMP ADDITION
AND TANK REHABILITATION

BLOOMINGTON, IN

PROJECT NUMBER: W-22-4619

ARTICLE 1 – BID RECIPIENT

THIS BID IS SUBMITTED TO:

The City of Bloomington Utilities Department
600 E. Miller Drive
Bloomington, IN 47401

1.01 The undersigned Bidder proposes and agrees, if this Bid is accepted, to enter into an Agreement with Owner in the form included in the Bidding Documents to perform all Work as specified or indicated in the Bidding Documents for the prices and within the times indicated in this Bid and in accordance with the other terms and conditions of the Bidding Documents.

ARTICLE 2 – BIDDER'S ACKNOWLEDGEMENTS

2.01 Bidder accepts all of the terms and conditions of the Advertisement for Bids and Instructions to Bidders, including without limitation those dealing with the disposition of Bid security. Bidder has not added any conditions or qualifying statements to the Bid. The Bid will remain subject to acceptance for the bid withdrawal time stated in the Advertisement for Bids, or for such longer period of time that Bidder may agree to in writing upon request of Owner. Bidder will sign and deliver the required number of counterparts of the Agreement with the Bonds, evidence of insurance coverage, and other documents required by the Bidding Requirements within 15 days after the date of Owner's Notice of Award.

ARTICLE 3 – BIDDER'S REPRESENTATIONS

3.01 In submitting this Bid, Bidder represents, as set forth in the Agreement, that:

A. Bidder has examined and carefully studied the Bidding Documents, the other related data identified in the Bidding Documents, and the following Addenda, receipt of all which is hereby acknowledged.

Addendum No.	Addendum Date
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

B. Bidder has visited the Site and become familiar with and is satisfied as to the general, local and Site conditions that may affect cost, progress, and performance of the Work.

C. Bidder is familiar with and is satisfied as to all federal, state and local Laws and Regulations that may affect cost, progress and performance of the Work.

D. Bidder has carefully studied all: reports of explorations and test of subsurface conditions at or contiguous to the Site and all drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the site (except Underground Facilities), if any, that have been identified in Paragraph 5.03 of the Supplementary Conditions as containing reliable Technical Data.

E. Bidder has considered and correlated the information known to the Bidder; information commonly known to bidders doing business in the locality of the Site; information and observations obtained from visits to the Site; the Contract Documents; an all additional or supplementary examinations, investigations, explorations, tests, studies, and data with respect to the effect of such information, observations, and documents on (1) the cost, progress, and performance of the Work; (2) the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder, including any specific means, methods, techniques, sequences, and procedures of construction expressly required by the Contract Documents; and (3) Bidder's safety precautions and programs.

F. Bidder does not consider that any further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of this Bid for performance of the Work at the price(s) bid and within the times and in accordance with the other terms and conditions of the Bidding Documents.

G. Bidder is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Bidding Documents.

H. Bidder has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder has discovered in the Bidding Documents, and confirms that the written resolution thereof by Engineer is acceptable to Bidder.

I. The Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance of the Work for which this Bid is submitted.

J. The submission of this Bid constitutes an incontrovertible representation by Bidder that Bidder has complied with every requirement of this Article, and that without exception the Bid and all prices in the Bid are premised upon performing and furnishing the Work required by the Bidding Documents.

ARTICLE 4 – BIDDER'S CERTIFICATION

4.01 Bidder further represents that:

A. This Bid is genuine and not made in the interest of or on behalf of any undisclosed individual or entity and is not submitted in conformity with any collusive agreement or rules of any group, association, organization or corporation;

B. Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham bid;

C. Bidder has not solicited or induced any individual or entity to refrain from bidding; and

D. Bidder has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for the Contract. For the purposes of this Paragraph 4.01.D:

1. "corrupt practice" means the offering, giving, receiving, or soliciting of any thing of value likely to influence the action of a public official in the bidding process;

2. "fraudulent practice" means an intentional misrepresentation of facts made (a) to influence the bidding process to the detriment of Owner, (b) to establish bid prices at artificial non-competitive levels, or (c) to deprive Owner of the benefits of free and open competition;

3. "collusive practice" means a scheme or arrangement between two or more Bidders, with or without the knowledge of Owner, purposes of which is to establish bid prices at artificial, non-competitive levels; and

4. "coercive practice" means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process or affect the execution of the Contract.

ARTICLE 5 – BASIS OF BID

5.01 Bidder will complete the Work in accordance with the Contract Documents for the following price:

No.	Section	Unit Description	Qty	Unit	Bid Unit Price	Bid Price
1	26 05 43	Duct Bank Relocation Allowance	1	LS	$ 50,000.00 per LS	$ 50,000.00
2	01 21 00	Work Allowance	1	LS	$ 100,000.00 per LS	$ 100,000.00
3	Appendix	Sodium Hypochlorite Storage Tank T-1 Rehabilitation	1	LS	$ 69,100.00 per LS	$ 69,100.00
4	All Sections	All other work not specified in Bid Item Nos. 1 through 3	1	LS	$ _____ per LS	$ _____

TOTAL OF ALL BID PRICES (Sum of Bid Price for Each Item) $ _____ (figures)

_____ Dollars
(words)

Qty = Estimated Quantity

Estimated Price (for each Item) = Qty x Unit Price (for each item)

LS = Lump Sum

All specific allowances identified in Section 01 21 00 are included in the price set forth above and have been computed in accordance with Paragraph 13.02 of the General Conditions.

A. Base Bid (Type I) Material and Equipment:

1. Bidder has included in the Bid price, the installed cost of material and equipment furnished by the circled Supplier as named in the Base Bid (Type I) Material and Equipment Schedule, which is included at the end of this Bid Form.

2. The circled Supplier has been selected from Supplier A, B, or C as named in the Base Bid (Type I) Material and Equipment Schedule in accordance with the Instructions to Bidders.

3. If a substitute is offered, Bidder has included the name of the Supplier and the amount to be deducted from the Bid price for the proposed substitute in the Base Bid (Type I) Material and Equipment Schedule in accordance with the Instructions to Bidders. Bidder agrees that the procedures for submission and consideration by Engineer for determining the acceptability of substitutes will be as set forth in the General Conditions and the Supplementary Conditions.

B. ALTERNATES: Include the following alternates as described in Section 01 23 00:

Alternate 1 – Work in the Fluoride Room. Add _____ Dollars (words) $ _____ (figures)
Alternate 2 – Replacement of all lighting fixtures with LED lights in the Chemical Building 800 Add _____ Dollars (words) $ _____ (figures)
Alternate 3 – Cleaning and coating of the Backwash Tank Add _____ Dollars (words) $ _____ (figures)

ARTICLE 6 – TIME OF COMPLETION

6.01 Bidder agrees that the Work will be substantially completed and will be completed and ready for final payment in accordance with Paragraph 15.06 of the General Conditions on or before the dates or within the number of calendar days indicated in the Agreement.

6.02 Bidder accepts the provisions of the Agreement as to liquidated damages in the event of failure to complete the Work within the Contract Times.

ARTICLE 7 – ATTACHMENTS TO THIS BID

7.01 The following documents are attached to and made a condition of this Bid:

A. Required Bid security in the form of _____
(Certified Check or Bid Bond)

in the amount of _____.
(Dollars or Percent of Lump Sum Bid Price)

B. List of proposed Subcontractors having a direct contract with the Contractor. The Subcontractor listing is included at the end of this Bid Form.

C. Required Bidder qualifications statement with supporting data.

D. Form 96 (attached).

E. Affirmative Action Plan.

F. Affidavit the Living Wage Ordinance.

ARTICLE 8 – DEFINED TERMS

8.01 The terms used in this Bid with initial capital letters have the meanings stated in the Instructions to Bidders, the General Conditions, and the Supplementary Conditions.

ARTICLE 9 – BID SUBMITTAL

SUBMITTED ON _____, 20____.

State Contractor License No. _____. (If applicable)

If Bidder is:

An Individual

Name (typed or printed): _____

By: _____ (SEAL)
(Individual's signature)

Doing business as: _____

Business address: _____

_____

Phone No.: _____ FAX No.: _____

A Partnership

Partnership Name: _____ (SEAL)

By: _____
(Signature of general partner – attach evidence of authority to sign)

Name (typed or printed): _____

Business address: _____

_____

Phone No.: _____ FAX No.: _____

A Corporation

Corporation Name: _____ (SEAL)

State of Incorporation: _____

Type (General Business, Professional, Service, Limited Liability): _____

By: _____
(Signature – attach evidence of authority to sign)

Name (typed or printed): _____

Title: _____

(CORPORATE SEAL)

Attest: _____
(Signature of Corporate Secretary)

Business Address: _____

Phone No: _____ FAX No.: _____

Date of Authorization to do business is _____

A Joint Venture

Name of Joint Venture: _____

First Joint Venturer Name: _____(SEAL)

By: _____
(Signature of joint venture partner – attach evidence of authority to sign)

Name (typed or printed): _____

Title: _____

Business address: _____

_____

Phone No.: _____ FAX No.: _____

Second Joint Venturer Name: _____ (SEAL)

By: _____
(Signature of joint venture partner – attach evidence of authority to sign)

Name (typed or printed): _____

Title: _____

Business address: _____

_____

Phone No.: _____ FAX No.: _____

Phone and FAX Number, and Address for receipt of official communications:

_____

_____

(Each joint venturer must sign. The manner of signing for each individual, partnership, and corporation that is a party to the joint venture should be in the manner indicated above.)

SUBCONTRACTOR LISTING

The following is a listing of proposed Subcontractors having a direct contract with the Contractor.

1. Electrical

2. Plumbing

3. Integration

4. Paving

5. Excavation

6. Process Pipe Installation

7.

8.

9.

10.

11.

12.

13.

BASE BID (TYPE I) MATERIAL AND EQUIPMENT SCHEDULE			
Specification Section	**Item**	**Supplier**	**Amount To Be Deducted From Bid Price**
43 23 31	Vertical Turbine Pumps	(A) Peerless Pump	
		(substitute)	$
43 41 45	Fiberglass Reinforced Plastic Tanks	(A) Belding Tank Technologies	
		(B) Design Tanks	
		(substitute)	$
46 33 00	Chemical Feed Systems	(A) Valmet	
		(B) Watson-Marlow	
		(substitute)	$

BID BOND

BID BOND

Any singular reference to Bidder, Surety, Owner or other party shall be considered plural where applicable.

BIDDER *(Name and Address)*:

SURETY *(Name, and Address of Principal Place of Business)*:

OWNER *(Name and Address)*:

BID

Bid Due Date:

Description *(Project Name— Include Location)*:

BOND

Bond Number:

Date:

Penal sum _____ $ _____

(Words) (Figures)

Surety and Bidder, intending to be legally bound hereby, subject to the terms set forth below, do each cause this Bid Bond to be duly executed by an authorized officer, agent, or representative.

BIDDER	**SURETY**
_____ (Seal)	_____ (Seal)
Bidder's Name and Corporate Seal	Surety's Name and Corporate Seal
By: _____	By: _____
Signature	Signature (Attach Power of Attorney)
_____	_____
Print Name	Print Name
_____	_____
Title	Title
Attest: _____	Attest: _____
Signature	Signature
Title	Title

Note: Addresses are to be used for giving any required notice.
Provide execution by any additional parties, such as joint venturers, if necessary.

1. Bidder and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to pay to Owner upon default of Bidder the penal sum set forth on the face of this Bond. Payment of the penal sum is the extent of Bidder's and Surety's liability. Recovery of such penal sum under the terms of this Bond shall be Owner's sole and exclusive remedy upon default of Bidder.

2. Default of Bidder shall occur upon the failure of Bidder to deliver within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents.

3. This obligation shall be null and void if:

3.1 Owner accepts Bidder's Bid and Bidder delivers within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents, or

3.2 All Bids are rejected by Owner, or

3.3 Owner fails to issue a Notice of Award to Bidder within the time specified in the Bidding Documents (or any extension thereof agreed to in writing by Bidder and, if applicable, consented to by Surety when required by Paragraph 5 hereof).

4. Payment under this Bond will be due and payable upon default of Bidder and within 30 calendar days after receipt by Bidder and Surety of written notice of default from Owner, which notice will be given with reasonable promptness, identifying this Bond and the Project and including a statement of the amount due.

5. Surety waives notice of any and all defenses based on or arising out of any time extension to issue Notice of Award agreed to in writing by Owner and Bidder, provided that the total time for issuing Notice of Award including extensions shall not in the aggregate exceed 120 days from the Bid due date without Surety's written consent.

6. No suit or action shall be commenced under this Bond prior to 30 calendar days after the notice of default required in Paragraph 4 above is received by Bidder and Surety and in no case later than one year after the Bid due date.

7. Any suit or action under this Bond shall be commenced only in a court of competent jurisdiction located in the state in which the Project is located.

8. Notices required hereunder shall be in writing and sent to Bidder and Surety at their respective addresses shown on the face of this Bond. Such notices may be sent by personal delivery, commercial courier, or by United States Registered or Certified Mail, return receipt requested, postage pre-paid, and shall be deemed to be effective upon receipt by the party concerned.

9. Surety shall cause to be attached to this Bond a current and effective Power of Attorney evidencing the authority of the officer, agent, or representative who executed this Bond on behalf of Surety to execute, seal, and deliver such Bond and bind the Surety thereby.

10. This Bond is intended to conform to all applicable statutory requirements. Any applicable requirement of any applicable statute that has been omitted from this Bond shall be deemed to be included herein as if set forth at length. If any provision of this Bond conflicts with any applicable statute, then the provision of said statute shall govern and the remainder of this Bond that is not in conflict therewith shall continue in full force and effect.

11. The term "Bid" as used herein includes a Bid, offer, or proposal as applicable.

NOTICE OF AWARD

NOTICE OF AWARD

DATED: _____

TO: _____
_____
_____
_____
_____

CONTRACT:

City of Bloomington Utilities
Monroe WTP Improvements: Chemical Feed Line
Replacement and Backwash System Pump Addition
And Tank Rehabilitation
Bloomington, IN

You are notified that Owner has accepted your Bid dated _____ for the above Contract, and that you are the Successful Bidder and are awarded a Contract for:

[Describe Work, alternates, or sections of Work awarded]

The Contract Price of your Contract is _____ Dollars ($_____).

Three copies of the Agreement accompany this Notice of Award and one copy of the Contract Documents accompanies this Notice of Award, or has been transmitted or made available to Bidder electronically. Additional sets of Contract Documents and Drawings will be delivered separately at a later date.

You must comply with the following conditions precedent within 15 days of the date of this Notice of Award, that is by _____.

1. Deliver to the Owner three fully executed counterparts of the Agreement, signed by Bidder (as Contractor).

2. Deliver with the signed Agreement the Contract security (Bonds) and insurance documentation, as specified in the Instructions to Bidders (Article 20) and General Conditions (Article 6).

Failure to comply with these conditions within the time specified will entitle Owner to consider your Bid in default, to annul this Notice of Award, and to declare your Bid security forfeited.

Within 10 days after you comply with the above conditions, Owner will return to you one fully executed counterpart of Agreement.

City of Bloomington Utilities
(OWNER)

(AUTHORIZED SIGNATURE)

(TITLE)

Copy: Engineer

STANDARD FORM OF AGREEMENT

AGREEMENT
BETWEEN
CITY OF BLOOMINGTON
UTILITIES DEPARTMENT
AND

_____

FOR
MONROE WTP IMPROVEMENTS:
CHEMICAL FEED LINE REPLACEMENT AND BACKWASH SYSTEM PUMP ADDITION AND TANK REHABILITATION

THIS AGREEMENT is executed by and between the City of Bloomington, Indiana, Utilities Department through the Utilities Service Board (hereinafter the "City"), and _____ (hereinafter the "Contractor").

WHEREAS, City desires to retain Contractor's services for the scope of work generally described in **Attachment "A"**, "Scope of Work", attached hereto and incorporated into this Agreement, and as otherwise specified or indicated in the contract documents (hereinafter the "Work"); and

WHEREAS, Contractor is capable of performing the Work as per its Bid on the Bid Proposal Form/Summary Sheet; and

WHEREAS, in accordance with Indiana Code § 5-16-13 *et seq*., incorporated herein by reference, Contractor is a Tier 1 or General Contractor for this project; and

WHEREAS, Contractor was determined to be the lowest responsible and responsive Bidder for said project.

NOW, THEREFORE, in consideration of the mutual promises hereinafter enumerated, the parties agree as follows:

ARTICLE 1. TERM

1.01 This Agreement shall be in effect upon execution of this Agreement by all parties. In accordance with Indiana Code 5-16-13 *et seq*., incorporated herein by reference, Contractor is a Tier 1 Contractor or general Contractor for this project.

ARTICLE 2. SERVICES

2.01 Contractor shall complete all Work as specified or indicated in the Contract Documents and as generally described in **Attachment "A"**.

2.02 All work required under this Agreement shall be substantially completed by the Contractor within forty-five (45) calendar days from the date of the Notice to Proceed, unless the parties mutually agree to a later completion date. Substantial Completion shall mean that all work is sufficiently completed in accordance with the plans and specifications, as modified by any approved change orders, so that it can be used for its intended purpose.

2.03 It is hereby understood by both parties that time is of the essence in this Agreement. Failure of Contractor to complete all work as herein provided will result in monetary damages to City. It is hereby agreed that City will be damaged for every day the work has not been performed in the manner herein provided and that the measure of those damages shall be determined by reference Section 13.00 of the General Conditions for Each Day of Overrun in Contract Time. Contractor agrees to pay City said damages or, in the alternative, City, at its sole discretion, may withhold monies otherwise due Contractor. It is expressly understood by the parties hereto that these damages relate to the time of performance and do not limit City's other remedies under this Agreement, or as provided by applicable law, for other damages.

2.04 Contractor agrees that no charges or claims for damages shall be made by him or her for any delays or hindrances, from any cause whatsoever during the progress of any portion of the services specified in the Agreement. Such delays or hindrances, if any, may be compensated for by an extension of time for a reasonable period as may be mutually agreed upon between the parties, it being understood, however, that permitting Contractor to proceed to complete any service, or any part of the services / project, after the date to which the time of completion may have been extended, shall in no way operate as a waiver on the part of City of any of its rights herein.

ARTICLE 3. COMPENSATION

3.01 Contractor shall provide services specified or indicated in the Contract Documents and as generally described in **Attachment "A"**.

3.02 City shall pay Contractor for completion of the Work in accordance with the Contract Documents, subject to adjustment under the Contract, at the unit prices stated in Contractor's Bid, attached hereto as **Attachment "B"**. City may withhold payment, in whole or in part, to the extent necessary to protect itself from a loss on account of any of the following:

Defective work.

Evidence indicating the probable filing of claims by other parties against Contractor which may adversely affect City.

Failure of Contractor to make payments due to subcontractors, material suppliers or employees.

Damage to City or a third party.

3.03 The submission of any request for payment shall be deemed a waiver and release by Contractor of all liens and claims with respect to the work and period to which such payment request pertains except as specifically reserved and noted on such request.

3.04 Contractor shall maintain proper account records for the scope of all services of this Agreement and provide an accounting for all charges and expenditures as may be necessary for audit purposes. All such records shall be subject to inspection and examination by City's representatives at reasonable business hours.

3.05 For projects utilizing federal funding the Contractor shall submit time sheets (WH-347) for his or her own and all subcontracted employees, to City Engineer or his or her representative for approval and review, including review for compliance with Davis Bacon requirements, if federal funds are used.

3.06 Engineer The City Of Bloomington Utilities Engineer shall act as the City's representative and assume all duties and responsibilities and have all the rights and authority assigned to the Engineer in the Contract Documents in connection with completion of the Work in accordance with the Contract Documents.

ARTICLE 4. RETAINAGE

For contracts in excess of $100,000 and for which Contractor requested Progressive Payments on its Bid Form, the Owner requires that retainage be held as set out below.

4.02 Retainage Amount The retainage amount shall be five percent (5%) of the dollar value of all work satisfactorily completed and shall be withheld until the Contract work is complete. The retainage amount shall be placed in an escrow account with an escrow agent or shall be held by the Utilities Service Board ("Board"). Yellow Cardinal Group Columbus, Indiana, shall serve as the escrow agent.

4.03 Escrow Agent If the retainage is held by an escrow agent, then the escrow agent, Owner and Contractor shall enter into a written escrow agreement and Contractor shall work directly with the escrow agent to set up the account. The escrow agent shall invest all escrowed principal in obligations selected by the escrow agent. The escrow agent shall be compensated for the agent's services by a reasonable fee, agreed upon by the parties, that is comparable with fees charged for the handling of escrow accounts of similar size and duration. The fee shall be paid from the escrow income. The escrow agent's fee may be determined by specifying an amount of interest the escrow agent will pay on the escrowed amount, with any additional earned interest serving as the escrow agent's fee. The escrow agreement may include other terms and conditions as deemed necessary by the parties. However, if Contractor intends to receive a Single Lump Sum payment upon acceptance of this project, retainage will not be required and an Escrow Agreement will not be required.

4.04 Board If the retainage is held by the Board, then the Owner shall place the funds so retained in a retainage account with the Board. Such deposit shall be made within three business days after the date such payments are made to Contractor. No income will be earned or will be payable on the deposit.

4.05 Payment of Escrow Amount The escrow agent shall hold the escrowed principal and income until receipt of the notice from Owner and Contractor that the Contract work has been substantially completed to the reasonable satisfaction of Owner, at which time Owner shall pay to the Contractor the balance to be paid under this Contract and execute such documents as are necessary to authorize the escrow agent to pay to the Contractor the funds in the escrow account, including both specifying the part of the escrowed principal to be released from the escrow and the person to whom that portion is to be released. After receipt of the notice, the escrow agent shall remit the designated part of the escrowed principal and the escrowed income, minus the escrow agent's fees, to the person specified in the notice. However, nothing in this section shall prohibit Owner from requiring the escrow agent to withhold amounts necessary to complete minor items of the Contract, following substantial completion of the Contract in accordance with the provisions of paragraph 4.07.

4.06 Payment of Retainage Amount by the Board The Board shall hold the retainage until notice from the Owner that the Contract work has been substantially completed to the reasonable satisfaction of the Owner. At this time, the Owner shall pay to the Contractor the balance to be paid under this Contract and execute such documents as are necessary to authorize the Board to

pay the Contractor the retainage. No interest will have been earned or will be payable. Nothing in this section shall prohibit Owner from requiring the Board to withhold amounts necessary to complete minor items of the Contract, following substantial completion of the Contract in accordance with the provisions of paragraph 4.07.

4.07 **Withholding Funds for Completion of Contract** If, upon substantial completion of the Contract, there still remains minor Contract work that needs to be completed, or minor Contract work that needs to be performed to the satisfaction of the Owner, the Owner may direct the escrow agent or the Board to retain and withhold from payment to the Contractor an amount equal to two hundred percent (200%) of the value of said work. The value of said work shall be determined by the architect/engineer. The escrow agent or the Board shall release the funds withheld under this section after receipt of notice from the Owner that all work on the Contract has been satisfactorily completed. In the event that said work is not completed by the Contractor, but by the Owner or another party under contract with Owner, said funds shall be released to Owner.

ARTICLE 5. GENERAL PROVISIONS

5.01 Contractor agrees to indemnify and hold harmless City and its officers, agents, officials and employees for any and all claims, actions, causes of action, judgments and liens arising out of any negligent act or omission by Contractor or any of its officers, agents, officials, employees, or subcontractors or any defect in materials or workmanship of any supply, materials, mechanism or other product or service which it or any of its officers, agents, officials, employees, or subcontractors has supplied to City or has used in connection with this Agreement and regardless of whether or not it is caused in part by a party indemnified herein under. Such indemnity shall include attorney's fees and all costs and other expenses arising there from or incurred in connection therewith and shall not be limited by reason of the enumeration of any insurance coverage required herein.

Contractor shall indemnify and hold harmless City and its officers, agents, officials and employees for any and all damages, actions, costs, (including, but not limited to, attorney's fees, court costs and costs of investigation) judgments and claims by anyone for damage to property, injury or death to persons resulting from the collapse or failure of any trenches, ditches or other excavations constructed under or associated with this contract.

5.02 Abandonment, Default and Termination

5.02.01. City shall have the right to abandon the work contracted for in this Agreement without penalty. If City abandons the work described herein, Contractor shall deliver to City all surveys, notes, drawings, specifications and estimates completed or partially completed and these shall become the property of City. The earned value of the work performed shall be based upon an estimate of the proportion between the work performed by Contractor under this Agreement and the work which Contractor was obligated to perform under this Agreement. This proportion shall be mutually agreed upon by City and Contractor. The payment made to Contractor shall be paid as a final payment in full settlement of his or her services hereunder.

5.02.02. **Default**: If Contractor breaches this Agreement or fails to perform the Work in an acceptable manner, he or she shall be considered in default. Any one or more of the following will be considered a default:

Failure to begin the work under this Agreement within the time specified.
Failure to perform the work with sufficient supervision, workmen, equipment and materials to insure prompt completion of said work within the time limits allowed.
Unsuitable performance of the work as determined by the Engineer or his or her representative.
Neglecting or refusing to remove defective materials or failure to perform anew such work as shall have been rejected.
Discontinuing the prosecution of the work or any part of it.
Inability to finance the work adequately.
If, for any other reason, Contractor breaches this Agreement or fails to carry on the work in an acceptable manner.

5.02.03. City shall send Contractor a written notice of default. If Contractor, or his or her Surety, within a period of seven (7) days after such notice, fails to remedy the default, then City shall have full power and authority, without violation of the Contract, to take the prosecution of the work out of the hands of said Contractor, to appropriate or use any or all materials and equipment on the ground as may be suitable and acceptable, and may, at its option, turn the work over to the Surety, or enter into an agreement with another Contractor for the completion of the Agreement according to the terms and provisions thereof, or City may use such other methods as, in its opinion, shall be required for the completion of said Contract in an acceptable manner.

5.02.04. All cost of completing the work under the Contract shall be deducted from the monies due or which may become due to said Contractor. In case the expenses so incurred by City shall be less than the sum which would have been payable under the Contract if it had been completed by said Contractor, Contractor shall be entitled to receive the difference. However, in case such expense shall exceed the sum which would have been payable under the Contract, Contractor and his or her Surety will be liable and shall pay to City the amount of said excess. By taking over the prosecution of the work, City does not forfeit the right to recover damages from Contractor or his or her Surety for his or her failure to complete the work in the time specified.

5.02.05. Notwithstanding any other provision of this Agreement, if funds for the continued fulfillment of the Agreement by City are at any time not forthcoming or are insufficient, through failure of any entity to appropriate the funds or otherwise, then City shall have the right to terminate this Agreement without penalty by giving prior written notice documenting the lack of funding in which instance, unless otherwise agreed to by the parties, this Agreement shall terminate and become null and void.

5.02.06. City agrees that it will make its best effort to obtain sufficient funds, including but not limited to, including in its budget for each fiscal period during the term hereof a request for sufficient funds to meet its obligations hereunder in full.

5.03 Successors and Assigns

5.03.01 Both parties agree that for the purpose of this Agreement, Contractor shall be an Independent Contractor and not an employee of City.

5.03.02 No portion of this Agreement shall be sublet, assigned, transferred or otherwise disposed of by Contractor except with the written consent of City being first obtained. Consent to sublet,

assign, transfer, or otherwise dispose of any portion of this Agreement shall not be construed to relieve Contractor of any responsibility of the fulfillment of this Agreement.

5.04 Extent of Agreement: Integration

5.04.01 This Agreement consists of the following parts, each of which is as fully a part of this Agreement as if set out herein and are referred to throughout this Agreement as the Contract Documents:

1. This Agreement and its Attachments.
2. All Written Amendments and other documents amending, modifying, or supplementing the Contract Documents which may be delivered or issued after the Effective Date of the Agreement and are not attached hereto.
3. All Addenda to the Bid Documents.
4. The Invitation to Bidders.
5. The Instructions to Bidders.
6. The Special Conditions.
7. All plans as provided for the work that is to be completed.
8. The Supplementary Conditions.
9. The General Conditions.
10. The Specifications.
11. The current Indiana Department of Transportation Standard Specifications and the latest addenda.
12. Contractor's submittals.
13. The Performance Bond and the Payment Bond.
14. The Escrow Agreement.
15. Request for Taxpayer Identification number and certification: Substitute W-9.

5.04.02 In resolving conflicts, errors, discrepancies and disputes concerning the Scope of Work to be performed by Contractor, and other rights and obligations of City and Contractor, the document expressing the greater quantity, quality or other scope of work in question, or imposing the greater obligation upon Contractor and affording the greater right or remedy to City shall govern; otherwise the documents shall be given precedence in the order as enumerated above.

5.05 Insurance

5.05.01 Contractor shall, as a prerequisite to this Agreement, purchase and thereafter maintain such insurance as will protect him or her from the claims set forth below which may arise out of or result from Contractor's operations under this Agreement, whether such operations be by Contractor or by any subcontractors or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable:

a. Comprehensive General Liability Insurance
   i. $1,000,000 for each occurrence;
   ii. $1,000,000 personal injury and advertising injury;
   iii. $2,000,000 products and completed operations aggregate; and
   iv. $2,000,000 general aggregate.

b. Automobile Liability providing coverage for all owned, hired and non-owned autos. The limit of liability required is $1,000,000 each accident.
c. Workers Compensation and Employers Liability (only if statutorily required for Service Provider). The limits required are: Workers Compensation – Statutory; and Employers Liability--$1,000,000 for each accident, for each employee.
d. Umbrella/Excess Liability with a required limit of $1,000,000.

For any agreement where the Contractor receives payment from the City of Bloomington and/or has access to critical City data, Contractor shall also have the following:

a. Cyber Attack and Cyber Extortion
  i. Computer Attack Limit (Annual Aggregate) of $1,000,000;
  ii. Sublimit (Per Occurrence) for Cyber Extortion of $100,000; and
  iii. Computer attack and Cyber Extortion deductible (per occurrence) of $10,000.
b. Network Security Liability
  i. Limit (Annual Aggregate) of $1,000,000; and
  ii. Deductible (per occurrence) of $10,000.
c. Electronic Media Liability
  i. Limit (Annual Aggregate) of $1,000,000; and
  ii. Deductible (Per Occurrence) of $10,000.
d. Fraudulent Impersonator Coverage
  i. Limit (Annual Aggregate) of $250,000; and
  ii. Deductible (Per Occurrence) of $5,000.

5.05.02 Contractor's comprehensive general liability insurance shall also provide coverage for the following:

Premises and operations;
Contractual liability insurance as applicable to any hold-harmless agreements;
Completed operations and products; which also must be maintained for a minimum period of two (2) years after final payment and Contractor shall continue to provide evidence of such coverage to CITY on an annual basis during the aforementioned period;
Broad form property damage - including completed operations;
Fellow employee claims under Personal Injury; and
Independent Contractors.

5.05.03 All insurance policies shall be issued by an insurance company authorized to issue such insurance in the State of Indiana. These policies shall name the City of Bloomington and its Utilities Company, and the officers, employees, and agents of each as insured under General Liability, Automobile, and Umbrella/Excess Liability policies. Such policies shall stipulate that the insurance will operate as primary insurance and that no other insurance of the City's will be called upon to contribute to a loss hereunder.

5.05.04 Contractor shall provide a Certificate of Insurance showing each insurance policy to the City prior to the commencement of work under this Agreement, and shall provide documentation of any changes to or cancellation of required insurance to the City within ten (10) days. Approval of the insurance by the City shall not relieve or decrease the extent to which Contractor may be held responsible for payment of damages resulting from Contractor's provision of the Services or its operations under this Agreement. If Contractor fails or refuses to procure or maintain the insurance required by these provisions, or fails or refuses to furnish the City's required proof

that the insurance has been procured and is in force and paid for, the City shall have the right at its election to terminate the Agreement.

5.06 Necessary Documentation. Contractor certifies that it will furnish City any and all documentation, certification, authorization, license, permit or registration required by the laws or rules and regulations of the City of Bloomington, the State of Indiana and the United States. Contractor further certifies that it is now and will maintain in good standing with such governmental agencies and that it will keep its license, permit registration, authorization or certification in force during the term of this Agreement.

5.07 Applicable Laws. Contractor agrees to comply with all federal, state, and local laws, rules and regulations applicable to Contractor in performing work pursuant to this Agreement, including, but not limited to, discrimination in employment, prevailing wage laws, conflicts of interest, public notice, accounting records and requirements. Contractor shall comply with City of Bloomington Ordinance 2.21.020 and all other federal, state and local laws and regulations governing non-discrimination, including but not limited to employment. This Agreement shall be governed by the laws of the United States, and the State of Indiana, and by all Municipal Ordinances and Codes of the City of Bloomington. Venue of any disputes arising under this Agreement shall be in the Monroe Circuit Court, Monroe County, Indiana.

5.08 Non-Discrimination

5.08.01 Contractor and subcontractors shall not discriminate against any employee or applicant for employment, to be employed in the performance of this Agreement, with respect to hire, tenure, terms, training, conditions or privileges of employment, because of race, sex, color, religion, national origin, ancestry, disability, sexual orientation, gender identity, veteran status or housing status. Breach of this covenant may be regarded as a material breach of the Agreement.

5.08.02 Contractor certifies for itself and all its subcontractors compliance with existing laws of the City of Bloomington, the State of Indiana and the United States regarding:

Prohibition of discrimination in employment practices on the basis of race, sex, color, religion, national origin, ancestry, disability, sexual orientation, gender identity, veteran status, housing status, or any other legally protected classification;

The utilization of Minority and Women Business Enterprises. Contractor further certifies that it:

a. Has formulated its own Affirmative Action plan for the recruitment, training and employment of minorities and women, including goals and timetable; which has been approved by the City's Contract Compliance Officer.

b. Encourages the use of small business, minority-owned business and women-owned business in its operations.

Contractor understands that the City of Bloomington prohibits its employees from engaging in harassment or discrimination of any kind, including harassing or discriminating against independent Contractors doing work for the City. If Contractor believes that a City employee engaged in such conduct towards Contractor and/or any of its employees, Contractor or its employees may file a complaint with the City department head in charge of the Contractor's work and/or with the City human resources department or the Bloomington Human Rights Commission.

The City takes all complaints of harassment and discrimination seriously and will take appropriate disciplinary action if it finds that any City employee engaged in such prohibited conduct.

5.08.03 FURTHER, PURSUANT TO INDIANA CODE 5-16-6-1, CONTRACTOR AGREES:

A) That in the hiring of employees for the performance of work under this Agreement or any sub agreement hereunder, no Contractor, or subcontractor, nor any person acting on behalf of such Contractor or subcontractor, shall by reason of race, sex, color, religion, national origin, ancestry, or any other legally protected classification, discriminate against any citizen of the State of Indiana who is qualified and available to perform the work to which the employment relates.

B) That no Contractor, subcontractor, or any person on their behalf, shall, in any manner, discriminate against or intimidate any employee hired for performance of work under this Agreement on account of race, religion, color, sex, national origin, ancestry, or any other legally protected classification.

C) That there may be deducted from the amount payable to Contractor, by City, under this Agreement, penalty of Five Dollars ($5.00) for each person for each calendar day during which such person was discriminated against or intimidated in violation of the provisions of this Agreement. Any such person discriminated against retains the right to file a discrimination complaint with the appropriate civil rights agency or court.

D) That this Agreement may be canceled or terminated by City and all money due or to become hereunder may be forfeited, for a second or any subsequent violations of the terms or conditions under this section of the Agreement.

5.09 Workmanship and Quality of Materials

5.09.01 Contractor shall guarantee the work for a period of one (1) year from the date of substantial completion. Failure of any portion of the work within one (1) year due to improper construction, materials of construction, or design may result in a refund to City of the purchase price of that portion which failed or may result in the forfeiture of Contractor's Performance Bond.

5.09.02 OR EQUAL: Wherever in any of the Agreement Documents an article, material or equipment is defined by describing a proprietary product, or by using the name of a manufacturer or vender, the term "Or Equal" or the term "The Equivalent" if not inserted, shall be implied, and it is done for the express purpose of establishing a basis of durability and efficiency and not for the purpose of limiting completion. Whenever material or equipment is submitted for approval as being equal to that specified, the submittal shall include sufficient information and data to demonstrate that the material or equipment conforms to the Contract requirements. The decision as to whether or not such material or equipment is equal to that specified shall be made by the Engineer. The approval by the Engineer of alternate material or equipment as being equivalent to that specified, shall not in any way relieve Contractor of responsibility for failure of the material or equipment due to faulty design, material, or workmanship, to perform the function required by the Contract Documents. Specifications as determined by other entities within the City of Bloomington such as City Utilities shall only be substituted or changed by their approval which shall be submitted in writing to the Engineer.

5.09.03 City shall be the sole judge of the sufficiency of workmanship and quality of materials. Disputes shall be resolved by the City Engineer and are not subject to arbitration.

5.10 Safety. Contractor shall be responsible for the safety of employees at all times and shall provide all equipment necessary to insure their safety. Contractor shall ensure the enforcement of all applicable safety rules, regulations, ordinances and laws, whether federal, state or local. Contractor's Superintendent of Safety shall make daily inspections upon the arrival and leaving of the site at the close of each workday.

5.10.01 Contractor is required to comply with IOSHA regulations 29 C.F.R 1926, Subpart P, Excavations for all trenches of at least five (5) feet in depth. All cost for trench safety systems shall be the responsibility of the Contractor and included in the cost of the principal work with which the safety systems are associated. Contractor shall sign an affidavit, attached as **Attachment "C"**, affirming that Contractor shall maintain compliance with IOSHA requirements for excavations of at least five (5) in depth.

5.11 Amendments/Changes

5.11.01 Except as provided in Paragraph 5.11.02, this Agreement may be amended only by written instrument signed by both City and Contractor.

5.11.02 Without invalidating the Agreement and without notice to any surety, City may, at any time or from time to time, order, in writing, additions, deletions, or revisions in the work. Upon receipt of any such document, Contractor shall promptly proceed with the work involved, which will be performed under the applicable conditions of the Contract Documents.

5.11.03 If Contractor believes that any direction of City under paragraph 5.11.02, or any other event or condition, will result in an increase in the Contract time or price, he or she shall file written notice with City no later than twenty (20) calendar days after the occurrence of the event giving rise to the claim and stating the general nature of the claim with supporting data. No claim for any adjustment of the Contract time or price will be valid if not submitted in accordance with this Paragraph.

5.11.04 Contractor shall carry on the work and adhere to the progress schedule during all disputes or disagreements with City. No work shall be delayed or postponed pending resolution of any dispute or disagreement except as Contractor and City may otherwise agree in writing.

5.12 Performance Bond and Payment Bond

5.12.01 For contracts in excess of $100,000, Contractor shall provide City with a Performance Bond and a Payment Bond in the amount of one hundred percent (100%) of the contract amount.

5.12.02 Failure by Contractor to perform the work in a timely or satisfactory fashion may result in forfeiture of Contractor's Performance Bond.

5.12.03 If the surety on any bond furnished by Contractor becomes a party to supervision, liquidation, or rehabilitation action pursuant Indiana Code 27-9 et seq. or its right to do business in the State of Indiana is terminated, Contractor shall, within thirty (30) calendar days thereafter, substitute another bond and surety, both of which must be acceptable to City.

5.13 Payment of Subcontractors Contractor shall pay all subcontractors, laborers, material suppliers and those performing services to Contractor on the project under this Agreement. City may, as a condition precedent to any payment hereunder, require Contractor to submit satisfactory evidence of payments of any and all claims of subcontractors, laborers, material suppliers, and those furnishing services to Contractor. Upon receipt of a lawful claim, City shall withhold money due to Contractor in a sufficient amount to pay the subcontractors, laborers, material suppliers, and those furnishing services to Contractor.

5.13.01 The surety of the Payment Bond and Performance Bond may not be released until one (1) year after the Board's final settlement with the Contractor.

5.14 Written Notice Written notice shall be considered as served when delivered in person or sent by mail to the individual, firm, or corporation, or to the last business address of such known to Contractor who serves the Notice. Notice shall be sent as follows:

TO CITY: TO CONTRACTOR:

City of Bloomington Utilities Department		
Attn:		
600 E. Miller		
Bloomington, Indiana 47401		

5.15 Severability and Waiver In the event that any clause or provision of this Agreement is held to be invalid by any court of competent jurisdiction, the invalidity of such clause or provision shall not affect any other provision of this Agreement. Failure of either party to insist on strict compliance with any provision of this Agreement shall not constitute waiver of that party's right to demand later compliance with the same or other provisions of this Agreement.

5.16 Notice to Proceed Contractor shall not begin the Work until it receives an official written Notice to Proceed from the City. Contractor shall start active and continuous work on the Agreement within fifteen (15) calendar days after the date of the Notice to Proceed. In no case shall work begin prior to the date of the Notice to Proceed. If a delayed starting date is indicated in the proposal, the fifteen (15) calendar day limitation will be waived. Work day charges will then begin on a date mutually agreed upon, but not later than the delayed starting date specified. In the event that any Agreement is canceled after an award has been made but prior to the issuing of the Notice to Proceed, no reimbursement will be made for any expenses accrued relative to this contract during that period.

5.17 Steel or Foundry Products

5.17.01 To comply with Indiana Code 5-16-8, affecting all contracts for the construction, reconstruction, alteration, repair, improvement or maintenance of public works, the following provision shall be added: If steel or foundry products are to be utilized or supplied in the performance of any contract or subcontract, only domestic steel or foundry products shall be used. Should City feel that the cost of domestic steel or foundry products is unreasonable; City will notify Contractor in writing of this fact.

5.17.02 Domestic Steel products are defined as follows:

> "Products rolled, formed, shaped, drawn, extruded, forged, cast, fabricated or otherwise similarly processed, or processed by a combination of two (2) or more of such operations, from steel made in the United States by open hearth, basic oxygen, electric furnace, Bessemer or other steel making process."

5.17.03 Domestic Foundry products are defined as follows:

> "Products cast from ferrous and nonferrous metals by foundries in the United States."

5.17.04 The United States is defined to include all territory subject to the jurisdiction of the United States.

5.17.05 CITY may not authorize or make any payment to Contractor unless City is satisfied that Contractor has fully complied with this provision.

5.18 Verification of Employees' Immigration Status

Contractor is required to enroll in and verify the work eligibility status of all newly-hired employees through the E-Verify program. (This is not required if the E-Verify program no longer exists). Contractor shall sign an affidavit, attached as **Attachment "D"**, affirming that Contractor does not knowingly employ an unauthorized alien. "Unauthorized alien" is defined at 8 U.S. Code 1324a(h)(3) as a person who is not a U.S. citizen or U.S. national and is not lawfully admitted for permanent residence or authorized to work in the U.S. under 8 U.S. Code Chapter 12 or by the U.S. Attorney General.

Contractor and any of its subcontractors may not knowingly employ or contract with an unauthorized alien, or retain an employee or contract with a person that the Contractor or any of its subcontractors learns is an unauthorized alien. If the City obtains information that the Contractor or any of its subcontractors employs or retains an employee who is an unauthorized alien, the City shall notify the Contractor or its subcontractors of the Agreement violation and require that the violation be remedied within thirty (30) calendar days of the date of notice. If the Contractor or any of its subcontractors verify the work eligibility status of the employee in question through the E-Verify program, there is a rebuttable presumption that the Contractor or its subcontractor did not knowingly employ an unauthorized alien. If the Contractor or its subcontractor fails to remedy the violation within the thirty (30) calendar day period, the City shall terminate the Agreement, unless the City determines that terminating the Agreement would be detrimental to the public interest or public property, in which case the City may allow the Agreement to remain in effect until the City procures a new Contractor. If the City terminates the Agreement, the Contractor or its subcontractor is liable to the City for actual damages.

Contractor shall require any subcontractors performing work under this Agreement to certify to the Contractor that, at the time of certification, the subcontractor does not knowingly employ or contract with an unauthorized alien and the subcontractor has enrolled in and is participating in the E-Verify program. Contractor shall maintain on file all subcontractors' certifications throughout the term of this Agreement with the City.

5.19 Drug Testing Plan

In accordance with Indiana Code 4-13-18 as amended, the Contractor was required to submit with his/her bid a written drug testing policy for a public works project that is estimated to cost $150,000 or more. Among other things, the law sets forth specific requirements that must be in the plan for a program to test the employees of the Contractor and Subcontractors for drugs. The successful Contractor must comply with all provisions of the statute. This contract is subject to cancellation if Contractor fails to implement its testing program during the term of this contract, fails to provide information regarding this testing at the request of CITY; or provides false information to City regarding Contractor's employee drug testing program. Contractor shall sign an affidavit, attached as **Attachment "E"**, affirming that Contractor has and shall implement Contractor's employee drug testing program throughout the term of this project.

5.20 Living Wage Ordinance. Contractor is a covered employer under City Ordinance 2.28, otherwise known as the "Living Wage Ordinance," or "LWO," and is required to pay its covered employees at least a living wage. Currently, the living wage is $15.75 per hour for covered employees, and up to 15% of that amount, or $2.36, may be in the form of the covered employer's contribution to health insurance available to the covered employee. As of January 1, 2025, the Living Wage shall be $16.22 per hour, up to $2.43 of which may be provided in the form of the covered employer's contribution to health insurance. Contractor signed the Living Wage Ordinance Affidavit, attached as **Attachment "F"** and agrees to abide by the LWO by paying its employees a living wage, and posting the Living Wage Poster in areas frequented by their covered employees.

IN WITNESS WHEREOF, the parties to this Agreement have hereunto set their hands.

CITY: CITY OF BLOOMINGTON, INDIANA
UTILITIES SERVICE BOARD

By: _____
Megan Parmenter **DATED**
President, Utilities Service Board

_____
Katherine Zaiger, Director **DATED**
City of Bloomington Utilities

_____
Kerry Thomson, Mayor **DATED**
City of Bloomington

CONTRACTOR: _____

By: _____
Authorized Contractor Representative

_____
Printed Name

_____
Title of Contractor Representative

ATTACHMENT "A"

SCOPE OF WORK

ATTACHMENT "B"

CONTRACTOR'S BID

ATTACHMENT "C"

BIDDER'S AFFIDAVIT IN COMPLIANCE WITH INDIANA CODE 36-1-12-20 TRENCH SAFETY SYSTEMS; COST RECOVERY

The undersigned, being duly sworn, hereby affirms and says that:

1. The undersigned is the _____ of
(job title)
_____.
(company name)

2. The undersigned is duly authorized and has full authority to execute this Bidder's Affidavit.

3. The company named herein that employs the undersigned:
   i. has contracted with or seeking to contract with the City of Bloomington to provide services; **OR**
   ii. is a subcontractor on a contract to provide services to the City of Bloomington.

4. By submission of this Bid and subsequent execution of a Contract, the undersigned Bidder certifies that as successful Bidder (Contractor) all trench excavation done within his/her control (by his/her own forces or by his/her Subcontractors) shall be accomplished in strict adherence with OSHA trench safety standards contained in 29 C.F.R. 1926, Subpart P, including all subsequent revisions or updates to these standards as adopted by the United States Department of Labor.

5. The undersigned Bidder certifies that as successful Bidder (Contractor) he/she has obtained or will obtain identical certification from any proposed Subcontractors that will perform trench excavation prior to award of the subcontracts and that he/she will retain such certifications in a file for a period of not less than three (3) years following final acceptance.

6. The Bidder acknowledges that included in the various items listed in the Schedule of Bid Prices and in the Total Amount of Bid Prices are costs for complying with I.C. 36-1-12-20. The Bidder further identifies the costs to be summarized below*:

	Trench Safety Measure	Units of Measure	Unit Cost	Unit Quantity	Extended Cost
A.					
B.					
C.					
D.					
				Total	**$_____**

Method of Compliance (Specify) _____

_____

Date: _____, 20_____

_____
Signature

_____
Printed Name

STATE OF INDIANA)
) SS:
COUNTY OF _____)

Before me, a Notary Public in and for said County and State, personally appeared _____ and acknowledged the execution of the foregoing this _____ day of _____, 20_____.

My Commission Expires: _____ _____
Signature of Notary Public

County of Residence: _____ _____
Printed Name of Notary Public

Commission #:_____

*Bidders: Add extra sheet(s), if needed.

If Bidder fails to complete and execute this sworn affidavit, his/her Bid may be declared nonresponsive and rejected by the **CITY OF BLOOMINGTON**.

ATTACHMENT "D"

AFFIDAVIT REGARDING E-VERIFY

The undersigned, being duly sworn, hereby affirms and says that:

1. The undersigned is the _____ of _____.
(job title) (company name)

2. The company named herein that employs the undersigned has contracted with or is seeking to contract with the City of Bloomington to provide services.

3. The undersigned hereby states that, to the best of his/her knowledge and belief, the company named herein does not knowingly employ an "unauthorized alien," as defined at 8 United State Code 1324a(h)(3).

4. The undersigned hereby states that, to the best of his/her knowledge and belief, the company named herein is enrolled in and participates in the E-verify program.

I affirm under the penalties of perjury that the foregoing facts and information are true and correct to the best of my knowledge and belief.

_____
Signature

_____
Printed name

STATE OF INDIANA)
) SS:
COUNTY OF _____)

Before me, a Notary Public in and for said County and State, personally appeared _____ _____ and acknowledged the execution of the foregoing this _____ day of _____, 20___.

My Commission Expires:_____ _____
Notary Public

County of Residence:_____ _____
Name Printed

_____
Commission Number

ATTACHMENT "E"

COMPLIANCE AFFIDAVIT
REGARDING INDIANA CODE CHAPTER 4-13-18
DRUG TESTING OF EMPLOYEES OF PUBLIC WORKS CONTRACTORS

The undersigned, being duly sworn, hereby affirms and says that:

1. The undersigned is the _____ of
(job title)
_____.
(company name)

2. The undersigned is duly authorized and has full authority to execute this Affidavit.

3. The company named herein that employs the undersigned:
   iii. has contracted with or seeking to contract with the City of Bloomington to provide services;
   OR
   iv. is a subcontractor on a contract to provide services to the City of Bloomington.

4. The undersigned certifies that Contractor's submitted written plan for a drug testing program to test employees of the Contractor and Subcontractor for public works projects with an estimated cost of $150,000 is in accordance with Indiana Code 4-13-18 as amended.

5. The undersigned acknowledges that this Contract shall be subject to cancellation should Contractor fail to comply all provisions of the statute.

_____
Signature

_____
Printed Name

STATE OF INDIANA)
) SS:
COUNTY OF _____)

Before me, a Notary Public in and for said County and State, personally appeared _____ and acknowledged the execution of the foregoing this _____ day of _____, 20_____.

My Commission Expires: _____

_____
Signature of Notary Public

County of Residence: _____

_____
Printed Name of Notary Public

My Commission #:_____

ATTACHMENT "F"

AFFIDAVIT REGARDING THE LIVING WAGE ORDINANCE

The undersigned, being duly sworn, hereby affirms and says that:

1. The undersigned is the _____ of _____,
(job title) (company name)

2. The company named herein that employs the undersigned has contracted with or is seeking to contract with the City of Bloomington to provide services.

3. The undersigned hereby states that, to the best of their knowledge and belief, the company named herein is subject to Bloomington City Ordinance 2.28, otherwise known as the "Living Wage Ordinance."

4. The projected employment needs under the award include the following: _____.

5. The projected net increase or decrease in jobs for covered employees by job title that will result from awarding the assistance: _____.

6. The undersigned hereby affirms that the smallest hourly wage to be earned by each of their covered employees shall be at least the living wage.

I affirm under the penalties of perjury that the foregoing facts and information are true and correct to the best of my knowledge and belief.

Dated this _____ day of _____, 20__.

_____
Signature

_____
Printed name

STATE OF INDIANA)
) SS:
COUNTY OF _____)

Before me, a Notary Public in and for said County and State, personally appeared _____ _____ and acknowledged the execution of the foregoing this _____ day of _____ _____, 20__.

My Commission Expires:_____ _____
Notary Public

County of Residence:_____ _____
Name Printed

_____
Commission Number

NOTICE TO PROCEED

NOTICE TO PROCEED

DATED: _____

TO: _____
_____
_____
_____
_____

CONTRACT:

City of Bloomington Utilities
Monroe WTP Improvements: Chemical Feed Line
Replacement and Backwash System Pump Addition
And Tank Rehabilitation
Bloomington, IN

Owner hereby notifies Contractor that the Contract Times under the above Contract will commence to run on _____.

On that date, Contractor shall start performing its obligations under the Contract Documents. No work shall be done prior to such date, without written approval from the Owner. In accordance with the Agreement the date of Substantial Completion is _____ and the date of readiness for final payment is _____.

Before starting any Work at the Site, Contractor must comply with the following:

_____

_____

_____

_____

_____

City of Bloomington Utilities
(OWNER)

_____
(AUTHORIZED SIGNATURE)

_____
(TITLE)

Copy: Engineer

PERFORMANCE BOND

EJCDC
ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

PERFORMANCE BOND

CONTRACTOR *(name and address)*:

SURETY *(name and address of principal place of business)*:

OWNER *(name and address)*:

CONSTRUCTION CONTRACT
Effective Date of the Agreement:
Amount:
Description *(name and location)*:

BOND
Bond Number:
Date *(not earlier than the Effective Date of the Agreement of the Construction Contract)*:
Amount:
Modifications to this Bond Form: ☐ None ☐ See Paragraph 16

Surety and Contractor, intending to be legally bound hereby, subject to the terms set forth below, do each cause this Performance Bond to be duly executed by an authorized officer, agent, or representative.

CONTRACTOR AS PRINCIPAL

_____ *(seal)*
Contractor's Name and Corporate Seal

By: _____
Signature

_____
Print Name

_____
Title

Attest: _____
Signature

_____
Title

SURETY

_____ *(seal)*
Surety's Name and Corporate Seal

By: _____
Signature *(attach power of attorney)*

_____
Print Name

_____
Title

Attest: _____
Signature

_____
Title

Notes: (1) Provide supplemental execution by any additional parties, such as joint venturers. (2) Any singular reference to Contractor, Surety, Owner, or other party shall be considered plural where applicable.

1. The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to the Owner for the performance of the Construction Contract, which is incorporated herein by reference.

2. If the Contractor performs the Construction Contract, the Surety and the Contractor shall have no obligation under this Bond, except when applicable to participate in a conference as provided in Paragraph 3.

3. If there is no Owner Default under the Construction Contract, the Surety's obligation under this Bond shall arise after:

3.1 The Owner first provides notice to the Contractor and the Surety that the Owner is considering declaring a Contractor Default. Such notice shall indicate whether the Owner is requesting a conference among the Owner, Contractor, and Surety to discuss the Contractor's performance. If the Owner does not request a conference, the Surety may, within five (5) business days after receipt of the Owner's notice, request such a conference. If the Surety timely requests a conference, the Owner shall attend. Unless the Owner agrees otherwise, any conference requested under this Paragraph 3.1 shall be held within ten (10) business days of the Surety's receipt of the Owner's notice. If the Owner, the Contractor, and the Surety agree, the Contractor shall be allowed a reasonable time to perform the Construction Contract, but such an agreement shall not waive the Owner's right, if any, subsequently to declare a Contractor Default;

3.2 The Owner declares a Contractor Default, terminates the Construction Contract and notifies the Surety; and

3.3 The Owner has agreed to pay the Balance of the Contract Price in accordance with the terms of the Construction Contract to the Surety or to a contractor selected to perform the Construction Contract.

4. Failure on the part of the Owner to comply with the notice requirement in Paragraph 3.1 shall not constitute a failure to comply with a condition precedent to the Surety's obligations, or release the Surety from its obligations, except to the extent the Surety demonstrates actual prejudice.

5. When the Owner has satisfied the conditions of Paragraph 3, the Surety shall promptly and at the Surety's expense take one of the following actions:

5.1 Arrange for the Contractor, with the consent of the Owner, to perform and complete the Construction Contract;

5.2 Undertake to perform and complete the Construction Contract itself, through its agents or independent contractors;

5.3 Obtain bids or negotiated proposals from qualified contractors acceptable to the Owner for a contract for performance and completion of the Construction Contract, arrange for a contract to be prepared for execution by the Owner and a contractor selected with the Owners concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Construction Contract, and pay to the Owner the amount of damages as described in Paragraph 7 in excess of the Balance of the Contract Price incurred by the Owner as a result of the Contractor Default; or

5.4 Waive its right to perform and complete, arrange for completion, or obtain a new contractor, and with reasonable promptness under the circumstances:

5.4.1 After investigation, determine the amount for which it may be liable to the Owner and, as soon as practicable after the amount is determined, make payment to the Owner; or

5.4.2 Deny liability in whole or in part and notify the Owner, citing the reasons for denial.

6. If the Surety does not proceed as provided in Paragraph 5 with reasonable promptness, the Surety shall be deemed to be in default on this Bond seven days after receipt of an additional written notice from the Owner to the Surety demanding that the Surety perform its obligations under this Bond, and the Owner shall be entitled to enforce any remedy available to the Owner. If the Surety proceeds as provided in Paragraph 5.4, and the Owner refuses the payment or the Surety has denied liability, in whole or in part, without further notice the Owner shall be entitled to enforce any remedy available to the Owner.

7. If the Surety elects to act under Paragraph 5.1, 5.2, or 5.3, then the responsibilities of the Surety to the Owner shall not be greater than those of the Contractor under the Construction Contract, and the responsibilities of the Owner to the Surety shall not be greater than those of the Owner under the Construction Contract. Subject to the commitment by the Owner to pay the Balance of the Contract Price, the Surety is obligated, without duplication for:

7.1 the responsibilities of the Contractor for correction of defective work and completion of the Construction Contract;

7.2 additional legal, design professional, and delay costs resulting from the Contractor's Default, and resulting from the actions or failure to act of the Surety under Paragraph 5; and

7.3 liquidated damages, or if no liquidated damages are specified in the Construction Contract, actual damages caused by delayed performance or non-performance of the Contractor.

8. If the Surety elects to act under Paragraph 5.1, 5.3, or 5.4, the Surety's liability is limited to the amount of this Bond.

9. The Surety shall not be liable to the Owner or others for obligations of the Contractor that are unrelated to the Construction Contract, and the Balance of the Contract Price shall not be reduced or set off on account of any such unrelated obligations. No right of action shall accrue on this Bond to any person or entity other than the Owner or its heirs, executors, administrators, successors, and assigns.

10. The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders, and other obligations.

11. Any proceeding, legal or equitable, under this Bond may be instituted in any court of competent jurisdiction in the location in which the work or part of the work is located and shall be instituted within two years after a declaration of Contractor Default or within two years after the Contractor ceased working or within two years after the Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this paragraph are void or prohibited by law, the minimum periods of limitations available to sureties as a defense in the jurisdiction of the suit shall be applicable.

12. Notice to the Surety, the Owner, or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears.

13. When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

14. Definitions

14.1 Balance of the Contract Price: The total amount payable by the Owner to the Contractor under the Construction Contract after all proper adjustments have been made including allowance for the Contractor for any amounts received or to be received by the Owner in settlement of insurance or other claims for damages to which the Contractor is entitled, reduced by all valid and proper payments made to or on behalf of the Contractor under the Construction Contract.

14.2 Construction Contract: The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and changes made to the agreement and the Contract Documents.

14.3 Contractor Default: Failure of the Contractor, which has not been remedied or waived, to perform or otherwise to comply with a material term of the Construction Contract.

14.4 Owner Default: Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

14.5 Contract Documents: All the documents that comprise the agreement between the Owner and Contractor.

15. If this Bond is issued for an agreement between a contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

16. Modifications to this Bond are as follows:

PAYMENT BOND

EJCDC
ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

PAYMENT BOND

CONTRACTOR *(name and address)*:

SURETY *(name and address of principal place of business)*:

OWNER *(name and address)*:

CONSTRUCTION CONTRACT

Effective Date of the Agreement:
Amount:
Description *(name and location)*:

BOND

Bond Number:
Date *(not earlier than the Effective Date of the Agreement of the Construction Contract)*:
Amount:
Modifications to this Bond Form: ☐ None ☐ See Paragraph 18

Surety and Contractor, intending to be legally bound hereby, subject to the terms set forth below, do each cause this Payment Bond to be duly executed by an authorized officer, agent, or representative.

CONTRACTOR AS PRINCIPAL

_____ *(seal)*
Contractor's Name and Corporate Seal

By: _____
Signature

_____
Print Name

_____
Title

Attest: _____
Signature

_____
Title

SURETY

_____ *(seal)*
Surety's Name and Corporate Seal

By: _____
Signature *(attach power of attorney)*

_____
Print Name

_____
Title

Attest: _____
Signature

_____
Title

Notes: (1) Provide supplemental execution by any additional parties, such as joint venturers. (2) Any singular reference to Contractor, Surety, Owner, or other party shall be considered plural where applicable.

1. The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to the Owner to pay for labor, materials, and equipment furnished for use in the performance of the Construction Contract, which is incorporated herein by reference, subject to the following terms.

2. If the Contractor promptly makes payment of all sums due to Claimants, and defends, indemnifies, and holds harmless the Owner from claims, demands, liens, or suits by any person or entity seeking payment for labor, materials, or equipment furnished for use in the performance of the Construction Contract, then the Surety and the Contractor shall have no obligation under this Bond.

3. If there is no Owner Default under the Construction Contract, the Surety's obligation to the Owner under this Bond shall arise after the Owner has promptly notified the Contractor and the Surety (at the address described in Paragraph 13) of claims, demands, liens, or suits against the Owner or the Owner's property by any person or entity seeking payment for labor, materials, or equipment furnished for use in the performance of the Construction Contract, and tendered defense of such claims, demands, liens, or suits to the Contractor and the Surety.

4. When the Owner has satisfied the conditions in Paragraph 3, the Surety shall promptly and at the Surety's expense defend, indemnify, and hold harmless the Owner against a duly tendered claim, demand, lien, or suit.

5. The Surety's obligations to a Claimant under this Bond shall arise after the following:

    5.1 Claimants who do not have a direct contract with the Contractor,

        5.1.1 have furnished a written notice of non-payment to the Contractor, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were, or equipment was, furnished or supplied or for whom the labor was done or performed, within ninety (90) days after having last performed labor or last furnished materials or equipment included in the Claim; and

        5.1.2 have sent a Claim to the Surety (at the address described in Paragraph 13).

    5.2 Claimants who are employed by or have a direct contract with the Contractor have sent a Claim to the Surety (at the address described in Paragraph 13).

6. If a notice of non-payment required by Paragraph 5.1.1 is given by the Owner to the Contractor, that is sufficient to satisfy a Claimant's obligation to furnish a written notice of non-payment under Paragraph 5.1.1.

7. When a Claimant has satisfied the conditions of Paragraph 5.1 or 5.2, whichever is applicable, the Surety shall promptly and at the Surety's expense take the following actions:

    7.1 Send an answer to the Claimant, with a copy to the Owner, within sixty (60) days after receipt of the Claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed; and

    7.2 Pay or arrange for payment of any undisputed amounts.

    7.3 The Surety's failure to discharge its obligations under Paragraph 7.1 or 7.2 shall not be deemed to constitute a waiver of defenses the Surety or Contractor may have or acquire as to a Claim, except as to undisputed amounts for which the Surety and Claimant have reached agreement. If, however, the Surety fails to discharge its obligations under Paragraph 7.1 or 7.2, the Surety shall indemnify the Claimant for the reasonable attorney's fees the Claimant incurs thereafter to recover any sums found to be due and owing to the Claimant.

8. The Surety's total obligation shall not exceed the amount of this Bond, plus the amount of reasonable attorney's fees provided under Paragraph 7.3, and the amount of this Bond shall be credited for any payments made in good faith by the Surety.

9. Amounts owed by the Owner to the Contractor under the Construction Contract shall be used for the performance of the Construction Contract and to satisfy claims, if any, under any construction performance bond. By the Contractor furnishing and the Owner accepting this Bond, they agree that all funds earned by the Contractor in the performance of the Construction Contract are dedicated to satisfy obligations of the Contractor and Surety under this Bond, subject to the Owner's priority to use the funds for the completion of the work.

10. The Surety shall not be liable to the Owner, Claimants, or others for obligations of the Contractor that are unrelated to the Construction Contract. The Owner shall not be liable for the payment of any costs or expenses of any Claimant under this Bond, and shall have under this Bond no obligation to make payments to or give notice on behalf of Claimants, or otherwise have any obligations to Claimants under this Bond.

11. The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders, and other obligations.

12. No suit or action shall be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the state in which the project that is the subject of the Construction Contract is located or after the expiration of one year from the date (1) on which the Claimant sent a Claim to the Surety pursuant to Paragraph 5.1.2 or 5.2, or (2) on which the last labor or service was performed by anyone or the last materials or equipment were furnished by anyone under the Construction Contract, whichever of (1) or (2) first occurs. If the provisions of this paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

13. Notice and Claims to the Surety, the Owner, or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears. Actual receipt of notice or Claims, however accomplished, shall be sufficient compliance as of the date received.

14. When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

15. Upon requests by any person or entity appearing to be a potential beneficiary of this Bond, the Contractor and Owner shall promptly furnish a copy of this Bond or shall permit a copy to be made.

16. **Definitions**

16.1 **Claim:** A written statement by the Claimant including at a minimum:

1. The name of the Claimant;
2. The name of the person for whom the labor was done, or materials or equipment furnished;
3. A copy of the agreement or purchase order pursuant to which labor, materials, or equipment was furnished for use in the performance of the Construction Contract;
4. A brief description of the labor, materials, or equipment furnished;
5. The date on which the Claimant last performed labor or last furnished materials or equipment for use in the performance of the Construction Contract;
6. The total amount earned by the Claimant for labor, materials, or equipment furnished as of the date of the Claim;
7. The total amount of previous payments received by the Claimant; and
8. The total amount due and unpaid to the Claimant for labor, materials, or equipment furnished as of the date of the Claim.

16.2 **Claimant:** An individual or entity having a direct contract with the Contractor or with a subcontractor of the Contractor to furnish labor, materials, or equipment for use in the performance of the Construction Contract. The term Claimant also includes any individual or entity that has rightfully asserted a claim under an applicable mechanic's lien or similar statute against the real property upon which the Project is located. The intent of this Bond shall be to include without limitation in the terms of "labor, materials, or equipment" that part of the water, gas, power, light, heat, oil, gasoline, telephone service, or rental equipment used in the Construction Contract, architectural and engineering services required for performance of the work of the Contractor and the Contractor's subcontractors, and all other items for which a mechanic's lien may be asserted in the jurisdiction where the labor, materials, or equipment were furnished.

16.3 **Construction Contract:** The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and all changes made to the agreement and the Contract Documents.

16.4 **Owner Default**: Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

16.5 **Contract Documents:** All the documents that comprise the agreement between the Owner and Contractor.

17. If this Bond is issued for an agreement between a contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

18. Modifications to this Bond are as follows:

REQUIRED STATE AND LOCAL FORMS

STATE FORMS

1. Indiana Form 96
2. Affidavit Regarding Nonresponsibility
3. Affidavit Regarding Nepotism
4. Affidavit Concerning Employment of Unauthorized Aliens

LOCAL FORMS

1. Affirmative Action Packet
2. Living Wage Ordinance

Reset Form

CONTRACTOR'S BID FOR PUBLIC WORK - FORM 96

State Form 52414 (R2 / 2-13) / Form 96 (Revised 2013)
Prescribed by State Board of Accounts

PART I
(To be completed for all bids. Please type or print)

Date *(month, day, year):*_____

1. Governmental Unit (Owner):_____
2. County :_____
3. Bidder (Firm):_____

   Address:_____

   City/State/ZIPcode:_____
4. Telephone Number:_____
5. Agent of Bidder *(if applicable):*_____

Pursuant to notices given, the undersigned offers to furnish labor and/or material necessary to complete the public works project of _____

(Governmental Unit) in accordance with plans and specifications prepared by _____

_____ and dated _____ for the sum of

_____ $_____

The undersigned further agrees to furnish a bond or certified check with this bid for an amount specified in the notice of the letting. If alternative bids apply, the undersigned submits a proposal for each in accordance with the notice. Any addendums attached will be specifically referenced at the applicable page.

If additional units of material included in the contract are needed, the cost of units must be the same as that shown in the original contract if accepted by the governmental unit. If the bid is to be awarded on a unit basis, the itemization of the units shall be shown on a separate attachment.

The contractor and his subcontractors, if any, shall not discriminate against or intimidate any employee, or applicant for employment, to be employed in the performance of this contract, with respect to any matter directly or indirectly related to employment because of race, religion, color, sex, national origin or ancestry. Breach of this covenant may be regarded as a material breach of the contract.

CERTIFICATION OF USE OF UNITED STATES STEEL PRODUCTS
(If applicable)

I, the undersigned bidder or agent as a contractor on a public works project, understand my statutory obligation to use steel products made in the United States (I.C. 5-16-8-2). I hereby certify that I and all subcontractors employed by me for this project will use U.S. steel products on this project if awarded. I understand that violations hereunder may result in forfeiture of contractual payments.

ACCEPTANCE

The above bid is accepted this _____ day of _____, _____, subject to the following conditions: _____

_____

Contracting Authority Members:

_____ _____

_____ _____

_____ _____

PART II

(For projects of $150,000 or more – IC 36-1-12-4)

Governmental Unit: _____

Bidder (Firm) _____

Date *(month, day, year):* _____

These statements to be submitted under oath by each bidder with and as a part of his bid. Attach additional pages for each section as needed.

SECTION I EXPERIENCE QUESTIONNAIRE

1. What public works projects has your organization completed for the period of one (1) year prior to the date of the current bid?

Contract Amount	Class of Work	Completion Date	Name and Address of Owner

2. What public works projects are now in process of construction by your organization?

Contract Amount	Class of Work	Expected Completion Date	Name and Address of Owner

3. Have you ever failed to complete any work awarded to you? _____ If so, where and why?

_____

_____

_____

4. List references from private firms for which you have performed work.

_____

_____

_____

_____

_____

SECTION II PLAN AND EQUIPMENT QUESTIONNAIRE

1. Explain your plan or layout for performing proposed work. *(Examples could include a narrative of when you could begin work, complete the project, number of workers, etc. and any other information which you believe would enable the governmental unit to consider your bid.)*

_____

_____

_____

_____

_____

2. Please list the names and addresses of all subcontractors *(i.e. persons or firms outside your own firm who have performed part of the work)* that you have used on public works projects during the past five (5) years along with a brief description of the work done by each subcontractor.

_____

_____

_____

_____

_____

3. If you intend to sublet any portion of the work, state the name and address of each subcontractor, equipment to be used by the subcontractor, and whether you will require a bond. However, if you are unable to currently provide a listing, please understand a listing must be provided prior to contract approval. Until the completion of the proposed project, you are under a continuing obligation to immediately notify the governmental unit in the event that you subsequently determine that you will use a subcontractor on the proposed project.

_____

_____

_____

_____

_____

4. What equipment do you have available to use for the proposed project? Any equipment to be used by subcontractors may also be required to be listed by the governmental unit.

_____

_____

_____

_____

_____

5. Have you entered into contracts or received offers for all materials which substantiate the prices used in preparing your proposal? If not, please explain the rationale used which would corroborate the prices listed.

_____

_____

_____

_____

_____

SECTION III CONTRACTOR'S FINANCIAL STATEMENT

Attachment of bidder's financial statement is mandatory. Any bid submitted without said financial statement as required by statute shall thereby be rendered invalid. The financial statement provided hereunder to the governing body awarding the contract must be specific enough in detail so that said governing body can make a proper determination of the bidder's capability for completing the project if awarded.

SECTION IV CONTRACTOR'S NON – COLLUSION AFFIDAVIT

The undersigned bidder or agent, being duly sworn on oath, says that he has not, nor has any other member, representative, or agent of the firm, company, corporation or partnership represented by him, entered into any combination, collusion or agreement with any person relative to the price to be bid by anyone at such letting nor to prevent any person from bidding nor to include anyone to refrain from bidding, and that this bid is made without reference to any other bid and without any agreement, understanding or combination with any other person in reference to such bidding.

He further says that no person or persons, firms, or corporation has, have or will receive directly or indirectly, any rebate, fee, gift, commission or thing of value on account of such sale.

SECTION V OATH AND AFFIRMATION

I HEREBY AFFIRM UNDER THE PENALTIES FOR PERJURY THAT THE FACTS AND INFORMATION CONTAINED IN THE FOREGOING BID FOR PUBLIC WORKS ARE TRUE AND CORRECT.

Dated at _____ this _____ day of _____, _____

_____
(Name of Organization)

By_____

_____
(Title of Person Signing)

ACKNOWLEDGEMENT

STATE OF _____)
) ss
COUNTY OF_____)

Before me, a Notary Public, personally appeared the above-named _____ and swore that the statements contained in the foregoing document are true and correct.

Subscribed and sworn to before me this _____ day of _____, _____.

_____
Notary Public

My Commission Expires:_____

County of Residence:_____

BID OF

_____
(Contractor)

_____
(Address)

_____

FOR

PUBLIC WORKS PROJECTS

OF

_____

_____

_____

Filed _____, _____

Action taken _____

_____

AFFIDAVIT REGARDING NONRESPONSIBILITY

Pursuant to Indiana Code 5-22-16.5-11, CONTRACTORS who have dealings with the government of Iran, including a successor to, or an affiliate of, the CONTRACTOR are deemed to be “Nonresponsible ” for purposes of:

(1) submitting an offer in response to a solicitation;

(2) submitting a bid, offer, or proposal relating to a public works project; or

(3) otherwise entering into or renewing a contract to provide supplies or services;

with the state or a political subdivision.

Pursuant to 5-22-16.5-9, the Indiana Department of Administration shall develop and update a list of persons the Department determines to be engaged in investment activities in Iran.

The undersigned, on behalf of CONTRACTOR, its successors or affiliates, being first duly sworn, deposes and states that the CONTRACTOR, its successors or affiliates are not currently on the list kept by the Indiana Department of Administration, and has not engaged in any activity which will cause the CONTRACTOR, its successors or affiliates to be added to said list.

_____
Name of Contractor

By:_____
(Authorized Representative of Contractor)

Dated:_____

STATE OF _____)
)SS:
COUNTY OF _____)

Before me, the undersigned a Notary Public in and for said County and State, personally appeared _____ by _____, its _____ and acknowledged the execution of the foregoing Declaration.

IN WITNESS WHEREOF, I have hereunto subscribed my name and affixed my Notarial Seal this _____ day of _____, 2022.

My Commission Expires:
_____

_____
_____, Notary Public
(Printed Name)
A resident of _____ County, Indiana

AFFADAVIT REGARDING NEPOTISM

CONTRACTOR is aware of the provisions under Indiana Code 36-1-21 et seq. with respect to anti-nepotism in contractual relationships with governmental entities. CONTRACTOR certifies that none of the owners of the CONTRACTOR is a relative of any elected Officials of the City of Bloomington Utilities, Bloomington, Indiana.

Name of Contractor

By:

(Authorized Representative of Contractor)

Dated:

AFFIDAVIT CONCERNING EMPLOYMENT OF UNAUTHORIZED ALIENS

I am a duly authorized officer of _____, (hereinafter called “Contractor”) and I hereby certify that as of the date of this Affidavit, Contractor, does not employ any “unauthorized aliens” as that term is defined in 8 U.S.C. 1324a(h)(3).

I AFFIRM UNDER THE PENALTIES FOR PERJURY THAT THE FOREGOING REPRESENTATIONS ARE TRUE.

Dated:_____, 20___

_____

Printed Name: _____

8 U.S.C. 1324a(h)(3) Definition of unauthorized alien

As used in this section, the term “unauthorized alien” means, with respect to the employment of an alien at a particular time, that the alien is not at that time either:

(A) an alien lawfully admitted for permanent residence, or

(B) authorized to be so employed by this chapter or by the Attorney General.

Updated February 2024

To: Prospective Bidders/Vendors/Grant recipients

RE: Affirmative Action/Harassment Policy, Living Wage Ordinance, and Drug Testing Policy

FROM: Audrey Brittingham, Assistant City Attorney/Contract Compliance Officer

AFFIRMATIVE ACTION: All bidders, quoters, vendors, and grant recipients with the City of Bloomington for projects in excess of $10,000.00 must submit an affirmative action plan to the City Legal Department. This plan must ensure applicants and employees are treated in a manner that provides equal employment opportunity and tends to eliminate inequality based upon race, religion, color, sex, national origin, ancestry, disability, sexual orientation, gender identity, veteran status and/or housing status.

Even if your company already has a plan on file with the City, you are strongly encouraged to check with City Legal Department to make sure it complies with the City's current requirements, including having a workforce breakdown form that is no more than six months out of date. If you already have a plan, but it does not cover all of the City's current requirements, you may submit a separate supplement with your plan to fill any gaps.

You must submit your written affirmative action plan (or supplement) to City Legal or as part of your bid packet by the bid deadline. Bidders who fail to submit an affirmative action plan by the bid deadline are subject to disqualification. **We strongly recommend you submit your affirmative action plan to the Legal Department prior to the bid deadline so Legal may review your plan to make sure it complies with the City's requirements.** If your bid is chosen and your affirmative action plan does not entirely comply with the City's requirements, you will be required to bring it into compliance prior to the execution of any City contract.

Accompanying this letter you will find the following materials:

1. A sample affirmative action. You are not required to adopt this plan; it is provided for your convenience. Feel free to adopt this plan as your own or to amend it to meet your needs.

2. A workforce breakdown form. You MUST submit a workforce breakdown form (sometimes called a "utilization report") with your affirmative action plan. If you have a different form that includes the same type of information, you may submit a copy of that form instead of using our form. **Your workforce breakdown data cannot be more than six months old.**

3. An affirmative action plan checklist. This is the checklist we use to crosscheck your company's affirmative action plan against the City's requirements. If your plan omits any elements on the checklist, your plan will not be approved.

Additional materials, such as the City of Bloomington's Contract Compliance Regulations, are available from the Legal Department upon request.

Once Legal has approved your affirmative action plan, you will receive a letter that can be used to verify your compliance for any City project or contract that requires an affirmative action plan. This letter will expire six months after you submitted the affirmative action plan. You will be issued a new letter when you submit an updated workforce breakdown form.

HARASSMENT POLICY: All bidders and vendors required to submit an affirmative action plan must also submit a harassment plan. The harassment plan must, at minimum, include a definition of harassment; the name or title of the individual designated to receive and investigate complaints; and a statement that the contractor will not retaliate against an employee for complaining about harassment. A model harassment policy is included for your convenience as part of our attached model affirmative action plan.

LIVING WAGE: Contractors that are considered "covered employers" under City Ordinance 2.28, otherwise known as the "Living Wage Ordinance" or "LWO," are required to pay their covered employees at least a living wage. Currently, the living wage is $15.75 per hour for covered employees. Up to 15% of that amount, or $2.36, may be in the form of the covered employer's contribution to health insurance available to the covered employee.

If the City determines the successful bidder is a covered employer under the LWO, Contractor shall execute the Living Wage Ordinance Affidavit; shall abide by the LWO by paying their employees a living wage and providing the City with information requested in the course of enforcing the LWO; and shall post the Living Wage Poster, provided on the last page of this packet, in areas frequented by their covered employees.

The attached flow chart provides guidance on whether the contractor is a "covered employer." If you have questions, please contact Audrey Brittingham at audrey.brittingham@bloomington.in.gov, or call 812-349-3426.

DRUG TEST POLICY: Finally, please be aware that if you are submitting a bid for a public works project with an estimated cost of $150,000.00 or more, you will need to submit your company's written drug testing plan with your bid. Your plan must comply with I.C. 4-13-18-1. Failure to do so may make you ineligible to be awarded a bid or contract. Please see your bid packet for more details.

If you have any questions, contact the City's Legal Department at 812.349.3426 or email the City at legal@bloomington.in.gov. The office hours are Monday through Friday, 8-5.

Thank you.

Model Affirmative Action Plan and
Harassment Policy

_____, declares its policy to provide equal opportunity in employment, training and advancement, and to administer its employment practices without regard to race, color, religion, sex, national origin, ancestry, disability, sexual orientation, gender identity, veteran status, or housing status. Our policy of nondiscrimination will prevail throughout every aspect of our employment practices, including recruitment, hiring, training and all other terms and conditions of employment. We shall implement this affirmative action plan to make it widely known that equal employment opportunities are available on the basis of individual merit. We shall survey and analyze our employment workforce annually to determine what steps, if any, are needed to conform effectively to this equal employment policy.

Responsible Officer

Mr. or Ms. _____ (or the _____officer) is the equal employment opportunity officer for our company and is responsible for implementing this affirmative action policy.

Publication of Policy

Our employees will be made aware of our commitment to affirmative action through the following procedures:

- posting notices on employee bulletin boards,
- including our policy statement and plan in our personnel manual,
- regularly sending out notices of our policy in paycheck envelopes, and/or
- training supervisors to recognize discriminatory practices.

We will make potential employees aware of our policy through the following procedures:

- including the words "Equal Opportunity Employer" in all of our advertisements and notices for job openings,
- notifying employment agencies about our commitment, and
- sending notice of our policy to unions.

Implementing Our Policy

Our affirmative action plan will be implemented by widening our recruitment sources. We shall advertise in newspapers and other media that reach people in protected classes. We shall send job notices to schools with large percentages of students in the protected classes and to local groups that serve these classes.

We shall examine our hiring practices periodically to insure that we consider only job-related qualifications in filling our positions. We shall discard irrelevant educational requirements and unnecessary physical requirements. We shall ask only job-related questions on our employment applications.

We shall keep affirmative action information on each applicant who voluntarily provides this information, but separate from his or her application. We shall keep records on our hiring decisions to evaluate the success of our affirmative action measures. We shall decide placement, duties, benefits, wages, training prospects, promotions, layoffs and terminations without regard to race, sex, religion, color, national origin, ancestry, disability, sexual orientation, gender identity, veteran status or housing status.

GRIEVANCE PROCEDURE

If an employee or applicant feels she or he has been discriminated against on the basis of race, sex, religion, color, national origin, ancestry, disability, sexual orientation, gender identity, veteran status or housing status, she or he may bring the complaint to her or his immediate supervisor. If the complaint is not resolved readily at that level, she or he may submit it to _____ (personnel officer, corporate president, other) who will make a final decision on its validity. This grievance process does not preclude him or her from complaining to local, state or federal civil rights agencies. We will not retaliate against an employee or applicant for voicing a grievance or for filing a complaint with the appropriate agency.

Our current workforce breakdown is shown on the attached form.

Policy prohibiting harassment in the workplace

It is the policy of _____ (company name) to maintain a workplace free of harassment on the basis of race, sex, color, ancestry, national origin, religion, disability, age, sexual orientation, gender identity, housing status or veteran status. Harassment, as defined herein, is strictly prohibited in the workplace, and is punishable by appropriate discipline up to and including termination.

Harassment means any unwelcome or offensive conduct, whether written, verbal or physical, which is

(a) directed at or to an employee because of his or her actual or perceived race, sex, color, ancestry, national origin, religion, disability, age, sexual orientation, gender identity, housing status or veteran status or

(b) directed toward any person concerning an individual, or a class of individuals, because of the race, sex, color, ancestry, national origin, religion, disability, age, sexual orientation, gender identity, housing status or veteran status of the individual or class of individuals. For example, racial or ethnic slurs or derogatory epithets are prohibited in the workplace, regardless of whether a member of the racial or ethnic group is present when the statement is made.

Harassment does not refer to occasional compliments or other statements of a socially acceptable nature. Harassment refers to behavior which is unwelcome and which is offensive and/or persistent enough to create, or has the potential of creating an intimidating, hostile or offensive working environment for any employee. Harassment includes unwelcome sexual advances or requests for sexual favors, unwelcome touching of a sexual nature and unwelcome and/or offensive sexual comments.

1. This policy applies to all full-time, part-time, permanent and temporary employees, including supervisors and department heads, as well as to volunteers.

2. It is a violation of this policy to use an individual's submission to or rejection of harassing conduct as the basis for any employment decision affecting the individual.

3. An employee who believes she, he or they have been subjected to harassment as defined in this policy shall promptly report the harassment to her, his or their supervisor and/or the director of human resources or designee. _____ (company name) will make reasonable efforts to insure that a human resources representative of each sex is available to receive such complaints. The human resources department shall conduct a thorough and prompt investigation and, if appropriate, take disciplinary action against any offender, including but not limited to discharge. Staff will keep the complaint as confidential as reasonably possible. No one will be retaliated against for filing a harassment complaint.

4. All supervisory personnel who observe or otherwise learn of or have reason to suspect any conduct which may violate this policy shall promptly report such facts to the director of human resources or designee, and shall cooperate fully in any investigation or disciplinary action undertaken pursuant to this policy. Failure to comply with this section shall be grounds for appropriate disciplinary action, up to and including termination.

5. _____ (company name) will provide regular training to employees and supervisors on the subject of harassment in the workplace. We will include information about this policy in our orientation and in our personnel policy. A copy of this policy will be posted on a prominent bulletin board. We take this matter seriously and will do all that is reasonably necessary to maintain a harassment-free workplace for our employees.

_____ _____

Signature Date

WORKFORCE BREAKDOWN FORM

COMPANY NAME: _____

ADDRESS: _____

_____

REPRESENTATIVE: _____

PHONE: _____

E-MAIL ADDRESS: _____

Position, Title Class or Category	Total Number Employees in Each Position	Total Number Minority Employees	Percent of Total	Total Number Female and Non-Binary Employees	Percent of Total	Total Number Employees with Disabilities	Percent of Total

I swear or affirm under penalties of perjury that this workforce breakdown is accurate, to the best of my knowledge.

_____ _____

Signature and Title of Representative: Date:

AFFIRMATIVE ACTION PLAN AND HARASSMENT POLICY CHECKLIST

NOTE: This is **not** an Affirmative Action Plan. This checklist is provided for organizations with existing affirmative action plans to crosscheck their plans against the City's requirements. Each item listed below is required by City ordinance or regulation.

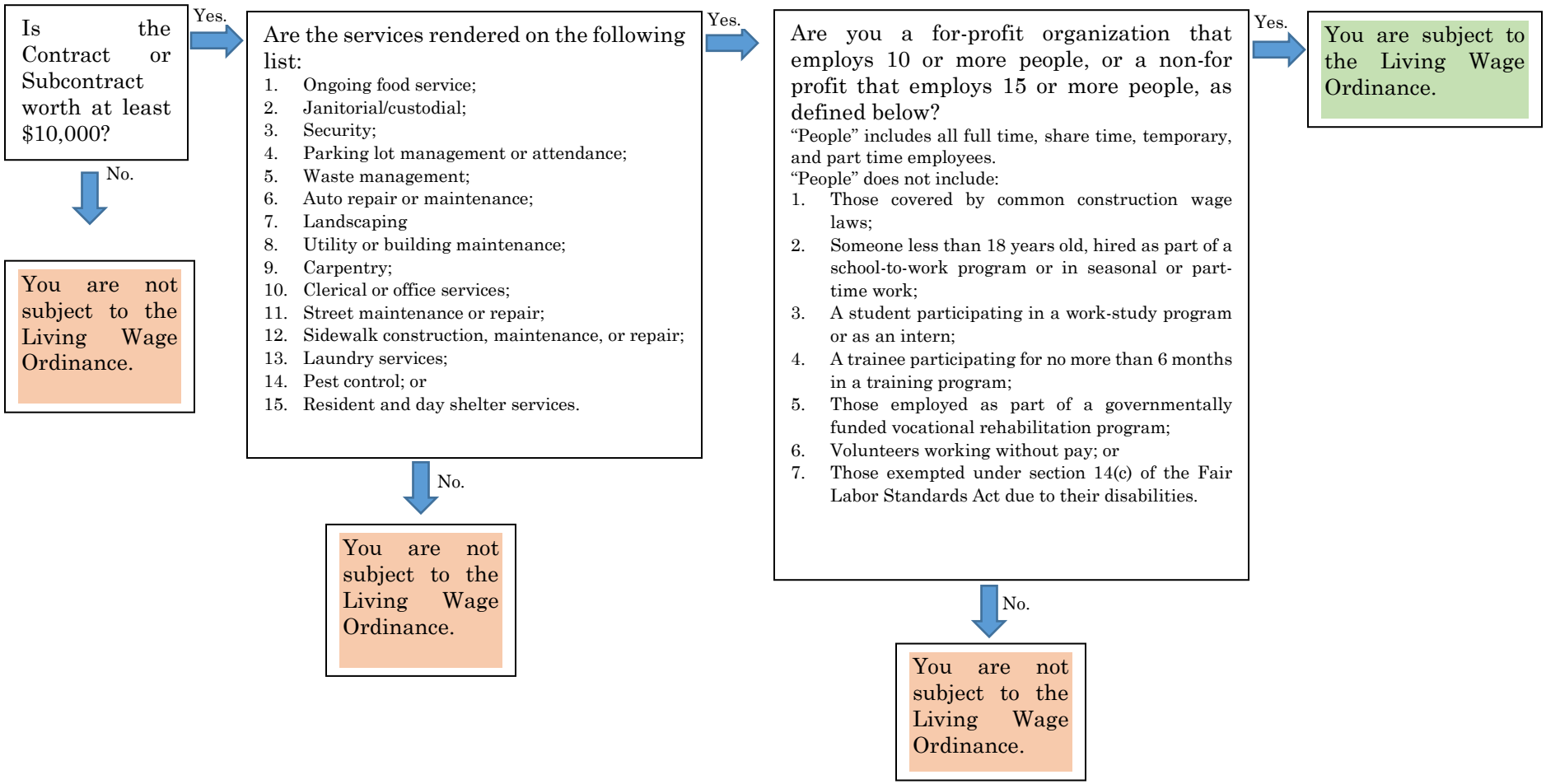
Contractor: Plan MUST Include:		Yes	No	Comments:
Policy statement of equal employment opportunity		☐	☐	
Covers:	Applicants for employment	☐	☐	
	Employees	☐	☐	
On basis of:	Race	☐	☐	
	Religion	☐	☐	
	Color	☐	☐	
	Sex	☐	☐	
	National Origin	☐	☐	
	Ancestry	☐	☐	
	Disability	☐	☐	
	Sexual Orientation	☐	☐	
	Gender Identity	☐	☐	
	Veteran Status	☐	☐	
	Housing Status	☐	☐	
Designates a person responsible for implementation of the Plan		☐	☐	
Provides for communication of the policy:				
	Within the Organization	☐	☐	
	Outside the Organization (e.g., recruitment sources, unions)	☐	☐	
Applies to all terms and conditions of employment (e.g., hiring, placement, promotion, duties, wages, benefits, use of facilities, layoff, discipline, termination)		☐	☐	
Provision for: Recruitment from minority groups		☐	☐	
Provision for: Equal access to training programs		☐	☐	
Grievance Procedure		☐	☐	
Prohibits retaliation for filing grievances		☐	☐	
Workforce Breakdown (figures up to date within 6 months)		☐	☐	
HARASSMENT POLICY CHECKLIST				
Definition of harassment		☐	☐	
Designates a person to receive and Investigate harassment complaints		☐	☐	
Prohibits retaliation for filing a harassment complaint		☐	☐	

The City of Bloomington (CoB) Living Wage Ordinance (LWO) applies to three groups of employers:

1) The CoB;
2) Companies that provide services to the CoB through contracts or subcontracts; or
3) Organizations that receive CoB subsidies or grants.

As an employer under categories 2 or 3, you may or may not be subject to the LWO. To find out, follow the applicable flow chart, below, or contact the City Legal Department.

<u>Companies that Provide Services to the CoB through Contracts or Subcontracts ("Agreement")</u>



Companies or Organizations that Receive CoB Subsidies or Grants

Is the Subsidy or Grant worth at least $25,000?

Yes.

Is the subsidy or grant of at least $25,000 part of one of the following:

1. A tax abatement pursuant to Indiana Code 6-1.1-12.1;
2. A grant from the Business Investment Incentive Loan Fund;
3. An expenditure from the Industrial Development Fund (except those associated with the acquisition of right-of-way for and the design, financing, construction, and maintenance of publicly owned infrastructure serving a Community Revitalization Enhancement District (CRED) pursuant to Indiana Code 36-7-13);
4. A grant from the Community Development Community Development Block Grant Funds; or
5. A grant from the Jack Hopkins Social Services Funding Program.

Yes.

Are you a for-profit organization that employs 10 or more people, or a non-for profit that employs 15 or more people, as defined below?

"People" includes all full time, share time, temporary, and part time employees.

"People" does not include:

1. Those covered by common construction wage laws;
2. Someone less than 18 years old, hired as part of a school-to-work program or in seasonal or part-time work;
3. A student participating in a work-study program or as an intern;
4. A trainee participating for no more than 6 months in a training program;
5. Those employed as part of a governmentally funded vocational rehabilitation program;
6. Volunteers working without pay; or
7. Those exempted under section 14(c) of the Fair Labor Standards Act due to their disabilities.

Yes.

You are subject to the Living Wage Ordinance.

No.

You are not subject to the Living Wage Ordinance.

No.

You are not subject to the Living Wage Ordinance.

No.

You are not subject to the Living Wage Ordinance.

EXHIBIT E
AFFIDAVIT THE LIVING WAGE ORDINANCE

The undersigned, being duly sworn, hereby affirms and says that:

1. The undersigned is the _____ (title) of _____ (company).

2. The company named herein that employs the undersigned has contracted with or is seeking to contract with the City of Bloomington to provide services.

3. The undersigned hereby states that, to the best of their knowledge and belief, the company named herein is subject to Bloomington City Ordinance 2.28, otherwise known as the "Living Wage Ordinance."

4. The projected employment needs under the award include the following: _____
_____.

5. The projected net increase or decrease in jobs for covered employees by job title that will result from awarding the assistance: _____.

6. The undersigned hereby affirms that the smallest hourly wage to be earned by each of their covered employees shall be at least the living wage.

I affirm under the penalties of perjury that the foregoing facts and information are true and correct to the best of my knowledge and belief.

_____ _____
Signature Printed name

STATE OF INDIANA)
) SS:
COUNTY OF _____)

Before me, a Notary Public in and for said County and State, personally appeared _____ _____ and acknowledged the execution of the foregoing this _____ day of _____ _____, 2023.

My Commission Expires:_____ _____
Notary Public

County of Residence:_____ _____
Name Printed

_____
Commission Number

Living Wage Ordinance Certification

Employer's Name: _____
Employer's Address: _____
_____
Employer's Phone Number: _____
Employer's Email Address: _____
Job title(s) of Covered Employees: _____
_____
(use additional sheet if necessary)

Do you pay all covered employees at least the living wage (for 2020, $13.21 per hour) for work done in connection with the City assistance or subsidy? Yes_____ No _____

If not, do the covered employees have access to a health insurance plan sponsored by you?
Yes_____ No_____

If you don't pay all of your covered employees at least the living wage, and your covered employees have access to a health insurance plan that you sponsor, please answer the following questions:

● What is the hourly equivalent value of your contribution to the health insurance plan on behalf of the covered employees who chose to participate in your health insurance plan? (To determine this, divide your annual contribution per employee by 2080.) $_____

● If the covered employee chose not to participate in your health insurance plan, but could have done so, then what would have been the hourly equivalent value of your contribution to the health insurance plan? (Again, divide your annual contribution by 2080). $_____

I hereby attest that the information I've provided above is truthful and accurate. I hereby attest that I am aware of the provisions of the Living Wage Ordinance chapter of the Bloomington Municipal Code.

_____ _____
Signature Printed Name

_____ _____
Date Office held

This form must be filed in the first quarter of the year following that in which the living wage ordinance applies. Send completed form to the Contract Compliance Officer, PO Box 100, Bloomington, IN 47402-0100, or fax to 349-3441.

Living Wage Ordinance. Contractor is considered a "covered employer" under City Ordinance 2.28, otherwise known as the "Living Wage Ordinance," or "LWO," and is required to pay their covered employees at least a living wage. Currently, the living wage is $15.75 per hour for covered employees, and up to 15% of that amount, or $2.36, may be in the form of the covered employer's contribution to health insurance available to the covered employee.

Contractor shall execute the Living Wage Ordinance Affidavit, attached as Exhibit ____; shall abide by the LWO by paying their employees a living wage; and shall post the Living Wage Poster, provided by the City Legal Department, in areas frequented by their covered employees.

GENERAL CONDITIONS

This document has important legal consequences; consultation with an attorney is encouraged with respect to its use or modification. This document should be adapted to the particular circumstances of the contemplated Project and the controlling Laws and Regulations.

STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

Prepared by

EJCDC®
ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

Issued and Published Jointly by

ACEC
AMERICAN COUNCIL OF ENGINEERING COMPANIES

ASCE
AMERICAN SOCIETY OF CIVIL ENGINEERS

National Society of Professional Engineers®

Endorsed by

CSI NUCA
REPRESENTING UTILITY & EXCAVATION CONTRACTORS

These General Conditions have been prepared for use with the Agreement Between Owner and Contractor for Construction Contract (EJCDC® C-520, Stipulated Sum, or C-525, Cost-Plus, 2013 Editions). Their provisions are interrelated and a change in one may necessitate a change in the other.

To prepare supplementary conditions that are coordinated with the General Conditions, use EJCDC's Guide to the Preparation of Supplementary Conditions (EJCDC® C-800, 2013 Edition). The full EJCDC Construction series of documents is discussed in the Commentary on the 2013 EJCDC Construction Documents (EJCDC® C-001, 2013 Edition).

National Society of Professional Engineers

1420 King Street, Alexandria, VA 22314-2794

(703) 684-2882

www.nspe.org

American Council of Engineering Companies

1015 15th Street N.W., Washington, DC 20005

(202) 347-7474

www.acec.org

American Society of Civil Engineers

1801 Alexander Bell Drive, Reston, VA 20191-4400

(800) 548-2723

www.asce.org

NOTE: EJCDC publications may be purchased at www.ejcdc.org, or from any of the sponsoring organizations above.

STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

TABLE OF CONTENTS

ARTICLE 1 – DEFINITIONS AND TERMINOLOGY

1.01 *Defined Terms*

A. Wherever used in the Bidding Requirements or Contract Documents, a term printed with initial capital letters, including the term's singular and plural forms, will have the meaning indicated in the definitions below. In addition to terms specifically defined, terms with initial capital letters in the Contract Documents include references to identified articles and paragraphs, and the titles of other documents or forms.

1. *Addenda*—Written or graphic instruments issued prior to the opening of Bids which clarify, correct, or change the Bidding Requirements or the proposed Contract Documents.

2. *Agreement*—The written instrument, executed by Owner and Contractor, that sets forth the Contract Price and Contract Times, identifies the parties and the Engineer, and designates the specific items that are Contract Documents.

3. *Application for Payment*—The form acceptable to Engineer which is to be used by Contractor during the course of the Work in requesting progress or final payments and which is to be accompanied by such supporting documentation as is required by the Contract Documents.

4. *Bid*—The offer of a Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.

5. *Bidder*—An individual or entity that submits a Bid to Owner.

6. *Bidding Documents*—The Bidding Requirements, the proposed Contract Documents, and all Addenda.

7. *Bidding Requirements*—The advertisement or invitation to bid, Instructions to Bidders, Bid Bond or other Bid security, if any, the Bid Form, and the Bid with any attachments.

8. *Change Order*—A document which is signed by Contractor and Owner and authorizes an addition, deletion, or revision in the Work or an adjustment in the Contract Price or the Contract Times, or other revision to the Contract, issued on or after the Effective Date of the Contract.

9. *Change Proposal*—A written request by Contractor, duly submitted in compliance with the procedural requirements set forth herein, seeking an adjustment in Contract Price or Contract Times, or both; contesting an initial decision by Engineer concerning the requirements of the Contract Documents or the acceptability of Work under the Contract Documents; challenging a set-off against payments due; or seeking other relief with respect to the terms of the Contract.

10. *Claim*—(a) A demand or assertion by Owner directly to Contractor, duly submitted in compliance with the procedural requirements set forth herein: seeking an adjustment of Contract Price or Contract Times, or both; contesting an initial decision by Engineer concerning the requirements of the Contract Documents or the acceptability of Work under the Contract Documents; contesting Engineer's decision regarding a Change Proposal; seeking resolution of a contractual issue that Engineer has declined to address; or seeking other relief with respect to the terms of the Contract; or (b) a demand or assertion by Contractor directly to Owner, duly submitted in compliance with the procedural requirements set forth herein, contesting Engineer's decision regarding a Change Proposal; or seeking resolution of a contractual issue that Engineer

has declined to address. A demand for money or services by a third party is not a Claim.

11. *Constituent of Concern*—Asbestos, petroleum, radioactive materials, polychlorinated biphenyls (PCBs), hazardous waste, and any substance, product, waste, or other material of any nature whatsoever that is or becomes listed, regulated, or addressed pursuant to (a) the Comprehensive Environmental Response, Compensation and Liability Act, 42 U.S.C. §§9601 et seq. ("CERCLA"); (b) the Hazardous Materials Transportation Act, 49 U.S.C. §§5101 et seq.; (c) the Resource Conservation and Recovery Act, 42 U.S.C. §§6901 et seq. ("RCRA"); (d) the Toxic Substances Control Act, 15 U.S.C. §§2601 et seq.; (e) the Clean Water Act, 33 U.S.C. §§1251 et seq.; (f) the Clean Air Act, 42 U.S.C. §§7401 et seq.; or (g) any other federal, state, or local statute, law, rule, regulation, ordinance, resolution, code, order, or decree regulating, relating to, or imposing liability or standards of conduct concerning, any hazardous, toxic, or dangerous waste, substance, or material.

12. *Contract*—The entire and integrated written contract between the Owner and Contractor concerning the Work.

13. *Contract Documents*—Those items so designated in the Agreement, and which together comprise the Contract.

14. *Contract Price*—The money that Owner has agreed to pay Contractor for completion of the Work in accordance with the Contract Documents. .

15. *Contract Times*—The number of days or the dates by which Contractor shall: (a) achieve Milestones, if any; (b) achieve Substantial Completion; and (c) complete the Work.

16. *Contractor*—The individual or entity with which Owner has contracted for performance of the Work.

17. *Cost of the Work*—See Paragraph 13.01 for definition.

18. *Drawings*—The part of the Contract that graphically shows the scope, extent, and character of the Work to be performed by Contractor.

19. *Effective Date of the Contract*—The date, indicated in the Agreement, on which the Contract becomes effective.

20. *Engineer*—The individual or entity named as such in the Agreement.

21. *Field Order*—A written order issued by Engineer which requires minor changes in the Work but does not change the Contract Price or the Contract Times.

22. *Hazardous Environmental Condition*—The presence at the Site of Constituents of Concern in such quantities or circumstances that may present a danger to persons or property exposed thereto. The presence at the Site of materials that are necessary for the execution of the Work, or that are to be incorporated in the Work, and that are controlled and contained pursuant to industry practices, Laws and Regulations, and the requirements of the Contract, does not establish a Hazardous Environmental Condition.

23. *Laws and Regulations; Laws or Regulations*—Any and all applicable laws, statutes, rules, regulations, ordinances, codes, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.

24. *Liens*—Charges, security interests, or encumbrances upon Contract-related funds, real property, or personal property.

25. *Milestone*—A principal event in the performance of the Work that the Contract requires Contractor to achieve by an intermediate completion date or by a time prior to Substantial Completion of all the Work.

26. *Notice of Award*—The written notice by Owner to a Bidder of Owner's acceptance of the Bid.

27. *Notice to Proceed*—A written notice by Owner to Contractor fixing the date on which the Contract Times will commence to run and on which Contractor shall start to perform the Work.

28. *Owner*—The individual or entity with which Contractor has contracted regarding the Work, and which has agreed to pay Contractor for the performance of the Work, pursuant to the terms of the Contract.

29. *Progress Schedule*—A schedule, prepared and maintained by Contractor, describing the sequence and duration of the activities comprising the Contractor's plan to accomplish the Work within the Contract Times.

30. *Project*—The total undertaking to be accomplished for Owner by engineers, contractors, and others, including planning, study, design, construction, testing, commissioning, and start-up, and of which the Work to be performed under the Contract Documents is a part.

31. *Project Manual*—The written documents prepared for, or made available for, procuring and constructing the Work, including but not limited to the Bidding Documents or other construction procurement documents, geotechnical and existing conditions information, the Agreement, bond forms, General Conditions, Supplementary Conditions, and Specifications. The contents of the Project Manual may be bound in one or more volumes.

32. *Resident Project Representative*—The authorized representative of Engineer assigned to assist Engineer at the Site. As used herein, the term Resident Project Representative or "RPR" includes any assistants or field staff of Resident Project Representative.

33. *Samples*—Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and that establish the standards by which such portion of the Work will be judged.

34. *Schedule of Submittals*—A schedule, prepared and maintained by Contractor, of required submittals and the time requirements for Engineer's review of the submittals and the performance of related construction activities.

35. *Schedule of Values*—A schedule, prepared and maintained by Contractor, allocating portions of the Contract Price to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

36. *Shop Drawings*—All drawings, diagrams, illustrations, schedules, and other data or information that are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work. Shop Drawings, whether approved or not, are not Drawings and are not Contract Documents.

37. *Site*—Lands or areas indicated in the Contract Documents as being furnished by Owner upon which the Work is to be performed, including rights-of-way and easements, and such other lands furnished by Owner which are designated for the use of Contractor.

38. *Specifications*—The part of the Contract that consists of written requirements for materials, equipment, systems, standards, and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable to the Work.

39. *Subcontractor*—An individual or entity having a direct contract with Contractor or with any other Subcontractor for the performance of a part of the Work.

40. *Substantial Completion*—The time at which the Work (or a specified part thereof) has progressed to the point where, in the opinion of Engineer, the Work (or a specified part thereof) is sufficiently complete, in accordance with the Contract Documents, so that the Work (or a specified part thereof) can be utilized for the purposes for which it is intended. The terms "substantially complete" and "substantially completed" as applied to all or part of the Work refer to Substantial Completion thereof.

41. *Successful Bidder*—The Bidder whose Bid the Owner accepts, and to which the Owner makes an award of contract, subject to stated conditions.

42. *Supplementary Conditions*—The part of the Contract that amends or supplements these General Conditions.

43. *Supplier*—A manufacturer, fabricator, supplier, distributor, materialman, or vendor having a direct contract with Contractor or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by Contractor or a Subcontractor.

44. *Technical Data*—Those items expressly identified as Technical Data in the Supplementary Conditions, with respect to either (a) subsurface conditions at the Site, or physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities) or (b) Hazardous Environmental Conditions at the Site. If no such express identifications of Technical Data have been made with respect to conditions at the Site, then the data contained in boring logs, recorded measurements of subsurface water levels, laboratory test results, and other factual, objective information regarding conditions at the Site that are set forth in any geotechnical or environmental report prepared for the Project and made available to Contractor are hereby defined as Technical Data with respect to conditions at the Site under Paragraphs 5.03, 5.04, and 5.06.

45. *Underground Facilities*—All underground pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or attachments, and any encasements containing such facilities, including but not limited to those that convey electricity, gases, steam, liquid petroleum products, telephone or other communications, fiber optic transmissions, cable television, water, wastewater, storm water, other liquids or chemicals, or traffic or other control systems.

46. *Unit Price Work*—Work to be paid for on the basis of unit prices.

47. *Work*—The entire construction or the various separately identifiable parts thereof required to be provided under the Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce such construction; furnishing, installing, and incorporating all materials and equipment into such construction; and may include related services such as testing, start-up, and commissioning, all as required by the Contract Documents.

48. *Work Change Directive*—A written directive to Contractor issued on or after the Effective Date of the Contract, signed by Owner and recommended by Engineer, ordering an addition, deletion, or revision in the Work.

1.02 *Terminology*

A. The words and terms discussed in the following paragraphs are not defined but, when used in the Bidding Requirements or Contract Documents, have the indicated meaning.

B. *Intent of Certain Terms or Adjectives*:

1. The Contract Documents include the terms "as allowed," "as approved," "as ordered," "as directed" or terms of like effect or import to authorize an exercise of professional judgment by Engineer. In addition, the adjectives "reasonable," "suitable," "acceptable," "proper," "satisfactory," or adjectives of like effect or import are used to describe an action or determination of Engineer as to the Work. It is intended that such exercise of professional judgment, action, or determination will be solely to evaluate, in general, the Work for compliance with the information in the Contract Documents and with the design concept of the Project as a functioning whole as shown or indicated in the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective is not intended to and shall not be effective to assign to Engineer any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility contrary to the provisions of Article 10 or any other provision of the Contract Documents.

C. *Day*:

1. The word "day" means a calendar day of 24 hours measured from midnight to the next midnight.

D. *Defective*:

1. The word "defective," when modifying the word "Work," refers to Work that is unsatisfactory, faulty, or deficient in that it:

a. does not conform to the Contract Documents; or

b. does not meet the requirements of any applicable inspection, reference standard, test, or approval referred to in the Contract Documents; or

c. has been damaged prior to Engineer's recommendation of final payment (unless responsibility for the protection thereof has been assumed by Owner at Substantial Completion in accordance with Paragraph 15.03 or 15.04).

E. *Furnish, Install, Perform, Provide*:

1. The word "furnish," when used in connection with services, materials, or equipment, shall mean to supply and deliver said services, materials, or equipment to the Site (or some other specified location) ready for use or installation and in usable or operable condition.

2. The word "install," when used in connection with services, materials, or equipment, shall mean to put into use or place in final position said services, materials, or equipment complete and ready for intended use.

3. The words “perform” or “provide,” when used in connection with services, materials, or equipment, shall mean to furnish and install said services, materials, or equipment complete and ready for intended use.

4. If the Contract Documents establish an obligation of Contractor with respect to specific services, materials, or equipment, but do not expressly use any of the four words “furnish,” “install,” “perform,” or “provide,” then Contractor shall furnish and install said services, materials, or equipment complete and ready for intended use.

F. Unless stated otherwise in the Contract Documents, words or phrases that have a well-known technical or construction industry or trade meaning are used in the Contract Documents in accordance with such recognized meaning.

ARTICLE 2 – PRELIMINARY MATTERS

2.01 *Delivery of Bonds and Evidence of Insurance*

A. *Bonds*: When Contractor delivers the executed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner such bonds as Contractor may be required to furnish.

B. *Evidence of Contractor’s Insurance*: When Contractor delivers the executed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner, with copies to each named insured and additional insured (as identified in the Supplementary Conditions or elsewhere in the Contract), the certificates and other evidence of insurance required to be provided by Contractor in accordance with Article 6.

C. *Evidence of Owner’s Insurance*: After receipt of the executed counterparts of the Agreement and all required bonds and insurance documentation, Owner shall promptly deliver to Contractor, with copies to each named insured and additional insured (as identified in the Supplementary Conditions or otherwise), the certificates and other evidence of insurance required to be provided by Owner under Article 6.

2.02 *Copies of Documents*

A. Owner shall furnish to Contractor four printed copies of the Contract (including one fully executed counterpart of the Agreement), and one copy in electronic portable document format (PDF). Additional printed copies will be furnished upon request at the cost of reproduction.

B. Owner shall maintain and safeguard at least one original printed record version of the Contract, including Drawings and Specifications signed and sealed by Engineer and other design professionals. Owner shall make such original printed record version of the Contract available to Contractor for review. Owner may delegate the responsibilities under this provision to Engineer.

2.03 *Before Starting Construction*

A. *Preliminary Schedules*: Within 10 days after the Effective Date of the Contract (or as otherwise specifically required by the Contract Documents), Contractor shall submit to Engineer for timely review:

1. a preliminary Progress Schedule indicating the times (numbers of days or dates) for starting and completing the various stages of the Work, including any Milestones specified in the Contract;

2. a preliminary Schedule of Submittals; and

3. a preliminary Schedule of Values for all of the Work which includes quantities and prices of items which when added together equal the Contract Price and subdivides the Work into component parts in sufficient detail to serve as the basis for progress payments during performance of the Work. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work.

2.04 *Preconstruction Conference; Designation of Authorized Representatives*

A. Before any Work at the Site is started, a conference attended by Owner, Contractor, Engineer, and others as appropriate will be held to establish a working understanding among the parties as to the Work and to discuss the schedules referred to in Paragraph 2.03.A, procedures for handling Shop Drawings, Samples, and other submittals, processing Applications for Payment, electronic or digital transmittals, and maintaining required records.

B. At this conference Owner and Contractor each shall designate, in writing, a specific individual to act as its authorized representative with respect to the services and responsibilities under the Contract. Such individuals shall have the authority to transmit and receive information, render decisions relative to the Contract, and otherwise act on behalf of each respective party.

2.05 *Initial Acceptance of Schedules*

A. At least 10 days before submission of the first Application for Payment a conference, attended by Contractor, Engineer, and others as appropriate, will be held to review for acceptability to Engineer as provided below the schedules submitted in accordance with Paragraph 2.03.A. Contractor shall have an additional 10 days to make corrections and adjustments and to complete and resubmit the schedules. No progress payment shall be made to Contractor until acceptable schedules are submitted to Engineer.

1. The Progress Schedule will be acceptable to Engineer if it provides an orderly progression of the Work to completion within the Contract Times. Such acceptance will not impose on Engineer responsibility for the Progress Schedule, for sequencing, scheduling, or progress of the Work, nor interfere with or relieve Contractor from Contractor's full responsibility therefor.

2. Contractor's Schedule of Submittals will be acceptable to Engineer if it provides a workable arrangement for reviewing and processing the required submittals.

3. Contractor's Schedule of Values will be acceptable to Engineer as to form and substance if it provides a reasonable allocation of the Contract Price to the component parts of the Work.

2.06 *Electronic Transmittals*

A. Except as otherwise stated elsewhere in the Contract, the Owner, Engineer, and Contractor may transmit, and shall accept, Project-related correspondence, text, data, documents, drawings, information, and graphics, including but not limited to Shop Drawings and other submittals, in electronic media or digital format, either directly, or through access to a secure Project website.

B. If the Contract does not establish protocols for electronic or digital transmittals, then Owner, Engineer, and Contractor shall jointly develop such protocols.

C. When transmitting items in electronic media or digital format, the transmitting party makes no representations as to long term compatibility, usability, or readability of the items resulting from the recipient's use of software application packages, operating systems, or

computer hardware differing from those used in the drafting or transmittal of the items, or from those established in applicable transmittal protocols.

ARTICLE 3 – DOCUMENTS: INTENT, REQUIREMENTS, REUSE

3.01 *Intent*

A. The Contract Documents are complementary; what is required by one is as binding as if required by all.

B. It is the intent of the Contract Documents to describe a functionally complete project (or part thereof) to be constructed in accordance with the Contract Documents.

C. Unless otherwise stated in the Contract Documents, if there is a discrepancy between the electronic or digital versions of the Contract Documents (including any printed copies derived from such electronic or digital versions) and the printed record version, the printed record version shall govern.

D. The Contract supersedes prior negotiations, representations, and agreements, whether written or oral.

E. Engineer will issue clarifications and interpretations of the Contract Documents as provided herein.

3.02 *Reference Standards*

A. Standards Specifications, Codes, Laws and Regulations

1. Reference in the Contract Documents to standard specifications, manuals, reference standards, or codes of any technical society, organization, or association, or to Laws or Regulations, whether such reference be specific or by implication, shall mean the standard specification, manual, reference standard, code, or Laws or Regulations in effect at the time of opening of Bids (or on the Effective Date of the Contract if there were no Bids), except as may be otherwise specifically stated in the Contract Documents.

2. No provision of any such standard specification, manual, reference standard, or code, or any instruction of a Supplier, shall be effective to change the duties or responsibilities of Owner, Contractor, or Engineer, or any of their subcontractors, consultants, agents, or employees, from those set forth in the part of the Contract Documents prepared by or for Engineer. No such provision or instruction shall be effective to assign to Owner, Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, any duty or authority to supervise or direct the performance of the Work or any duty or authority to undertake responsibility inconsistent with the provisions of the part of the Contract Documents prepared by or for Engineer.

3.03 *Reporting and Resolving Discrepancies*

A. *Reporting Discrepancies*:

1. *Contractor's Verification of Figures and Field Measurements*: Before undertaking each part of the Work, Contractor shall carefully study the Contract Documents, and check and verify pertinent figures and dimensions therein, particularly with respect to applicable field measurements. Contractor shall promptly report in writing to Engineer any conflict, error, ambiguity, or discrepancy that Contractor discovers, or has actual knowledge of, and shall not proceed with any Work affected thereby until the conflict,

error, ambiguity, or discrepancy is resolved, by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract Documents issued pursuant to Paragraph 11.01.

2. *Contractor's Review of Contract Documents*: If, before or during the performance of the Work, Contractor discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents, or between the Contract Documents and (a) any applicable Law or Regulation, (b) actual field conditions, (c) any standard specification, manual, reference standard, or code, or (d) any instruction of any Supplier, then Contractor shall promptly report it to Engineer in writing. Contractor shall not proceed with the Work affected thereby (except in an emergency as required by Paragraph 7.15) until the conflict, error, ambiguity, or discrepancy is resolved, by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract Documents issued pursuant to Paragraph 11.01.

3. Contractor shall not be liable to Owner or Engineer for failure to report any conflict, error, ambiguity, or discrepancy in the Contract Documents unless Contractor had actual knowledge thereof.

B. *Resolving Discrepancies*:

1. Except as may be otherwise specifically stated in the Contract Documents, the provisions of the part of the Contract Documents prepared by or for Engineer shall take precedence in resolving any conflict, error, ambiguity, or discrepancy between such provisions of the Contract Documents and:

a. the provisions of any standard specification, manual, reference standard, or code, or the instruction of any Supplier (whether or not specifically incorporated by reference as a Contract Document); or

b. the provisions of any Laws or Regulations applicable to the performance of the Work (unless such an interpretation of the provisions of the Contract Documents would result in violation of such Law or Regulation).

3.04 *Requirements of the Contract Documents*

A. During the performance of the Work and until final payment, Contractor and Owner shall submit to the Engineer all matters in question concerning the requirements of the Contract Documents (sometimes referred to as requests for information or interpretation—RFIs), or relating to the acceptability of the Work under the Contract Documents, as soon as possible after such matters arise. Engineer will be the initial interpreter of the requirements of the Contract Documents, and judge of the acceptability of the Work thereunder.

B. Engineer will, with reasonable promptness, render a written clarification, interpretation, or decision on the issue submitted, or initiate an amendment or supplement to the Contract Documents. Engineer's written clarification, interpretation, or decision will be final and binding on Contractor, unless it appeals by submitting a Change Proposal, and on Owner, unless it appeals by filing a Claim.

C. If a submitted matter in question concerns terms and conditions of the Contract Documents that do not involve (1) the performance or acceptability of the Work under the Contract Documents, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, then Engineer will promptly give written notice to Owner and Contractor that Engineer is unable to provide a decision or interpretation. If Owner and Contractor are unable to agree on resolution of such a matter in question, either party may pursue resolution as provided in Article 12.

3.05 *Reuse of Documents*

A. Contractor and its Subcontractors and Suppliers shall not:

1. have or acquire any title to or ownership rights in any of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of Engineer or its consultants, including electronic media editions, or reuse any such Drawings, Specifications, other documents, or copies thereof on extensions of the Project or any other project without written consent of Owner and Engineer and specific written verification or adaptation by Engineer; or

2. have or acquire any title or ownership rights in any other Contract Documents, reuse any such Contract Documents for any purpose without Owner's express written consent, or violate any copyrights pertaining to such Contract Documents.

B. The prohibitions of this Paragraph 3.05 will survive final payment, or termination of the Contract. Nothing herein shall preclude Contractor from retaining copies of the Contract Documents for record purposes.

ARTICLE 4 – COMMENCEMENT AND PROGRESS OF THE WORK

4.01 *Commencement of Contract Times; Notice to Proceed*

A. The Contract Times will commence to run on the thirtieth day after the Effective Date of the Contract or, if a Notice to Proceed is given, on the day indicated in the Notice to Proceed. A Notice to Proceed may be given at any time within 30 days after the Effective Date of the Contract. In no event will the Contract Times commence to run later than the sixtieth day after the day of Bid opening or the thirtieth day after the Effective Date of the Contract, whichever date is earlier.

4.02 *Starting the Work*

A. Contractor shall start to perform the Work on the date when the Contract Times commence to run. No Work shall be done at the Site prior to such date.

4.03 *Reference Points*

A. Owner shall provide engineering surveys to establish reference points for construction which in Engineer's judgment are necessary to enable Contractor to proceed with the Work. Contractor shall be responsible for laying out the Work, shall protect and preserve the established reference points and property monuments, and shall make no changes or relocations without the prior written approval of Owner. Contractor shall report to Engineer whenever any reference point or property monument is lost or destroyed or requires relocation because of necessary changes in grades or locations, and shall be responsible for the accurate replacement or relocation of such reference points or property monuments by professionally qualified personnel.

4.04 *Progress Schedule*

A. Contractor shall adhere to the Progress Schedule established in accordance with Paragraph 2.05 as it may be adjusted from time to time as provided below.

1. Contractor shall submit to Engineer for acceptance (to the extent indicated in Paragraph 2.05) proposed adjustments in the Progress Schedule that will not result in changing the Contract Times.

2. Proposed adjustments in the Progress Schedule that will change the Contract Times shall be submitted in accordance with the requirements of Article 11.

B. Contractor shall carry on the Work and adhere to the Progress Schedule during all disputes or disagreements with Owner. No Work shall be delayed or postponed pending resolution of any disputes or disagreements, or during any appeal process, except as permitted by Paragraph 16.04, or as Owner and Contractor may otherwise agree in writing.

4.05 *Delays in Contractor's Progress*

A. If Owner, Engineer, or anyone for whom Owner is responsible, delays, disrupts, or interferes with the performance or progress of the Work, then Contractor shall be entitled to an equitable adjustment in the Contract Times and Contract Price. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.

B. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for delay, disruption, or interference caused by or within the control of Contractor. Delay, disruption, and interference attributable to and within the control of a Subcontractor or Supplier shall be deemed to be within the control of Contractor.

C. If Contractor's performance or progress is delayed, disrupted, or interfered with by unanticipated causes not the fault of and beyond the control of Owner, Contractor, and those for which they are responsible, then Contractor shall be entitled to an equitable adjustment in Contract Times. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times. Such an adjustment shall be Contractor's sole and exclusive remedy for the delays, disruption, and interference described in this paragraph. Causes of delay, disruption, or interference that may give rise to an adjustment in Contract Times under this paragraph include but are not limited to the following:

1. severe and unavoidable natural catastrophes such as fires, floods, epidemics, and earthquakes;

2. abnormal weather conditions;

3. acts or failures to act of utility owners (other than those performing other work at or adjacent to the Site by arrangement with the Owner, as contemplated in Article 8); and

4. acts of war or terrorism.

D. Delays, disruption, and interference to the performance or progress of the Work resulting from the existence of a differing subsurface or physical condition, an Underground Facility that was not shown or indicated by the Contract Documents, or not shown or indicated with reasonable accuracy, and those resulting from Hazardous Environmental Conditions, are governed by Article 5.

E. Paragraph 8.03 governs delays, disruption, and interference to the performance or progress of the Work resulting from the performance of certain other work at or adjacent to the Site.

F. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for any delay, disruption, or interference if such delay is concurrent with a delay, disruption, or interference caused by or within the control of Contractor.

G. Contractor must submit any Change Proposal seeking an adjustment in Contract Price or Contract Times under this paragraph within 30 days of the commencement of the delaying, disrupting, or interfering event.

ARTICLE 5 – AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS

5.01 *Availability of Lands*

A. Owner shall furnish the Site. Owner shall notify Contractor of any encumbrances or restrictions not of general application but specifically related to use of the Site with which Contractor must comply in performing the Work.

B. Upon reasonable written request, Owner shall furnish Contractor with a current statement of record legal title and legal description of the lands upon which permanent improvements are to be made and Owner's interest therein as necessary for giving notice of or filing a mechanic's or construction lien against such lands in accordance with applicable Laws and Regulations.

C. Contractor shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.

5.02 *Use of Site and Other Areas*

A. *Limitation on Use of Site and Other Areas*:

1. Contractor shall confine construction equipment, temporary construction facilities, the storage of materials and equipment, and the operations of workers to the Site, adjacent areas that Contractor has arranged to use through construction easements or otherwise, and other adjacent areas permitted by Laws and Regulations, and shall not unreasonably encumber the Site and such other adjacent areas with construction equipment or other materials or equipment. Contractor shall assume full responsibility for (a) damage to the Site; (b) damage to any such other adjacent areas used for Contractor's operations; (c) damage to any other adjacent land or areas; and (d) for injuries and losses sustained by the owners or occupants of any such land or areas; provided that such damage or injuries result from the performance of the Work or from other actions or conduct of the Contractor or those for which Contractor is responsible.

2. If a damage or injury claim is made by the owner or occupant of any such land or area because of the performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible, Contractor shall (a) take immediate corrective or remedial action as required by Paragraph 7.12, or otherwise; (b) promptly attempt to settle the claim as to all parties through negotiations with such owner or occupant, or otherwise resolve the claim by arbitration or other dispute resolution proceeding, or at law; and (c) to the fullest extent permitted by Laws and Regulations, indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against any such claim, and against all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any claim or action, legal or equitable, brought by any such owner or occupant against Owner, Engineer, or any other party indemnified hereunder to the extent caused directly or indirectly, in whole or in part

by, or based upon, Contractor's performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible.

B. *Removal of Debris During Performance of the Work*: During the progress of the Work the Contractor shall keep the Site and other adjacent areas free from accumulations of waste materials, rubbish, and other debris. Removal and disposal of such waste materials, rubbish, and other debris shall conform to applicable Laws and Regulations.

C. *Cleaning*: Prior to Substantial Completion of the Work Contractor shall clean the Site and the Work and make it ready for utilization by Owner. At the completion of the Work Contractor shall remove from the Site and adjacent areas all tools, appliances, construction equipment and machinery, and surplus materials and shall restore to original condition all property not designated for alteration by the Contract Documents.

D. *Loading of Structures*: Contractor shall not load nor permit any part of any structure to be loaded in any manner that will endanger the structure, nor shall Contractor subject any part of the Work or adjacent structures or land to stresses or pressures that will endanger them.

5.03 *Subsurface and Physical Conditions*

A. *Reports and Drawings*: The Supplementary Conditions identify:

1. those reports known to Owner of explorations and tests of subsurface conditions at or adjacent to the Site;

2. those drawings known to Owner of physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities); and

3. Technical Data contained in such reports and drawings.

B. *Reliance by Contractor on Technical Data Authorized*: Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely upon the accuracy of the Technical Data (as defined in Article 1) contained in any geotechnical or environmental report prepared for the Project and made available to Contractor. Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, with respect to:

1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto; or

2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings; or

3. any Contractor interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions, or information.

5.04 *Differing Subsurface or Physical Conditions*

A. *Notice by Contractor*: If Contractor believes that any subsurface or physical condition that is uncovered or revealed at the Site either:

1. is of such a nature as to establish that any Technical Data on which Contractor is entitled to rely as provided in Paragraph 5.03 is materially inaccurate; or

2. is of such a nature as to require a change in the Drawings or Specifications; or

3. differs materially from that shown or indicated in the Contract Documents; or

4. is of an unusual nature, and differs materially from conditions ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents;

then Contractor shall, promptly after becoming aware thereof and before further disturbing the subsurface or physical conditions or performing any Work in connection therewith (except in an emergency as required by Paragraph 7.15), notify Owner and Engineer in writing about such condition. Contractor shall not further disturb such condition or perform any Work in connection therewith (except with respect to an emergency) until receipt of a written statement permitting Contractor to do so.

B. *Engineer's Review*: After receipt of written notice as required by the preceding paragraph, Engineer will promptly review the subsurface or physical condition in question; determine the necessity of Owner's obtaining additional exploration or tests with respect to the condition; conclude whether the condition falls within any one or more of the differing site condition categories in Paragraph 5.04.A above; obtain any pertinent cost or schedule information from Contractor; prepare recommendations to Owner regarding the Contractor's resumption of Work in connection with the subsurface or physical condition in question and the need for any change in the Drawings or Specifications; and advise Owner in writing of Engineer's findings, conclusions, and recommendations.

C. *Owner's Statement to Contractor Regarding Site Condition*: After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the subsurface or physical condition in question, addressing the resumption of Work in connection with such condition, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations, in whole or in part.

D. *Possible Price and Times Adjustments*:

1. Contractor shall be entitled to an equitable adjustment in Contract Price or Contract Times, or both, to the extent that the existence of a differing subsurface or physical condition, or any related delay, disruption, or interference, causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:

a. such condition must fall within any one or more of the categories described in Paragraph 5.04.A;

b. with respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraph 13.03; and,

c. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.

2. Contractor shall not be entitled to any adjustment in the Contract Price or Contract Times with respect to a subsurface or physical condition if:

a. Contractor knew of the existence of such condition at the time Contractor made a commitment to Owner with respect to Contract Price and Contract Times by the submission of a Bid or becoming bound under a negotiated contract, or otherwise; or

b. the existence of such condition reasonably could have been discovered or revealed as a result of any examination, investigation, exploration, test, or study of the Site and contiguous areas expressly required by the Bidding Requirements or Contract Documents to be conducted by or for Contractor prior to Contractor's making such commitment; or

c. Contractor failed to give the written notice as required by Paragraph 5.04.A.

3. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, or both, then any such adjustment shall be set forth in a Change Order.

4. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, or both, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the subsurface or physical condition in question.

5.05 *Underground Facilities*

A. *Contractor's Responsibilities*: The information and data shown or indicated in the Contract Documents with respect to existing Underground Facilities at or adjacent to the Site is based on information and data furnished to Owner or Engineer by the owners of such Underground Facilities, including Owner, or by others. Unless it is otherwise expressly provided in the Supplementary Conditions:

1. Owner and Engineer do not warrant or guarantee the accuracy or completeness of any such information or data provided by others; and

2. the cost of all of the following will be included in the Contract Price, and Contractor shall have full responsibility for:

a. reviewing and checking all information and data regarding existing Underground Facilities at the Site;

b. locating all Underground Facilities shown or indicated in the Contract Documents as being at the Site;

c. coordination of the Work with the owners (including Owner) of such Underground Facilities, during construction; and

d. the safety and protection of all existing Underground Facilities at the Site, and repairing any damage thereto resulting from the Work.

B. *Notice by Contractor*: If Contractor believes that an Underground Facility that is uncovered or revealed at the Site was not shown or indicated in the Contract Documents, or was not shown or indicated with reasonable accuracy, then Contractor shall, promptly after

becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency as required by Paragraph 7.15), identify the owner of such Underground Facility and give written notice to that owner and to Owner and Engineer.

C. *Engineer's Review*: Engineer will promptly review the Underground Facility and conclude whether such Underground Facility was not shown or indicated in the Contract Documents, or was not shown or indicated with reasonable accuracy; obtain any pertinent cost or schedule information from Contractor; prepare recommendations to Owner regarding the Contractor's resumption of Work in connection with the Underground Facility in question; determine the extent, if any, to which a change is required in the Drawings or Specifications to reflect and document the consequences of the existence or location of the Underground Facility; and advise Owner in writing of Engineer's findings, conclusions, and recommendations. During such time, Contractor shall be responsible for the safety and protection of such Underground Facility.

D. *Owner's Statement to Contractor Regarding Underground Facility*: After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the Underground Facility in question, addressing the resumption of Work in connection with such Underground Facility, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations in whole or in part.

E. *Possible Price and Times Adjustments*:

1. Contractor shall be entitled to an equitable adjustment in the Contract Price or Contract Times, or both, to the extent that any existing Underground Facility at the Site that was not shown or indicated in the Contract Documents, or was not shown or indicated with reasonable accuracy, or any related delay, disruption, or interference, causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:

    a. Contractor did not know of and could not reasonably have been expected to be aware of or to have anticipated the existence or actual location of the Underground Facility in question;

    b. With respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraph 13.03;

    c. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times; and

    d. Contractor gave the notice required in Paragraph 5.05.B.

2. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, or both, then any such adjustment shall be set forth in a Change Order.

3. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, or both, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the Underground Facility in question.

5.06 *Hazardous Environmental Conditions at Site*

A. *Reports and Drawings*: The Supplementary Conditions identify:

1. those reports and drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site; and

2. Technical Data contained in such reports and drawings.

B. *Reliance by Contractor on Technical Data Authorized*: Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely on the accuracy of the Technical Data (as defined in Article 1) contained in any geotechnical or environmental report prepared for the Project and made available to Contractor. Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors with respect to:

1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences and procedures of construction to be employed by Contractor and safety precautions and programs incident thereto; or

2. other data, interpretations, opinions and information contained in such reports or shown or indicated in such drawings; or

3. any Contractor interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions or information.

C. Contractor shall not be responsible for removing or remediating any Hazardous Environmental Condition encountered, uncovered, or revealed at the Site unless such removal or remediation is expressly identified in the Contract Documents to be within the scope of the Work.

D. Contractor shall be responsible for controlling, containing, and duly removing all Constituents of Concern brought to the Site by Contractor, Subcontractors, Suppliers, or anyone else for whom Contractor is responsible, and for any associated costs; and for the costs of removing and remediating any Hazardous Environmental Condition created by the presence of any such Constituents of Concern.

E. If Contractor encounters, uncovers, or reveals a Hazardous Environmental Condition whose removal or remediation is not expressly identified in the Contract Documents as being within the scope of the Work, or if Contractor or anyone for whom Contractor is responsible creates a Hazardous Environmental Condition, then Contractor shall immediately: (1) secure or otherwise isolate such condition; (2) stop all Work in connection with such condition and in any area affected thereby (except in an emergency as required by Paragraph 7.15); and (3) notify Owner and Engineer (and promptly thereafter confirm such notice in writing). Owner shall promptly consult with Engineer concerning the necessity for Owner to retain a qualified expert to evaluate such condition or take corrective action, if any. Promptly after consulting with Engineer, Owner shall take such actions as are necessary to permit Owner to timely obtain required permits and provide Contractor the written notice required by Paragraph 5.06.F. If Contractor or anyone for whom Contractor is responsible created the Hazardous Environmental Condition in question, then Owner may remove and remediate the Hazardous Environmental Condition, and impose a set-off against payments to account for the associated costs.

F. Contractor shall not resume Work in connection with such Hazardous Environmental Condition or in any affected area until after Owner has obtained any required permits related thereto, and delivered written notice to Contractor either (1) specifying that such condition and any affected area is or has been rendered safe for the resumption of Work, or (2) specifying any special conditions under which such Work may be resumed safely.

G. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times, or both, as a result of such Work stoppage or such special conditions under which Work is agreed to be resumed by Contractor, then within 30 days of Owner's written notice regarding the resumption of Work, Contractor may submit a Change Proposal, or Owner may impose a set-off.

H. If after receipt of such written notice Contractor does not agree to resume such Work based on a reasonable belief it is unsafe, or does not agree to resume such Work under such special conditions, then Owner may order the portion of the Work that is in the area affected by such condition to be deleted from the Work, following the contractual change procedures in Article 11. Owner may have such deleted portion of the Work performed by Owner's own forces or others in accordance with Article 8.

I. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition, provided that such Hazardous Environmental Condition (1) was not shown or indicated in the Drawings, Specifications, or other Contract Documents, identified as Technical Data entitled to limited reliance pursuant to Paragraph 5.06.B, or identified in the Contract Documents to be included within the scope of the Work, and (2) was not created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.I shall obligate Owner to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

J. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the failure to control, contain, or remove a Constituent of Concern brought to the Site by Contractor or by anyone for whom Contractor is responsible, or to a Hazardous Environmental Condition created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.J shall obligate Contractor to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

K. The provisions of Paragraphs 5.03, 5.04, and 5.05 do not apply to the presence of Constituents of Concern or to a Hazardous Environmental Condition uncovered or revealed at the Site.

ARTICLE 6 – BONDS AND INSURANCE

6.01 *Performance, Payment, and Other Bonds*

A. Contractor shall furnish a performance bond and a payment bond, each in an amount at least equal to the Contract Price, as security for the faithful performance and payment of all of Contractor's obligations under the Contract. These bonds shall remain in effect until one year after the date when final payment becomes due or until completion of the correction period specified in Paragraph 15.08, whichever is later, except as provided otherwise by Laws or Regulations, the Supplementary Conditions, or other specific provisions of the Contract. Contractor shall also furnish such other bonds as are required by the Supplementary Conditions or other specific provisions of the Contract.

B. All bonds shall be in the form prescribed by the Contract except as provided otherwise by Laws or Regulations, and shall be executed by such sureties as are named in "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Circular 570 (as amended and supplemented) by the Financial Management Service, Surety Bond Branch, U.S. Department of the Treasury. A bond signed by an agent or attorney-in-fact must be accompanied by a certified copy of that individual's authority to bind the surety. The evidence of authority shall show that it is effective on the date the agent or attorney-in-fact signed the accompanying bond.

C. Contractor shall obtain the required bonds from surety companies that are duly licensed or authorized in the jurisdiction in which the Project is located to issue bonds in the required amounts.

D. If the surety on a bond furnished by Contractor is declared bankrupt or becomes insolvent, or its right to do business is terminated in any state or jurisdiction where any part of the Project is located, or the surety ceases to meet the requirements above, then Contractor shall promptly notify Owner and Engineer and shall, within 20 days after the event giving rise to such notification, provide another bond and surety, both of which shall comply with the bond and surety requirements above.

E. If Contractor has failed to obtain a required bond, Owner may exclude the Contractor from the Site and exercise Owner's termination rights under Article 16.

F. Upon request, Owner shall provide a copy of the payment bond to any Subcontractor, Supplier, or other person or entity claiming to have furnished labor or materials used in the performance of the Work.

6.02 *Insurance—General Provisions*

A. Owner and Contractor shall obtain and maintain insurance as required in this Article and in the Supplementary Conditions.

B. All insurance required by the Contract to be purchased and maintained by Owner or Contractor shall be obtained from insurance companies that are duly licensed or authorized, in the state or jurisdiction in which the Project is located, to issue insurance policies for the required limits and coverages. Unless a different standard is indicated in the Supplementary Conditions, all companies that provide insurance policies required under this Contract shall have an A.M. Best rating of A-VII or better.

C. Contractor shall deliver to Owner, with copies to each named insured and additional insured (as identified in this Article, in the Supplementary Conditions, or elsewhere in the Contract), certificates of insurance establishing that Contractor has obtained and is

maintaining the policies, coverages, and endorsements required by the Contract. Upon request by Owner or any other insured, Contractor shall also furnish other evidence of such required insurance, including but not limited to copies of policies and endorsements, and documentation of applicable self-insured retentions and deductibles. Contractor may block out (redact) any confidential premium or pricing information contained in any policy or endorsement furnished under this provision.

D. Owner shall deliver to Contractor, with copies to each named insured and additional insured (as identified in this Article, the Supplementary Conditions, or elsewhere in the Contract), certificates of insurance establishing that Owner has obtained and is maintaining the policies, coverages, and endorsements required of Owner by the Contract (if any). Upon request by Contractor or any other insured, Owner shall also provide other evidence of such required insurance (if any), including but not limited to copies of policies and endorsements, and documentation of applicable self-insured retentions and deductibles. Owner may block out (redact) any confidential premium or pricing information contained in any policy or endorsement furnished under this provision.

E. Failure of Owner or Contractor to demand such certificates or other evidence of the other party's full compliance with these insurance requirements, or failure of Owner or Contractor to identify a deficiency in compliance from the evidence provided, shall not be construed as a waiver of the other party's obligation to obtain and maintain such insurance.

F. If either party does not purchase or maintain all of the insurance required of such party by the Contract, such party shall notify the other party in writing of such failure to purchase prior to the start of the Work, or of such failure to maintain prior to any change in the required coverage.

G. If Contractor has failed to obtain and maintain required insurance, Owner may exclude the Contractor from the Site, impose an appropriate set-off against payment, and exercise Owner's termination rights under Article 16.

H. Without prejudice to any other right or remedy, if a party has failed to obtain required insurance, the other party may elect to obtain equivalent insurance to protect such other party's interests at the expense of the party who was required to provide such coverage, and the Contract Price shall be adjusted accordingly.

I. Owner does not represent that insurance coverage and limits established in this Contract necessarily will be adequate to protect Contractor or Contractor's interests.

J. The insurance and insurance limits required herein shall not be deemed as a limitation on Contractor's liability under the indemnities granted to Owner and other individuals and entities in the Contract.

6.03 *Contractor's Insurance*

A. *Workers' Compensation*: Contractor shall purchase and maintain workers' compensation and employer's liability insurance for:

1. claims under workers' compensation, disability benefits, and other similar employee benefit acts.

2. United States Longshoreman and Harbor Workers' Compensation Act and Jones Act coverage (if applicable).

3. claims for damages because of bodily injury, occupational sickness or disease, or death of Contractor's employees (by stop-gap endorsement in monopolist worker's compensation states).

4. Foreign voluntary worker compensation (if applicable).

B. *Commercial General Liability—Claims Covered*: Contractor shall purchase and maintain commercial general liability insurance, covering all operations by or on behalf of Contractor, on an occurrence basis, against:

1. claims for damages because of bodily injury, sickness or disease, or death of any person other than Contractor's employees.

2. claims for damages insured by reasonably available personal injury liability coverage.

3. claims for damages, other than to the Work itself, because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom.

C. *Commercial General Liability—Form and Content*: Contractor's commercial liability policy shall be written on a 1996 (or later) ISO commercial general liability form (occurrence form) and include the following coverages and endorsements:

1. Products and completed operations coverage:

a. Such insurance shall be maintained for three years after final payment.

b. Contractor shall furnish Owner and each other additional insured (as identified in the Supplementary Conditions or elsewhere in the Contract) evidence of continuation of such insurance at final payment and three years thereafter.

2. Blanket contractual liability coverage, to the extent permitted by law, including but not limited to coverage of Contractor's contractual indemnity obligations in Paragraph 7.18.

3. Broad form property damage coverage.

4. Severability of interest.

5. Underground, explosion, and collapse coverage.

6. Personal injury coverage.

7. Additional insured endorsements that include both ongoing operations and products and completed operations coverage through ISO Endorsements CG 20 10 10 01 and CG 20 37 10 01 (together); or CG 20 10 07 04 and CG 20 37 07 04 (together); or their equivalent.

8. For design professional additional insureds, ISO Endorsement CG 20 32 07 04, "Additional Insured—Engineers, Architects or Surveyors Not Engaged by the Named Insured" or its equivalent.

D. *Automobile liability*: Contractor shall purchase and maintain automobile liability insurance against claims for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance, or use of any motor vehicle. The automobile liability policy shall be written on an occurrence basis.

E. *Umbrella or excess liability*: Contractor shall purchase and maintain umbrella or excess liability insurance written over the underlying employer's liability, commercial general liability, and automobile liability insurance described in the paragraphs above. Subject to industry-standard exclusions, the coverage afforded shall follow form as to each and every one of the underlying policies.

F. *Contractor's pollution liability insurance*: Contractor shall purchase and maintain a policy covering third-party injury and property damage claims, including clean-up costs, as a result

of pollution conditions arising from Contractor's operations and completed operations. This insurance shall be maintained for no less than three years after final completion.

G. *Additional insureds*: The Contractor's commercial general liability, automobile liability, umbrella or excess, and pollution liability policies shall include and list as additional insureds Owner and Engineer, and any individuals or entities identified in the Supplementary Conditions; include coverage for the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of all such additional insureds; and the insurance afforded to these additional insureds shall provide primary coverage for all claims covered thereby (including as applicable those arising from both ongoing and completed operations) on a non-contributory basis. Contractor shall obtain all necessary endorsements to support these requirements.

H. *Contractor's professional liability insurance*: If Contractor will provide or furnish professional services under this Contract, through a delegation of professional design services or otherwise, then Contractor shall be responsible for purchasing and maintaining applicable professional liability insurance. This insurance shall provide protection against claims arising out of performance of professional design or related services, and caused by a negligent error, omission, or act for which the insured party is legally liable. It shall be maintained throughout the duration of the Contract and for a minimum of two years after Substantial Completion. If such professional design services are performed by a Subcontractor, and not by Contractor itself, then the requirements of this paragraph may be satisfied through the purchasing and maintenance of such insurance by such Subcontractor.

I. *General provisions*: The policies of insurance required by this Paragraph 6.03 shall:

1. include at least the specific coverages provided in this Article.

2. be written for not less than the limits of liability provided in this Article and in the Supplementary Conditions, or required by Laws or Regulations, whichever is greater.

3. contain a provision or endorsement that the coverage afforded will not be canceled, materially changed, or renewal refused until at least 10 days prior written notice has been given to Contractor. Within three days of receipt of any such written notice, Contractor shall provide a copy of the notice to Owner, Engineer, and each other insured under the policy.

4. remain in effect at least until final payment (and longer if expressly required in this Article) and at all times thereafter when Contractor may be correcting, removing, or replacing defective Work as a warranty or correction obligation, or otherwise, or returning to the Site to conduct other tasks arising from the Contract Documents.

5. be appropriate for the Work being performed and provide protection from claims that may arise out of or result from Contractor's performance of the Work and Contractor's other obligations under the Contract Documents, whether it is to be performed by Contractor, any Subcontractor or Supplier, or by anyone directly or indirectly employed by any of them to perform any of the Work, or by anyone for whose acts any of them may be liable.

J. The coverage requirements for specific policies of insurance must be met by such policies, and not by reference to excess or umbrella insurance provided in other policies.

6.04 *Owner's Liability Insurance*

A. In addition to the insurance required to be provided by Contractor under Paragraph 6.03, Owner, at Owner's option, may purchase and maintain at Owner's expense Owner's own liability insurance as will protect Owner against claims which may arise from operations under the Contract Documents.

B. Owner's liability policies, if any, operate separately and independently from policies required to be provided by Contractor, and Contractor cannot rely upon Owner's liability policies for any of Contractor's obligations to the Owner, Engineer, or third parties.

6.05 *Property Insurance*

A. *Builder's Risk*: Unless otherwise provided in the Supplementary Conditions, Contractor shall purchase and maintain builder's risk insurance upon the Work on a completed value basis, in the amount of the full insurable replacement cost thereof (subject to such deductible amounts as may be provided in the Supplementary Conditions or required by Laws and Regulations). This insurance shall:

1. include the Owner and Contractor as named insureds, and all Subcontractors, and any individuals or entities required by the Supplementary Conditions to be insured under such builder's risk policy, as insureds or named insureds. For purposes of the remainder of this Paragraph 6.05, Paragraphs 6.06 and 6.07, and any corresponding Supplementary Conditions, the parties required to be insured shall collectively be referred to as "insureds."

2. be written on a builder's risk "all risk" policy form that shall at least include insurance for physical loss or damage to the Work, temporary buildings, falsework, and materials and equipment in transit, and shall insure against at least the following perils or causes of loss: fire; lightning; windstorm; riot; civil commotion; terrorism; vehicle impact; aircraft; smoke; theft; vandalism and malicious mischief; mechanical breakdown, boiler explosion, and artificially generated electric current; earthquake; volcanic activity, and other earth movement; flood; collapse; explosion; debris removal; demolition occasioned by enforcement of Laws and Regulations; water damage (other than that caused by flood); and such other perils or causes of loss as may be specifically required by the Supplementary Conditions. If insurance against mechanical breakdown, boiler explosion, and artificially generated electric current; earthquake; volcanic activity, and other earth movement; or flood, are not commercially available under builder's risk policies, by endorsement or otherwise, such insurance may be provided through other insurance policies acceptable to Owner and Contractor.

3. cover, as insured property, at least the following: (a) the Work and all materials, supplies, machinery, apparatus, equipment, fixtures, and other property of a similar nature that are to be incorporated into or used in the preparation, fabrication, construction, erection, or completion of the Work, including Owner-furnished or assigned property; (b) spare parts inventory required within the scope of the Contract; and (c) temporary works which are not intended to form part of the permanent constructed Work but which are intended to provide working access to the Site, or to the Work under construction, or which are intended to provide temporary support for the Work under construction, including scaffolding, form work, fences, shoring, falsework, and temporary structures.

4. cover expenses incurred in the repair or replacement of any insured property (including but not limited to fees and charges of engineers and architects).

5. extend to cover damage or loss to insured property while in temporary storage at the Site or in a storage location outside the Site (but not including property stored at the premises of a manufacturer or Supplier).

6. extend to cover damage or loss to insured property while in transit.

7. allow for partial occupation or use of the Work by Owner, such that those portions of the Work that are not yet occupied or used by Owner shall remain covered by the builder's risk insurance.

8. allow for the waiver of the insurer's subrogation rights, as set forth below.

9. provide primary coverage for all losses and damages caused by the perils or causes of loss covered.

10. not include a co-insurance clause.

11. include an exception for ensuing losses from physical damage or loss with respect to any defective workmanship, design, or materials exclusions.

12. include performance/hot testing and start-up.

13. be maintained in effect, subject to the provisions herein regarding Substantial Completion and partial occupancy or use of the Work by Owner, until the Work is complete.

B. *Notice of Cancellation or Change*: All the policies of insurance (and the certificates or other evidence thereof) required to be purchased and maintained in accordance with this Paragraph 6.05 will contain a provision or endorsement that the coverage afforded will not be canceled or materially changed or renewal refused until at least 10 days prior written notice has been given to the purchasing policyholder. Within three days of receipt of any such written notice, the purchasing policyholder shall provide a copy of the notice to each other insured.

C. *Deductibles*: The purchaser of any required builder's risk or property insurance shall pay for costs not covered because of the application of a policy deductible.

D. *Partial Occupancy or Use by Owner*: If Owner will occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work as provided in Paragraph 15.04, then Owner (directly, if it is the purchaser of the builder's risk policy, or through Contractor) will provide notice of such occupancy or use to the builder's risk insurer. The builder's risk insurance shall not be canceled or permitted to lapse on account of any such partial use or occupancy; rather, those portions of the Work that are occupied or used by Owner may come off the builder's risk policy, while those portions of the Work not yet occupied or used by Owner shall remain covered by the builder's risk insurance.

E. *Additional Insurance*: If Contractor elects to obtain other special insurance to be included in or supplement the builder's risk or property insurance policies provided under this Paragraph 6.05, it may do so at Contractor's expense.

F. *Insurance of Other Property*: If the express insurance provisions of the Contract do not require or address the insurance of a property item or interest, such as tools, construction equipment, or other personal property owned by Contractor, a Subcontractor, or an employee of Contractor or a Subcontractor, then the entity or individual owning such property item will be responsible for deciding whether to insure it, and if so in what amount.

6.06 *Waiver of Rights*

A. All policies purchased in accordance with Paragraph 6.05, expressly including the builder's risk policy, shall contain provisions to the effect that in the event of payment of any loss or damage the insurers will have no rights of recovery against any insureds thereunder, or against Engineer or its consultants, or their officers, directors, members, partners, employees, agents, consultants, or subcontractors. Owner and Contractor waive all rights against each other and the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, or resulting from any of the perils or causes of loss covered by such policies and any other property insurance applicable to the Work; and, in addition, waive all such rights against Engineer, its consultants, all Subcontractors, all individuals or entities identified in the Supplementary Conditions as insureds, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, under such policies for losses and damages so caused. None of the above waivers shall extend to the rights that any party making such waiver may have to the proceeds of insurance held by Owner or Contractor as trustee or fiduciary, or otherwise payable under any policy so issued.

B. Owner waives all rights against Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, for:

1. loss due to business interruption, loss of use, or other consequential loss extending beyond direct physical loss or damage to Owner's property or the Work caused by, arising out of, or resulting from fire or other perils whether or not insured by Owner; and

2. loss or damage to the completed Project or part thereof caused by, arising out of, or resulting from fire or other insured peril or cause of loss covered by any property insurance maintained on the completed Project or part thereof by Owner during partial occupancy or use pursuant to Paragraph 15.04, after Substantial Completion pursuant to Paragraph 15.03, or after final payment pursuant to Paragraph 15.06.

C. Any insurance policy maintained by Owner covering any loss, damage or consequential loss referred to in Paragraph 6.06.B shall contain provisions to the effect that in the event of payment of any such loss, damage, or consequential loss, the insurers will have no rights of recovery against Contractor, Subcontractors, or Engineer, or the officers, directors, members, partners, employees, agents, consultants, or subcontractors of each and any of them.

D. Contractor shall be responsible for assuring that the agreement under which a Subcontractor performs a portion of the Work contains provisions whereby the Subcontractor waives all rights against Owner, Contractor, all individuals or entities identified in the Supplementary Conditions as insureds, the Engineer and its consultants, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, relating to, or resulting from any of the perils or causes of loss covered by builder's risk insurance and any other property insurance applicable to the Work.

6.07 *Receipt and Application of Property Insurance Proceeds*

A. Any insured loss under the builder's risk and other policies of insurance required by Paragraph 6.05 will be adjusted and settled with the named insured that purchased the

policy. Such named insured shall act as fiduciary for the other insureds, and give notice to such other insureds that adjustment and settlement of a claim is in progress. Any other insured may state its position regarding a claim for insured loss in writing within 15 days after notice of such claim.

B. Proceeds for such insured losses may be made payable by the insurer either jointly to multiple insureds, or to the named insured that purchased the policy in its own right and as fiduciary for other insureds, subject to the requirements of any applicable mortgage clause. A named insured receiving insurance proceeds under the builder's risk and other policies of insurance required by Paragraph 6.05 shall distribute such proceeds in accordance with such agreement as the parties in interest may reach, or as otherwise required under the dispute resolution provisions of this Contract or applicable Laws and Regulations.

C. If no other special agreement is reached, the damaged Work shall be repaired or replaced, the money so received applied on account thereof, and the Work and the cost thereof covered by Change Order, if needed.

ARTICLE 7 – CONTRACTOR'S RESPONSIBILITIES

7.01 *Supervision and Superintendence*

A. Contractor shall supervise, inspect, and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents. Contractor shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction.

B. At all times during the progress of the Work, Contractor shall assign a competent resident superintendent who shall not be replaced without written notice to Owner and Engineer except under extraordinary circumstances.

7.02 *Labor; Working Hours*

A. Contractor shall provide competent, suitably qualified personnel to survey and lay out the Work and perform construction as required by the Contract Documents. Contractor shall at all times maintain good discipline and order at the Site.

B. Except as otherwise required for the safety or protection of persons or the Work or property at the Site or adjacent thereto, and except as otherwise stated in the Contract Documents, all Work at the Site shall be performed during regular working hours, Monday through Friday. Contractor will not perform Work on a Saturday, Sunday, or any legal holiday. Contractor may perform Work outside regular working hours or on Saturdays, Sundays, or legal holidays only with Owner's written consent, which will not be unreasonably withheld.

7.03 *Services, Materials, and Equipment*

A. Unless otherwise specified in the Contract Documents, Contractor shall provide and assume full responsibility for all services, materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and all other facilities and incidentals necessary for the performance, testing, start up, and completion of the Work, whether or not such items are specifically called for in the Contract Documents.

B. All materials and equipment incorporated into the Work shall be of good quality and new, except as otherwise provided in the Contract Documents. All special warranties and

guarantees required by the Specifications shall expressly run to the benefit of Owner. If required by Engineer, Contractor shall furnish satisfactory evidence (including reports of required tests) as to the source, kind, and quality of materials and equipment.

C. All materials and equipment shall be stored, applied, installed, connected, erected, protected, used, cleaned, and conditioned in accordance with instructions of the applicable Supplier, except as otherwise may be provided in the Contract Documents.

7.04 *"Or Equals"*

A. Whenever an item of material or equipment is specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular Supplier, the Contract Price has been based upon Contractor furnishing such item as specified. The specification or description of such an item is intended to establish the type, function, appearance, and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent, or "or equal" item is permitted, Contractor may request that Engineer authorize the use of other items of material or equipment, or items from other proposed suppliers under the circumstances described below.

1. If Engineer in its sole discretion determines that an item of material or equipment proposed by Contractor is functionally equal to that named and sufficiently similar so that no change in related Work will be required, Engineer shall deem it an "or equal" item. For the purposes of this paragraph, a proposed item of material or equipment will be considered functionally equal to an item so named if:

a. in the exercise of reasonable judgment Engineer determines that:

1) it is at least equal in materials of construction, quality, durability, appearance, strength, and design characteristics;

2) it will reliably perform at least equally well the function and achieve the results imposed by the design concept of the completed Project as a functioning whole;

3) it has a proven record of performance and availability of responsive service; and

4) it is not objectionable to Owner.

b. Contractor certifies that, if approved and incorporated into the Work:

1) there will be no increase in cost to the Owner or increase in Contract Times; and

2) it will conform substantially to the detailed requirements of the item named in the Contract Documents.

B. *Contractor's Expense*: Contractor shall provide all data in support of any proposed "or equal" item at Contractor's expense.

C. *Engineer's Evaluation and Determination*: Engineer will be allowed a reasonable time to evaluate each "or-equal" request. Engineer may require Contractor to furnish additional data about the proposed "or-equal" item. Engineer will be the sole judge of acceptability. No "or-equal" item will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an "or-equal", which will be evidenced by an approved Shop Drawing or other written communication. Engineer will advise Contractor in writing of any negative determination.

D. *Effect of Engineer's Determination*: Neither approval nor denial of an "or-equal" request shall result in any change in Contract Price. The Engineer's denial of an "or-equal" request shall be final and binding, and may not be reversed through an appeal under any provision of the Contract Documents.

E. *Treatment as a Substitution Request*: If Engineer determines that an item of material or equipment proposed by Contractor does not qualify as an "or-equal" item, Contractor may request that Engineer considered the proposed item as a substitute pursuant to Paragraph 7.05.

7.05 *Substitutes*

A. Unless the specification or description of an item of material or equipment required to be furnished under the Contract Documents contains or is followed by words reading that no substitution is permitted, Contractor may request that Engineer authorize the use of other items of material or equipment under the circumstances described below. To the extent possible such requests shall be made before commencement of related construction at the Site.

1. Contractor shall submit sufficient information as provided below to allow Engineer to determine if the item of material or equipment proposed is functionally equivalent to that named and an acceptable substitute therefor. Engineer will not accept requests for review of proposed substitute items of material or equipment from anyone other than Contractor.

2. The requirements for review by Engineer will be as set forth in Paragraph 7.05.B, as supplemented by the Specifications, and as Engineer may decide is appropriate under the circumstances.

3. Contractor shall make written application to Engineer for review of a proposed substitute item of material or equipment that Contractor seeks to furnish or use. The application:

a. shall certify that the proposed substitute item will:

1) perform adequately the functions and achieve the results called for by the general design,

2) be similar in substance to that specified, and

3) be suited to the same use as that specified.

b. will state:

1) the extent, if any, to which the use of the proposed substitute item will necessitate a change in Contract Times,

2) whether use of the proposed substitute item in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with Owner for other work on the Project) to adapt the design to the proposed substitute item, and

3) whether incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty.

c. will identify:

1) all variations of the proposed substitute item from that specified, and

2) available engineering, sales, maintenance, repair, and replacement services.

d. shall contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including but not limited to changes in Contract Price, shared savings, costs of redesign, and claims of other contractors affected by any resulting change.

B. *Engineer's Evaluation and Determination*: Engineer will be allowed a reasonable time to evaluate each substitute request, and to obtain comments and direction from Owner. Engineer may require Contractor to furnish additional data about the proposed substitute item. Engineer will be the sole judge of acceptability. No substitute will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an acceptable substitute. Engineer's determination will be evidenced by a Field Order or a proposed Change Order accounting for the substitution itself and all related impacts, including changes in Contract Price or Contract Times. Engineer will advise Contractor in writing of any negative determination.

C. *Special Guarantee*: Owner may require Contractor to furnish at Contractor's expense a special performance guarantee or other surety with respect to any substitute.

D. *Reimbursement of Engineer's Cost*: Engineer will record Engineer's costs in evaluating a substitute proposed or submitted by Contractor. Whether or not Engineer approves a substitute so proposed or submitted by Contractor, Contractor shall reimburse Owner for the reasonable charges of Engineer for evaluating each such proposed substitute. Contractor shall also reimburse Owner for the reasonable charges of Engineer for making changes in the Contract Documents (or in the provisions of any other direct contract with Owner) resulting from the acceptance of each proposed substitute.

E. *Contractor's Expense*: Contractor shall provide all data in support of any proposed substitute at Contractor's expense.

F. *Effect of Engineer's Determination*: If Engineer approves the substitution request, Contractor shall execute the proposed Change Order and proceed with the substitution. The Engineer's denial of a substitution request shall be final and binding, and may not be reversed through an appeal under any provision of the Contract Documents. Contractor may challenge the scope of reimbursement costs imposed under Paragraph 7.05.D, by timely submittal of a Change Proposal.

7.06 *Concerning Subcontractors, Suppliers, and Others*

A. Contractor may retain Subcontractors and Suppliers for the performance of parts of the Work. Such Subcontractors and Suppliers must be acceptable to Owner.

B. Contractor shall retain specific Subcontractors, Suppliers, or other individuals or entities for the performance of designated parts of the Work if required by the Contract to do so.

C. Subsequent to the submittal of Contractor's Bid or final negotiation of the terms of the Contract, Owner may not require Contractor to retain any Subcontractor, Supplier, or other individual or entity to furnish or perform any of the Work against which Contractor has reasonable objection.

D. Prior to entry into any binding subcontract or purchase order, Contractor shall submit to Owner the identity of the proposed Subcontractor or Supplier (unless Owner has already deemed such proposed Subcontractor or Supplier acceptable, during the bidding process or otherwise). Such proposed Subcontractor or Supplier shall be deemed acceptable to Owner unless Owner raises a substantive, reasonable objection within five days.

E. Owner may require the replacement of any Subcontractor, Supplier, or other individual or entity retained by Contractor to perform any part of the Work. Owner also may require Contractor to retain specific replacements; provided, however, that Owner may not require a replacement to which Contractor has a reasonable objection. If Contractor has submitted the identity of certain Subcontractors, Suppliers, or other individuals or entities for acceptance by Owner, and Owner has accepted it (either in writing or by failing to make written objection thereto), then Owner may subsequently revoke the acceptance of any such Subcontractor, Supplier, or other individual or entity so identified solely on the basis of substantive, reasonable objection after due investigation. Contractor shall submit an acceptable replacement for the rejected Subcontractor, Supplier, or other individual or entity.

F. If Owner requires the replacement of any Subcontractor, Supplier, or other individual or entity retained by Contractor to perform any part of the Work, then Contractor shall be entitled to an adjustment in Contract Price or Contract Times, or both, with respect to the replacement; and Contractor shall initiate a Change Proposal for such adjustment within 30 days of Owner's requirement of replacement.

G. No acceptance by Owner of any such Subcontractor, Supplier, or other individual or entity, whether initially or as a replacement, shall constitute a waiver of the right of Owner to the completion of the Work in accordance with the Contract Documents.

H. On a monthly basis Contractor shall submit to Engineer a complete list of all Subcontractors and Suppliers having a direct contract with Contractor, and of all other Subcontractors and Suppliers known to Contractor at the time of submittal.

I. Contractor shall be fully responsible to Owner and Engineer for all acts and omissions of the Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work just as Contractor is responsible for Contractor's own acts and omissions.

J. Contractor shall be solely responsible for scheduling and coordinating the work of Subcontractors, Suppliers, and all other individuals or entities performing or furnishing any of the Work.

K. Contractor shall restrict all Subcontractors, Suppliers, and such other individuals or entities performing or furnishing any of the Work from communicating with Engineer or Owner, except through Contractor or in case of an emergency, or as otherwise expressly allowed herein.

L. The divisions and sections of the Specifications and the identifications of any Drawings shall not control Contractor in dividing the Work among Subcontractors or Suppliers or delineating the Work to be performed by any specific trade.

M. All Work performed for Contractor by a Subcontractor or Supplier shall be pursuant to an appropriate contractual agreement that specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract Documents for the benefit of Owner and Engineer.

N. Owner may furnish to any Subcontractor or Supplier, to the extent practicable, information about amounts paid to Contractor on account of Work performed for Contractor by the particular Subcontractor or Supplier.

O. Nothing in the Contract Documents:

1. shall create for the benefit of any such Subcontractor, Supplier, or other individual or entity any contractual relationship between Owner or Engineer and any such Subcontractor, Supplier, or other individual or entity; nor

2. shall create any obligation on the part of Owner or Engineer to pay or to see to the payment of any money due any such Subcontractor, Supplier, or other individual or entity except as may otherwise be required by Laws and Regulations.

7.07 *Patent Fees and Royalties*

A. Contractor shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product, or device which is the subject of patent rights or copyrights held by others. If a particular invention, design, process, product, or device is specified in the Contract Documents for use in the performance of the Work and if, to the actual knowledge of Owner or Engineer, its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights shall be disclosed by Owner in the Contract Documents.

B. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, and its officers, directors, members, partners, employees, agents, consultants, and subcontractors from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device specified in the Contract Documents, but not identified as being subject to payment of any license fee or royalty to others required by patent rights or copyrights.

C. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device not specified in the Contract Documents.

7.08 *Permits*

A. Unless otherwise provided in the Contract Documents, Contractor shall obtain and pay for all construction permits and licenses. Owner shall assist Contractor, when necessary, in obtaining such permits and licenses. Contractor shall pay all governmental charges and inspection fees necessary for the prosecution of the Work which are applicable at the time of the submission of Contractor's Bid (or when Contractor became bound under a negotiated contract). Owner shall pay all charges of utility owners for connections for providing permanent service to the Work

7.09 *Taxes*

A. Contractor shall pay all sales, consumer, use, and other similar taxes required to be paid by Contractor in accordance with the Laws and Regulations of the place of the Project which are applicable during the performance of the Work.

7.10 *Laws and Regulations*

A. Contractor shall give all notices required by and shall comply with all Laws and Regulations applicable to the performance of the Work. Except where otherwise expressly required by applicable Laws and Regulations, neither Owner nor Engineer shall be responsible for monitoring Contractor's compliance with any Laws or Regulations.

B. If Contractor performs any Work or takes any other action knowing or having reason to know that it is contrary to Laws or Regulations, Contractor shall bear all resulting costs and losses, and shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such Work or other action. It shall not be Contractor's responsibility to make certain that the Work described in the Contract Documents is in accordance with Laws and Regulations, but this shall not relieve Contractor of Contractor's obligations under Paragraph 3.03.

C. Owner or Contractor may give notice to the other party of any changes after the submission of Contractor's Bid (or after the date when Contractor became bound under a negotiated contract) in Laws or Regulations having an effect on the cost or time of performance of the Work, including but not limited to changes in Laws or Regulations having an effect on procuring permits and on sales, use, value-added, consumption, and other similar taxes. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times resulting from such changes, then within 30 days of such notice Contractor may submit a Change Proposal, or Owner may initiate a Claim.

7.11 *Record Documents*

A. Contractor shall maintain in a safe place at the Site one printed record copy of all Drawings, Specifications, Addenda, Change Orders, Work Change Directives, Field Orders, written interpretations and clarifications, and approved Shop Drawings. Contractor shall keep such record documents in good order and annotate them to show changes made during construction. These record documents, together with all approved Samples, will be available to Engineer for reference. Upon completion of the Work, Contractor shall deliver these record documents to Engineer.

7.12 *Safety and Protection*

A. Contractor shall be solely responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the Work. Such responsibility does not relieve Subcontractors of their responsibility for the safety of persons or property in the performance of their work, nor for compliance with applicable safety Laws and Regulations. Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury, or loss to:

1. all persons on the Site or who may be affected by the Work;

2. all the Work and materials and equipment to be incorporated therein, whether in storage on or off the Site; and

3. other property at the Site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, other work in progress, utilities, and Underground Facilities not designated for removal, relocation, or replacement in the course of construction.

B. Contractor shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss; and shall erect and maintain all necessary safeguards for such safety and protection. Contractor shall notify Owner; the owners of adjacent property, Underground Facilities, and other utilities; and other contractors and utility owners performing work at or adjacent to the Site, when prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property or work in progress.

C. Contractor shall comply with the applicable requirements of Owner's safety programs, if any. The Supplementary Conditions identify any Owner's safety programs that are applicable to the Work.

D. Contractor shall inform Owner and Engineer of the specific requirements of Contractor's safety program with which Owner's and Engineer's employees and representatives must comply while at the Site.

E. All damage, injury, or loss to any property referred to in Paragraph 7.12.A.2 or 7.12.A.3 caused, directly or indirectly, in whole or in part, by Contractor, any Subcontractor, Supplier, or any other individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, shall be remedied by Contractor at its expense (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of Owner or Engineer or anyone employed by any of them, or anyone for whose acts any of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of Contractor or any Subcontractor, Supplier, or other individual or entity directly or indirectly employed by any of them).

F. Contractor's duties and responsibilities for safety and protection shall continue until such time as all the Work is completed and Engineer has issued a notice to Owner and Contractor in accordance with Paragraph 15.06.B that the Work is acceptable (except as otherwise expressly provided in connection with Substantial Completion).

G. Contractor's duties and responsibilities for safety and protection shall resume whenever Contractor or any Subcontractor or Supplier returns to the Site to fulfill warranty or correction obligations, or to conduct other tasks arising from the Contract Documents.

7.13 *Safety Representative*

A. Contractor shall designate a qualified and experienced safety representative at the Site whose duties and responsibilities shall be the prevention of accidents and the maintaining and supervising of safety precautions and programs.

7.14 *Hazard Communication Programs*

A. Contractor shall be responsible for coordinating any exchange of material safety data sheets or other hazard communication information required to be made available to or

exchanged between or among employers at the Site in accordance with Laws or Regulations.

7.15 *Emergencies*

A. In emergencies affecting the safety or protection of persons or the Work or property at the Site or adjacent thereto, Contractor is obligated to act to prevent threatened damage, injury, or loss. Contractor shall give Engineer prompt written notice if Contractor believes that any significant changes in the Work or variations from the Contract Documents have been caused thereby or are required as a result thereof. If Engineer determines that a change in the Contract Documents is required because of the action taken by Contractor in response to such an emergency, a Work Change Directive or Change Order will be issued.

7.16 *Shop Drawings, Samples, and Other Submittals*

A. *Shop Drawing and Sample Submittal Requirements*:

1. Before submitting a Shop Drawing or Sample, Contractor shall have:

a. reviewed and coordinated the Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents;

b. determined and verified all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect thereto;

c. determined and verified the suitability of all materials and equipment offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and

d. determined and verified all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto.

2. Each submittal shall bear a stamp or specific written certification that Contractor has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review of that submittal, and that Contractor approves the submittal.

3. With each submittal, Contractor shall give Engineer specific written notice of any variations that the Shop Drawing or Sample may have from the requirements of the Contract Documents. This notice shall be set forth in a written communication separate from the Shop Drawings or Sample submittal; and, in addition, in the case of Shop Drawings by a specific notation made on each Shop Drawing submitted to Engineer for review and approval of each such variation.

B. *Submittal Procedures for Shop Drawings and Samples*: Contractor shall submit Shop Drawings and Samples to Engineer for review and approval in accordance with the accepted Schedule of Submittals. Each submittal will be identified as Engineer may require.

1. *Shop Drawings*:

a. Contractor shall submit the number of copies required in the Specifications.

b. Data shown on the Shop Drawings will be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show Engineer the services, materials, and equipment Contractor proposes to

provide and to enable Engineer to review the information for the limited purposes required by Paragraph 7.16.D.

2. *Samples*:

   a. Contractor shall submit the number of Samples required in the Specifications.

   b. Contractor shall clearly identify each Sample as to material, Supplier, pertinent data such as catalog numbers, the use for which intended and other data as Engineer may require to enable Engineer to review the submittal for the limited purposes required by Paragraph 7.16.D.

3. Where a Shop Drawing or Sample is required by the Contract Documents or the Schedule of Submittals, any related Work performed prior to Engineer's review and approval of the pertinent submittal will be at the sole expense and responsibility of Contractor.

C. *Other Submittals*: Contractor shall submit other submittals to Engineer in accordance with the accepted Schedule of Submittals, and pursuant to the applicable terms of the Specifications.

D. *Engineer's Review*:

1. Engineer will provide timely review of Shop Drawings and Samples in accordance with the Schedule of Submittals acceptable to Engineer. Engineer's review and approval will be only to determine if the items covered by the submittals will, after installation or incorporation in the Work, conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.

2. Engineer's review and approval will not extend to means, methods, techniques, sequences, or procedures of construction or to safety precautions or programs incident thereto.

3. Engineer's review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

4. Engineer's review and approval of a Shop Drawing or Sample shall not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has complied with the requirements of Paragraph 7.16.A.3 and Engineer has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample. Engineer will document any such approved variation from the requirements of the Contract Documents in a Field Order.

5. Engineer's review and approval of a Shop Drawing or Sample shall not relieve Contractor from responsibility for complying with the requirements of Paragraph 7.16.A and B.

6. Engineer's review and approval of a Shop Drawing or Sample, or of a variation from the requirements of the Contract Documents, shall not, under any circumstances, change the Contract Times or Contract Price, unless such changes are included in a Change Order.

7. Neither Engineer's receipt, review, acceptance or approval of a Shop Drawing, Sample, or other submittal shall result in such item becoming a Contract Document.

8. Contractor shall perform the Work in compliance with the requirements and commitments set forth in approved Shop Drawings and Samples, subject to the provisions of Paragraph 7.16.D.4.

E. *Resubmittal Procedures*:

1. Contractor shall make corrections required by Engineer and shall return the required number of corrected copies of Shop Drawings and submit, as required, new Samples for review and approval. Contractor shall direct specific attention in writing to revisions other than the corrections called for by Engineer on previous submittals.

2. Contractor shall furnish required submittals with sufficient information and accuracy to obtain required approval of an item with no more than three submittals. Engineer will record Engineer's time for reviewing a fourth or subsequent submittal of a Shop Drawings, sample, or other item requiring approval, and Contractor shall be responsible for Engineer's charges to Owner for such time. Owner may impose a set-off against payments due to Contractor to secure reimbursement for such charges.

3. If Contractor requests a change of a previously approved submittal item, Contractor shall be responsible for Engineer's charges to Owner for its review time, and Owner may impose a set-off against payments due to Contractor to secure reimbursement for such charges, unless the need for such change is beyond the control of Contractor.

7.17 *Contractor's General Warranty and Guarantee*

A. Contractor warrants and guarantees to Owner that all Work will be in accordance with the Contract Documents and will not be defective. Engineer and its officers, directors, members, partners, employees, agents, consultants, and subcontractors shall be entitled to rely on Contractor's warranty and guarantee.

B. Contractor's warranty and guarantee hereunder excludes defects or damage caused by:

1. abuse, modification, or improper maintenance or operation by persons other than Contractor, Subcontractors, Suppliers, or any other individual or entity for whom Contractor is responsible; or

2. normal wear and tear under normal usage.

C. Contractor's obligation to perform and complete the Work in accordance with the Contract Documents shall be absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents or a release of Contractor's obligation to perform the Work in accordance with the Contract Documents:

1. observations by Engineer;

2. recommendation by Engineer or payment by Owner of any progress or final payment;

3. the issuance of a certificate of Substantial Completion by Engineer or any payment related thereto by Owner;

4. use or occupancy of the Work or any part thereof by Owner;

5. any review and approval of a Shop Drawing or Sample submittal;

6. the issuance of a notice of acceptability by Engineer;

7. any inspection, test, or approval by others; or

8. any correction of defective Work by Owner.

D. If the Contract requires the Contractor to accept the assignment of a contract entered into by Owner, then the specific warranties, guarantees, and correction obligations contained in the assigned contract shall govern with respect to Contractor's performance obligations to Owner for the Work described in the assigned contract.

7.18 *Indemnification*

A. To the fullest extent permitted by Laws and Regulations, and in addition to any other obligations of Contractor under the Contract or otherwise, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the performance of the Work, provided that any such claim, cost, loss, or damage is attributable to bodily injury, sickness, disease, or death, or to injury to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom but only to the extent caused by any negligent act or omission of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work or anyone for whose acts any of them may be liable.

B. In any and all claims against Owner or Engineer or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors by any employee (or the survivor or personal representative of such employee) of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, the indemnification obligation under Paragraph 7.18.A shall not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for Contractor or any such Subcontractor, Supplier, or other individual or entity under workers' compensation acts, disability benefit acts, or other employee benefit acts.

C. The indemnification obligations of Contractor under Paragraph 7.18.A shall not extend to the liability of Engineer and Engineer's officers, directors, members, partners, employees, agents, consultants and subcontractors arising out of:

1. the preparation or approval of, or the failure to prepare or approve maps, Drawings, opinions, reports, surveys, Change Orders, designs, or Specifications; or

2. giving directions or instructions, or failing to give them, if that is the primary cause of the injury or damage.

7.19 *Delegation of Professional Design Services*

A. Contractor will not be required to provide professional design services unless such services are specifically required by the Contract Documents for a portion of the Work or unless such services are required to carry out Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. Contractor shall not be required to provide professional services in violation of applicable Laws and Regulations.

B. If professional design services or certifications by a design professional related to systems, materials, or equipment are specifically required of Contractor by the Contract Documents, Owner and Engineer will specify all performance and design criteria that such services must satisfy. Contractor shall cause such services or certifications to be provided by a properly licensed professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, and other submittals prepared by such professional. Shop

Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to Engineer.

C. Owner and Engineer shall be entitled to rely upon the adequacy, accuracy, and completeness of the services, certifications, or approvals performed by such design professionals, provided Owner and Engineer have specified to Contractor all performance and design criteria that such services must satisfy.

D. Pursuant to this paragraph, Engineer's review and approval of design calculations and design drawings will be only for the limited purpose of checking for conformance with performance and design criteria given and the design concept expressed in the Contract Documents. Engineer's review and approval of Shop Drawings and other submittals (except design calculations and design drawings) will be only for the purpose stated in Paragraph 7.16.D.1.

E. Contractor shall not be responsible for the adequacy of the performance or design criteria specified by Owner or Engineer.

ARTICLE 8 – OTHER WORK AT THE SITE

8.01 *Other Work*

A. In addition to and apart from the Work under the Contract Documents, the Owner may perform other work at or adjacent to the Site. Such other work may be performed by Owner's employees, or through contracts between the Owner and third parties. Owner may also arrange to have third-party utility owners perform work on their utilities and facilities at or adjacent to the Site.

B. If Owner performs other work at or adjacent to the Site with Owner's employees, or through contracts for such other work, then Owner shall give Contractor written notice thereof prior to starting any such other work. If Owner has advance information regarding the start of any utility work at or adjacent to the Site, Owner shall provide such information to Contractor.

C. Contractor shall afford each other contractor that performs such other work, each utility owner performing other work, and Owner, if Owner is performing other work with Owner's employees, proper and safe access to the Site, and provide a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work. Contractor shall do all cutting, fitting, and patching of the Work that may be required to properly connect or otherwise make its several parts come together and properly integrate with such other work. Contractor shall not endanger any work of others by cutting, excavating, or otherwise altering such work; provided, however, that Contractor may cut or alter others' work with the written consent of Engineer and the others whose work will be affected.

D. If the proper execution or results of any part of Contractor's Work depends upon work performed by others under this Article 8, Contractor shall inspect such other work and promptly report to Engineer in writing any delays, defects, or deficiencies in such other work that render it unavailable or unsuitable for the proper execution and results of Contractor's Work. Contractor's failure to so report will constitute an acceptance of such other work as fit and proper for integration with Contractor's Work except for latent defects and deficiencies in such other work.

8.02 *Coordination*

A. If Owner intends to contract with others for the performance of other work at or adjacent to the Site, to perform other work at or adjacent to the Site with Owner's employees, or to arrange to have utility owners perform work at or adjacent to the Site, the following will be set forth in the Supplementary Conditions or provided to Contractor prior to the start of any such other work:

1. the identity of the individual or entity that will have authority and responsibility for coordination of the activities among the various contractors;

2. an itemization of the specific matters to be covered by such authority and responsibility; and

3. the extent of such authority and responsibilities.

B. Unless otherwise provided in the Supplementary Conditions, Owner shall have sole authority and responsibility for such coordination.

8.03 *Legal Relationships*

A. If, in the course of performing other work at or adjacent to the Site for Owner, the Owner's employees, any other contractor working for Owner, or any utility owner for whom the Owner is responsible causes damage to the Work or to the property of Contractor or its Subcontractors, or delays, disrupts, interferes with, or increases the scope or cost of the performance of the Work, through actions or inaction, then Contractor shall be entitled to an equitable adjustment in the Contract Price or the Contract Times, or both. Contractor must submit any Change Proposal seeking an equitable adjustment in the Contract Price or the Contract Times under this paragraph within 30 days of the damaging, delaying, disrupting, or interfering event. The entitlement to, and extent of, any such equitable adjustment shall take into account information (if any) regarding such other work that was provided to Contractor in the Contract Documents prior to the submittal of the Bid or the final negotiation of the terms of the Contract. When applicable, any such equitable adjustment in Contract Price shall be conditioned on Contractor assigning to Owner all Contractor's rights against such other contractor or utility owner with respect to the damage, delay, disruption, or interference that is the subject of the adjustment. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.

B. Contractor shall take reasonable and customary measures to avoid damaging, delaying, disrupting, or interfering with the work of Owner, any other contractor, or any utility owner performing other work at or adjacent to the Site. If Contractor fails to take such measures and as a result damages, delays, disrupts, or interferes with the work of any such other contractor or utility owner, then Owner may impose a set-off against payments due to Contractor, and assign to such other contractor or utility owner the Owner's contractual rights against Contractor with respect to the breach of the obligations set forth in this paragraph.

C. When Owner is performing other work at or adjacent to the Site with Owner's employees, Contractor shall be liable to Owner for damage to such other work, and for the reasonable direct delay, disruption, and interference costs incurred by Owner as a result of Contractor's failure to take reasonable and customary measures with respect to Owner's other work. In response to such damage, delay, disruption, or interference, Owner may impose a set-off against payments due to Contractor.

D. If Contractor damages, delays, disrupts, or interferes with the work of any other contractor, or any utility owner performing other work at or adjacent to the Site, through Contractor's failure to take reasonable and customary measures to avoid such impacts, or if any claim arising out of Contractor's actions, inactions, or negligence in performance of the Work at or adjacent to the Site is made by any such other contractor or utility owner against Contractor, Owner, or Engineer, then Contractor shall (1) promptly attempt to settle the claim as to all parties through negotiations with such other contractor or utility owner, or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law, and (2) indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against any such claims, and against all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such damage, delay, disruption, or interference.

ARTICLE 9 – OWNER'S RESPONSIBILITIES

9.01 *Communications to Contractor*

A. Except as otherwise provided in these General Conditions, Owner shall issue all communications to Contractor through Engineer.

9.02 *Replacement of Engineer*

A. Owner may at its discretion appoint an engineer to replace Engineer, provided Contractor makes no reasonable objection to the replacement engineer. The replacement engineer's status under the Contract Documents shall be that of the former Engineer.

9.03 *Furnish Data*

A. Owner shall promptly furnish the data required of Owner under the Contract Documents.

9.04 *Pay When Due*

A. Owner shall make payments to Contractor when they are due as provided in the Agreement.

9.05 *Lands and Easements; Reports, Tests, and Drawings*

A. Owner's duties with respect to providing lands and easements are set forth in Paragraph 5.01.

B. Owner's duties with respect to providing engineering surveys to establish reference points are set forth in Paragraph 4.03.

C. Article 5 refers to Owner's identifying and making available to Contractor copies of reports of explorations and tests of conditions at the Site, and drawings of physical conditions relating to existing surface or subsurface structures at the Site.

9.06 *Insurance*

A. Owner's responsibilities, if any, with respect to purchasing and maintaining liability and property insurance are set forth in Article 6.

9.07 *Change Orders*

A. Owner's responsibilities with respect to Change Orders are set forth in Article 11.

9.08 *Inspections, Tests, and Approvals*

A. Owner's responsibility with respect to certain inspections, tests, and approvals is set forth in Paragraph 14.02.B.

9.09 *Limitations on Owner's Responsibilities*

A. The Owner shall not supervise, direct, or have control or authority over, nor be responsible for, Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Owner will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

9.10 *Undisclosed Hazardous Environmental Condition*

A. Owner's responsibility in respect to an undisclosed Hazardous Environmental Condition is set forth in Paragraph 5.06.

9.11 *Evidence of Financial Arrangements*

A. Upon request of Contractor, Owner shall furnish Contractor reasonable evidence that financial arrangements have been made to satisfy Owner's obligations under the Contract Documents (including obligations under proposed changes in the Work).

9.12 *Safety Programs*

A. While at the Site, Owner's employees and representatives shall comply with the specific applicable requirements of Contractor's safety programs of which Owner has been informed.

B. Owner shall furnish copies of any applicable Owner safety programs to Contractor.

ARTICLE 10 – ENGINEER'S STATUS DURING CONSTRUCTION

10.01 *Owner's Representative*

A. Engineer will be Owner's representative during the construction period. The duties and responsibilities and the limitations of authority of Engineer as Owner's representative during construction are set forth in the Contract.

10.02 *Visits to Site*

A. Engineer will make visits to the Site at intervals appropriate to the various stages of construction as Engineer deems necessary in order to observe as an experienced and qualified design professional the progress that has been made and the quality of the various aspects of Contractor's executed Work. Based on information obtained during such visits and observations, Engineer, for the benefit of Owner, will determine, in general, if the Work is proceeding in accordance with the Contract Documents. Engineer will not be required to make exhaustive or continuous inspections on the Site to check the quality or quantity of the Work. Engineer's efforts will be directed toward providing for Owner a greater degree of confidence that the completed Work will conform generally to the Contract Documents. On the basis of such visits and observations, Engineer will keep Owner informed of the progress of the Work and will endeavor to guard Owner against defective Work.

B. Engineer's visits and observations are subject to all the limitations on Engineer's authority and responsibility set forth in Paragraph 10.08. Particularly, but without limitation, during

or as a result of Engineer's visits or observations of Contractor's Work, Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work.

10.03 *Project Representative*

A. If Owner and Engineer have agreed that Engineer will furnish a Resident Project Representative to represent Engineer at the Site and assist Engineer in observing the progress and quality of the Work, then the authority and responsibilities of any such Resident Project Representative will be as provided in the Supplementary Conditions, and limitations on the responsibilities thereof will be as provided in Paragraph 10.08. If Owner designates another representative or agent to represent Owner at the Site who is not Engineer's consultant, agent, or employee, the responsibilities and authority and limitations thereon of such other individual or entity will be as provided in the Supplementary Conditions.

10.04 *Rejecting Defective Work*

A. Engineer has the authority to reject Work in accordance with Article 14.

10.05 *Shop Drawings, Change Orders and Payments*

A. Engineer's authority, and limitations thereof, as to Shop Drawings and Samples, are set forth in Paragraph 7.16.

B. Engineer's authority, and limitations thereof, as to design calculations and design drawings submitted in response to a delegation of professional design services, if any, are set forth in Paragraph 7.19.

C. Engineer's authority as to Change Orders is set forth in Article 11.

D. Engineer's authority as to Applications for Payment is set forth in Article 15.

10.06 *Determinations for Unit Price Work*

A. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor as set forth in Paragraph 13.03.

10.07 *Decisions on Requirements of Contract Documents and Acceptability of Work*

A. Engineer will render decisions regarding the requirements of the Contract Documents, and judge the acceptability of the Work, pursuant to the specific procedures set forth herein for initial interpretations, Change Proposals, and acceptance of the Work. In rendering such decisions and judgments, Engineer will not show partiality to Owner or Contractor, and will not be liable to Owner, Contractor, or others in connection with any proceedings, interpretations, decisions, or judgments conducted or rendered in good faith.

10.08 *Limitations on Engineer's Authority and Responsibilities*

A. Neither Engineer's authority or responsibility under this Article 10 or under any other provision of the Contract, nor any decision made by Engineer in good faith either to exercise or not exercise such authority or responsibility or the undertaking, exercise, or performance of any authority or responsibility by Engineer, shall create, impose, or give rise to any duty in contract, tort, or otherwise owed by Engineer to Contractor, any Subcontractor, any Supplier, any other individual or entity, or to any surety for or employee or agent of any of them.

B. Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Engineer will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

C. Engineer will not be responsible for the acts or omissions of Contractor or of any Subcontractor, any Supplier, or of any other individual or entity performing any of the Work.

D. Engineer's review of the final Application for Payment and accompanying documentation and all maintenance and operating instructions, schedules, guarantees, bonds, certificates of inspection, tests and approvals, and other documentation required to be delivered by Paragraph 15.06.A will only be to determine generally that their content complies with the requirements of, and in the case of certificates of inspections, tests, and approvals, that the results certified indicate compliance with the Contract Documents.

E. The limitations upon authority and responsibility set forth in this Paragraph 10.08 shall also apply to the Resident Project Representative, if any.

10.09 *Compliance with Safety Program*

A. While at the Site, Engineer's employees and representatives will comply with the specific applicable requirements of Owner's and Contractor's safety programs (if any) of which Engineer has been informed.

ARTICLE 11 – AMENDING THE CONTRACT DOCUMENTS; CHANGES IN THE WORK

11.01 *Amending and Supplementing Contract Documents*

A. The Contract Documents may be amended or supplemented by a Change Order, a Work Change Directive, or a Field Order.

1. *Change Orders*:

a. If an amendment or supplement to the Contract Documents includes a change in the Contract Price or the Contract Times, such amendment or supplement must be set forth in a Change Order. A Change Order also may be used to establish amendments and supplements of the Contract Documents that do not affect the Contract Price or Contract Times.

b. Owner and Contractor may amend those terms and conditions of the Contract Documents that do not involve (1) the performance or acceptability of the Work, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, without the recommendation of the Engineer. Such an amendment shall be set forth in a Change Order.

2. *Work Change Directives*: A Work Change Directive will not change the Contract Price or the Contract Times but is evidence that the parties expect that the modification ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order, following negotiations by the parties as to the Work Change Directive's effect, if any, on the Contract Price and Contract Times; or, if negotiations are unsuccessful, by a determination under the terms of the Contract Documents governing adjustments, expressly including Paragraph 11.04 regarding change of Contract Price. Contractor must submit any Change Proposal seeking an

adjustment of the Contract Price or the Contract Times, or both, no later than 30 days after the completion of the Work set out in the Work Change Directive. Owner must submit any Claim seeking an adjustment of the Contract Price or the Contract Times, or both, no later than 60 days after issuance of the Work Change Directive.

3. *Field Orders*: Engineer may authorize minor changes in the Work if the changes do not involve an adjustment in the Contract Price or the Contract Times and are compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. Such changes will be accomplished by a Field Order and will be binding on Owner and also on Contractor, which shall perform the Work involved promptly. If Contractor believes that a Field Order justifies an adjustment in the Contract Price or Contract Times, or both, then before proceeding with the Work at issue, Contractor shall submit a Change Proposal as provided herein.

11.02 *Owner-Authorized Changes in the Work*

A. Without invalidating the Contract and without notice to any surety, Owner may, at any time or from time to time, order additions, deletions, or revisions in the Work. Such changes shall be supported by Engineer's recommendation, to the extent the change involves the design (as set forth in the Drawings, Specifications, or otherwise), or other engineering or technical matters. Such changes may be accomplished by a Change Order, if Owner and Contractor have agreed as to the effect, if any, of the changes on Contract Times or Contract Price; or by a Work Change Directive. Upon receipt of any such document, Contractor shall promptly proceed with the Work involved; or, in the case of a deletion in the Work, promptly cease construction activities with respect to such deleted Work. Added or revised Work shall be performed under the applicable conditions of the Contract Documents. Nothing in this paragraph shall obligate Contractor to undertake work that Contractor reasonably concludes cannot be performed in a manner consistent with Contractor's safety obligations under the Contract Documents or Laws and Regulations.

11.03 *Unauthorized Changes in the Work*

A. Contractor shall not be entitled to an increase in the Contract Price or an extension of the Contract Times with respect to any work performed that is not required by the Contract Documents, as amended, modified, or supplemented, except in the case of an emergency as provided in Paragraph 7.15 or in the case of uncovering Work as provided in Paragraph 14.05.

11.04 *Change of Contract Price*

A. The Contract Price may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Price shall comply with the provisions of Paragraph 11.06. Any Claim for an adjustment of Contract Price shall comply with the provisions of Article 12.

B. An adjustment in the Contract Price will be determined as follows:

1. where the Work involved is covered by unit prices contained in the Contract Documents, then by application of such unit prices to the quantities of the items involved (subject to the provisions of Paragraph 13.03); or

2. where the Work involved is not covered by unit prices contained in the Contract Documents, then by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with Paragraph 11.04.C.2); or

3. where the Work involved is not covered by unit prices contained in the Contract Documents and the parties do not reach mutual agreement to a lump sum, then on

the basis of the Cost of the Work (determined as provided in Paragraph 13.01) plus a Contractor's fee for overhead and profit (determined as provided in Paragraph 11.04.C).

C. *Contractor's Fee*: When applicable, the Contractor's fee for overhead and profit shall be determined as follows:

1. a mutually acceptable fixed fee; or

2. if a fixed fee is not agreed upon, then a fee based on the following percentages of the various portions of the Cost of the Work:

a. for costs incurred under Paragraphs 13.01.B.1 and 13.01.B.2, the Contractor's fee shall be 15 percent;

b. for costs incurred under Paragraph 13.01.B.3, the Contractor's fee shall be five percent;

c. where one or more tiers of subcontracts are on the basis of Cost of the Work plus a fee and no fixed fee is agreed upon, the intent of Paragraphs 11.04.C.2.a and 11.04.C.2.b is that the Contractor's fee shall be based on: (1) a fee of 15 percent of the costs incurred under Paragraphs 13.01.A.1 and 13.01.A.2 by the Subcontractor that actually performs the Work, at whatever tier, and (2) with respect to Contractor itself and to any Subcontractors of a tier higher than that of the Subcontractor that actually performs the Work, a fee of five percent of the amount (fee plus underlying costs incurred) attributable to the next lower tier Subcontractor; provided, however, that for any such subcontracted work the maximum total fee to be paid by Owner shall be no greater than 27 percent of the costs incurred by the Subcontractor that actually performs the work;

d. no fee shall be payable on the basis of costs itemized under Paragraphs 13.01.B.4, 13.01.B.5, and 13.01.C;

e. the amount of credit to be allowed by Contractor to Owner for any change which results in a net decrease in cost will be the amount of the actual net decrease in cost plus a deduction in Contractor's fee by an amount equal to five percent of such net decrease; and

f. when both additions and credits are involved in any one change, the adjustment in Contractor's fee shall be computed on the basis of the net change in accordance with Paragraphs 11.04.C.2.a through 11.04.C.2.e, inclusive.

11.05 *Change of Contract Times*

A. The Contract Times may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Times shall comply with the provisions of Paragraph 11.06. Any Claim for an adjustment in the Contract Times shall comply with the provisions of Article 12.

B. An adjustment of the Contract Times shall be subject to the limitations set forth in Paragraph 4.05, concerning delays in Contractor's progress.

11.06 *Change Proposals*

A. Contractor shall submit a Change Proposal to Engineer to request an adjustment in the Contract Times or Contract Price; appeal an initial decision by Engineer concerning the requirements of the Contract Documents or relating to the acceptability of the Work under the Contract Documents; contest a set-off against payment due; or seek other relief under

the Contract. The Change Proposal shall specify any proposed change in Contract Times or Contract Price, or both, or other proposed relief, and explain the reason for the proposed change, with citations to any governing or applicable provisions of the Contract Documents.

1. *Procedures*: Contractor shall submit each Change Proposal to Engineer promptly (but in no event later than 30 days) after the start of the event giving rise thereto, or after such initial decision. The Contractor shall submit supporting data, including the proposed change in Contract Price or Contract Time (if any), to the Engineer and Owner within 15 days after the submittal of the Change Proposal. The supporting data shall be accompanied by a written statement that the supporting data are accurate and complete, and that any requested time or price adjustment is the entire adjustment to which Contractor believes it is entitled as a result of said event. Engineer will advise Owner regarding the Change Proposal, and consider any comments or response from Owner regarding the Change Proposal.

2. *Engineer's Action*: Engineer will review each Change Proposal and, within 30 days after receipt of the Contractor's supporting data, either deny the Change Proposal in whole, approve it in whole, or deny it in part and approve it in part. Such actions shall be in writing, with a copy provided to Owner and Contractor. If Engineer does not take action on the Change Proposal within 30 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of Engineer's inaction the Change Proposal is deemed denied, thereby commencing the time for appeal of the denial under Article 12.

3. *Binding Decision*: Engineer's decision will be final and binding upon Owner and Contractor, unless Owner or Contractor appeals the decision by filing a Claim under Article 12.

B. *Resolution of Certain Change Proposals*: If the Change Proposal does not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters, then Engineer will notify the parties that the Engineer is unable to resolve the Change Proposal. For purposes of further resolution of such a Change Proposal, such notice shall be deemed a denial, and Contractor may choose to seek resolution under the terms of Article 12.

11.07 *Execution of Change Orders*

A. Owner and Contractor shall execute appropriate Change Orders covering:

1. changes in the Contract Price or Contract Times which are agreed to by the parties, including any undisputed sum or amount of time for Work actually performed in accordance with a Work Change Directive;

2. changes in Contract Price resulting from an Owner set-off, unless Contractor has duly contested such set-off;

3. changes in the Work which are: (a) ordered by Owner pursuant to Paragraph 11.02, (b) required because of Owner's acceptance of defective Work under Paragraph 14.04 or Owner's correction of defective Work under Paragraph 14.07, or (c) agreed to by the parties, subject to the need for Engineer's recommendation if the change in the Work involves the design (as set forth in the Drawings, Specifications, or otherwise), or other engineering or technical matters; and

4. changes in the Contract Price or Contract Times, or other changes, which embody the substance of any final and binding results under Paragraph 11.06, or Article 12.

B. If Owner or Contractor refuses to execute a Change Order that is required to be executed under the terms of this Paragraph 11.07, it shall be deemed to be of full force and effect, as if fully executed.

11.08 *Notification to Surety*

A. If the provisions of any bond require notice to be given to a surety of any change affecting the general scope of the Work or the provisions of the Contract Documents (including, but not limited to, Contract Price or Contract Times), the giving of any such notice will be Contractor's responsibility. The amount of each applicable bond will be adjusted to reflect the effect of any such change.

ARTICLE 12 – CLAIMS

12.01 *Claims*

A. *Claims Process*: The following disputes between Owner and Contractor shall be submitted to the Claims process set forth in this Article:

1. Appeals by Owner or Contractor of Engineer's decisions regarding Change Proposals;

2. Owner demands for adjustments in the Contract Price or Contract Times, or other relief under the Contract Documents; and

3. Disputes that Engineer has been unable to address because they do not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters.

B. *Submittal of Claim*: The party submitting a Claim shall deliver it directly to the other party to the Contract promptly (but in no event later than 30 days) after the start of the event giving rise thereto; in the case of appeals regarding Change Proposals within 30 days of the decision under appeal. The party submitting the Claim shall also furnish a copy to the Engineer, for its information only. The responsibility to substantiate a Claim shall rest with the party making the Claim. In the case of a Claim by Contractor seeking an increase in the Contract Times or Contract Price, or both, Contractor shall certify that the Claim is made in good faith, that the supporting data are accurate and complete, and that to the best of Contractor's knowledge and belief the amount of time or money requested accurately reflects the full amount to which Contractor is entitled.

C. *Review and Resolution*: The party receiving a Claim shall review it thoroughly, giving full consideration to its merits. The two parties shall seek to resolve the Claim through the exchange of information and direct negotiations. The parties may extend the time for resolving the Claim by mutual agreement. All actions taken on a Claim shall be stated in writing and submitted to the other party, with a copy to Engineer.

D. *Mediation*:

1. At any time after initiation of a Claim, Owner and Contractor may mutually agree to mediation of the underlying dispute. The agreement to mediate shall stay the Claim submittal and response process.

2. If Owner and Contractor agree to mediation, then after 60 days from such agreement, either Owner or Contractor may unilaterally terminate the mediation process, and the Claim submittal and decision process shall resume as of the date of the termination. If the mediation proceeds but is unsuccessful in resolving the dispute, the Claim

submittal and decision process shall resume as of the date of the conclusion of the mediation, as determined by the mediator.

3. Owner and Contractor shall each pay one-half of the mediator's fees and costs.

E. *Partial Approval*: If the party receiving a Claim approves the Claim in part and denies it in part, such action shall be final and binding unless within 30 days of such action the other party invokes the procedure set forth in Article 17 for final resolution of disputes.

F. *Denial of Claim*: If efforts to resolve a Claim are not successful, the party receiving the Claim may deny it by giving written notice of denial to the other party. If the receiving party does not take action on the Claim within 90 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of the inaction, the Claim is deemed denied, thereby commencing the time for appeal of the denial. A denial of the Claim shall be final and binding unless within 30 days of the denial the other party invokes the procedure set forth in Article 17 for the final resolution of disputes.

G. *Final and Binding Results*: If the parties reach a mutual agreement regarding a Claim, whether through approval of the Claim, direct negotiations, mediation, or otherwise; or if a Claim is approved in part and denied in part, or denied in full, and such actions become final and binding; then the results of the agreement or action on the Claim shall be incorporated in a Change Order to the extent they affect the Contract, including the Work, the Contract Times, or the Contract Price.

ARTICLE 13 – COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK

13.01 *Cost of the Work*

A. *Purposes for Determination of Cost of the Work*: The term Cost of the Work means the sum of all costs necessary for the proper performance of the Work at issue, as further defined below. The provisions of this Paragraph 13.01 are used for two distinct purposes:

1. To determine Cost of the Work when Cost of the Work is a component of the Contract Price, under cost-plus-fee, time-and-materials, or other cost-based terms; or

2. To determine the value of a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price. When the value of any such adjustment is determined on the basis of Cost of the Work, Contractor is entitled only to those additional or incremental costs required because of the change in the Work or because of the event giving rise to the adjustment.

B. *Costs Included*: Except as otherwise may be agreed to in writing by Owner, costs included in the Cost of the Work shall be in amounts no higher than those prevailing in the locality of the Project, shall not include any of the costs itemized in Paragraph 13.01.C, and shall include only the following items:

1. Payroll costs for employees in the direct employ of Contractor in the performance of the Work under schedules of job classifications agreed upon by Owner and Contractor. Such employees shall include, without limitation, superintendents, foremen, and other personnel employed full time on the Work. Payroll costs for employees not employed full time on the Work shall be apportioned on the basis of their time spent on the Work. Payroll costs shall include, but not be limited to, salaries and wages plus the cost of fringe benefits, which shall include social security contributions, unemployment, excise, and payroll taxes, workers' compensation, health and retirement benefits, bonuses, sick leave, and vacation and holiday pay applicable

thereto. The expenses of performing Work outside of regular working hours, on Saturday, Sunday, or legal holidays, shall be included in the above to the extent authorized by Owner.

2. Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and Suppliers' field services required in connection therewith. All cash discounts shall accrue to Contractor unless Owner deposits funds with Contractor with which to make payments, in which case the cash discounts shall accrue to Owner. All trade discounts, rebates, and refunds and returns from sale of surplus materials and equipment shall accrue to Owner, and Contractor shall make provisions so that they may be obtained.

3. Payments made by Contractor to Subcontractors for Work performed by Subcontractors. If required by Owner, Contractor shall obtain competitive bids from subcontractors acceptable to Owner and Contractor and shall deliver such bids to Owner, who will then determine, with the advice of Engineer, which bids, if any, will be acceptable. If any subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work plus a fee, the Subcontractor's Cost of the Work and fee shall be determined in the same manner as Contractor's Cost of the Work and fee as provided in this Paragraph 13.01.

4. Costs of special consultants (including but not limited to engineers, architects, testing laboratories, surveyors, attorneys, and accountants) employed for services specifically related to the Work.

5. Supplemental costs including the following:

    a. The proportion of necessary transportation, travel, and subsistence expenses of Contractor's employees incurred in discharge of duties connected with the Work.

    b. Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office, and temporary facilities at the Site, and hand tools not owned by the workers, which are consumed in the performance of the Work, and cost, less market value, of such items used but not consumed which remain the property of Contractor.

    c. Rentals of all construction equipment and machinery, and the parts thereof, whether rented from Contractor or others in accordance with rental agreements approved by Owner with the advice of Engineer, and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs shall be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts shall cease when the use thereof is no longer necessary for the Work.

    d. Sales, consumer, use, and other similar taxes related to the Work, and for which Contractor is liable, as imposed by Laws and Regulations.

    e. Deposits lost for causes other than negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, and royalty payments and fees for permits and licenses.

    f. Losses and damages (and related expenses) caused by damage to the Work, not compensated by insurance or otherwise, sustained by Contractor in connection with the performance of the Work (except losses and damages within the deductible amounts of property insurance established in accordance with Paragraph 6.05), provided such losses and damages have resulted from causes

other than the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable. Such losses shall include settlements made with the written consent and approval of Owner. No such losses, damages, and expenses shall be included in the Cost of the Work for the purpose of determining Contractor's fee.

g. The cost of utilities, fuel, and sanitary facilities at the Site.

h. Minor expenses such as communication service at the Site, express and courier services, and similar petty cash items in connection with the Work.

i. The costs of premiums for all bonds and insurance that Contractor is required by the Contract Documents to purchase and maintain.

C. *Costs Excluded*: The term Cost of the Work shall not include any of the following items:

1. Payroll costs and other compensation of Contractor's officers, executives, principals (of partnerships and sole proprietorships), general managers, safety managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expediters, timekeepers, clerks, and other personnel employed by Contractor, whether at the Site or in Contractor's principal or branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in Paragraph 13.01.B.1 or specifically covered by Paragraph 13.01.B.4. The payroll costs and other compensation excluded here are to be considered administrative costs covered by the Contractor's fee.

2. Expenses of Contractor's principal and branch offices other than Contractor's office at the Site.

3. Any part of Contractor's capital expenses, including interest on Contractor's capital employed for the Work and charges against Contractor for delinquent payments.

4. Costs due to the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not limited to, the correction of defective Work, disposal of materials or equipment wrongly supplied, and making good any damage to property.

5. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in Paragraph 13.01.B.

D. *Contractor's Fee*: When the Work as a whole is performed on the basis of cost-plus, Contractor's fee shall be determined as set forth in the Agreement. When the value of any Work covered by a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price is determined on the basis of Cost of the Work, Contractor's fee shall be determined as set forth in Paragraph 11.04.C.

E. *Documentation*: Whenever the Cost of the Work for any purpose is to be determined pursuant to this Article 13, Contractor will establish and maintain records thereof in accordance with generally accepted accounting practices and submit in a form acceptable to Engineer an itemized cost breakdown together with supporting data.

13.02 *Allowances*

A. It is understood that Contractor has included in the Contract Price all allowances so named in the Contract Documents and shall cause the Work so covered to be performed for such sums and by such persons or entities as may be acceptable to Owner and Engineer.

B. *Cash Allowances*: Contractor agrees that:

1. the cash allowances include the cost to Contractor (less any applicable trade discounts) of materials and equipment required by the allowances to be delivered at the Site, and all applicable taxes; and

2. Contractor's costs for unloading and handling on the Site, labor, installation, overhead, profit, and other expenses contemplated for the cash allowances have been included in the Contract Price and not in the allowances, and no demand for additional payment on account of any of the foregoing will be valid.

C. *Contingency Allowance*: Contractor agrees that a contingency allowance, if any, is for the sole use of Owner to cover unanticipated costs.

D. Prior to final payment, an appropriate Change Order will be issued as recommended by Engineer to reflect actual amounts due Contractor on account of Work covered by allowances, and the Contract Price shall be correspondingly adjusted.

13.03 *Unit Price Work*

A. Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement.

B. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Payments to Contractor for Unit Price Work will be based on actual quantities.

C. Each unit price will be deemed to include an amount considered by Contractor to be adequate to cover Contractor's overhead and profit for each separately identified item.

D. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor. Engineer will review with Contractor the Engineer's preliminary determinations on such matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise). Engineer's written decision thereon will be final and binding (except as modified by Engineer to reflect changed factual conditions or more accurate data) upon Owner and Contractor, subject to the provisions of the following paragraph.

E. Within 30 days of Engineer's written decision under the preceding paragraph, Contractor may submit a Change Proposal, or Owner may file a Claim, seeking an adjustment in the Contract Price if:

1. the quantity of any item of Unit Price Work performed by Contractor differs materially and significantly from the estimated quantity of such item indicated in the Agreement;

2. there is no corresponding adjustment with respect to any other item of Work; and

3. Contractor believes that it is entitled to an increase in Contract Price as a result of having incurred additional expense or Owner believes that Owner is entitled to a decrease in Contract Price, and the parties are unable to agree as to the amount of any such increase or decrease.

ARTICLE 14 – TESTS AND INSPECTIONS; CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK

14.01 *Access to Work*

A. Owner, Engineer, their consultants and other representatives and personnel of Owner, independent testing laboratories, and authorities having jurisdiction will have access to the Site and the Work at reasonable times for their observation, inspection, and testing. Contractor shall provide them proper and safe conditions for such access and advise them of Contractor's safety procedures and programs so that they may comply therewith as applicable.

14.02 *Tests, Inspections, and Approvals*

A. Contractor shall give Engineer timely notice of readiness of the Work (or specific parts thereof) for all required inspections and tests, and shall cooperate with inspection and testing personnel to facilitate required inspections and tests.

B. Owner shall retain and pay for the services of an independent inspector, testing laboratory, or other qualified individual or entity to perform all inspections and tests expressly required by the Contract Documents to be furnished and paid for by Owner, except that costs incurred in connection with tests or inspections of covered Work shall be governed by the provisions of Paragraph 14.05.

C. If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested, or approved by an employee or other representative of such public body, Contractor shall assume full responsibility for arranging and obtaining such inspections, tests, or approvals, pay all costs in connection therewith, and furnish Engineer the required certificates of inspection or approval.

D. Contractor shall be responsible for arranging, obtaining, and paying for all inspections and tests required:

1. by the Contract Documents, unless the Contract Documents expressly allocate responsibility for a specific inspection or test to Owner;

2. to attain Owner's and Engineer's acceptance of materials or equipment to be incorporated in the Work;

3. by manufacturers of equipment furnished under the Contract Documents;

4. for testing, adjusting, and balancing of mechanical, electrical, and other equipment to be incorporated into the Work; and

5. for acceptance of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation in the Work.

Such inspections and tests shall be performed by independent inspectors, testing laboratories, or other qualified individuals or entities acceptable to Owner and Engineer.

E. If the Contract Documents require the Work (or part thereof) to be approved by Owner, Engineer, or another designated individual or entity, then Contractor shall assume full responsibility for arranging and obtaining such approvals.

F. If any Work (or the work of others) that is to be inspected, tested, or approved is covered by Contractor without written concurrence of Engineer, Contractor shall, if requested by Engineer, uncover such Work for observation. Such uncovering shall be at Contractor's expense unless Contractor had given Engineer timely notice of Contractor's intention to

cover the same and Engineer had not acted with reasonable promptness in response to such notice.

14.03 *Defective Work*

A. *Contractor's Obligation*: It is Contractor's obligation to assure that the Work is not defective.

B. *Engineer's Authority*: Engineer has the authority to determine whether Work is defective, and to reject defective Work.

C. *Notice of Defects*: Prompt notice of all defective Work of which Owner or Engineer has actual knowledge will be given to Contractor.

D. *Correction, or Removal and Replacement*: Promptly after receipt of written notice of defective Work, Contractor shall correct all such defective Work, whether or not fabricated, installed, or completed, or, if Engineer has rejected the defective Work, remove it from the Project and replace it with Work that is not defective.

E. *Preservation of Warranties*: When correcting defective Work, Contractor shall take no action that would void or otherwise impair Owner's special warranty and guarantee, if any, on said Work.

F. *Costs and Damages*: In addition to its correction, removal, and replacement obligations with respect to defective Work, Contractor shall pay all claims, costs, losses, and damages arising out of or relating to defective Work, including but not limited to the cost of the inspection, testing, correction, removal, replacement, or reconstruction of such defective Work, fines levied against Owner by governmental authorities because the Work is defective, and the costs of repair or replacement of work of others resulting from defective Work. Prior to final payment, if Owner and Contractor are unable to agree as to the measure of such claims, costs, losses, and damages resulting from defective Work, then Owner may impose a reasonable set-off against payments due under Article 15.

14.04 *Acceptance of Defective Work*

A. If, instead of requiring correction or removal and replacement of defective Work, Owner prefers to accept it, Owner may do so (subject, if such acceptance occurs prior to final payment, to Engineer's confirmation that such acceptance is in general accord with the design intent and applicable engineering principles, and will not endanger public safety). Contractor shall pay all claims, costs, losses, and damages attributable to Owner's evaluation of and determination to accept such defective Work (such costs to be approved by Engineer as to reasonableness), and for the diminished value of the Work to the extent not otherwise paid by Contractor. If any such acceptance occurs prior to final payment, the necessary revisions in the Contract Documents with respect to the Work shall be incorporated in a Change Order. If the parties are unable to agree as to the decrease in the Contract Price, reflecting the diminished value of Work so accepted, then Owner may impose a reasonable set-off against payments due under Article 15. If the acceptance of defective Work occurs after final payment, Contractor shall pay an appropriate amount to Owner.

14.05 *Uncovering Work*

A. Engineer has the authority to require additional inspection or testing of the Work, whether or not the Work is fabricated, installed, or completed.

B. If any Work is covered contrary to the written request of Engineer, then Contractor shall, if requested by Engineer, uncover such Work for Engineer's observation, and then replace the covering, all at Contractor's expense.

C. If Engineer considers it necessary or advisable that covered Work be observed by Engineer or inspected or tested by others, then Contractor, at Engineer's request, shall uncover, expose, or otherwise make available for observation, inspection, or testing as Engineer may require, that portion of the Work in question, and provide all necessary labor, material, and equipment.

1. If it is found that the uncovered Work is defective, Contractor shall be responsible for all claims, costs, losses, and damages arising out of or relating to such uncovering, exposure, observation, inspection, and testing, and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and pending Contractor's full discharge of this responsibility the Owner shall be entitled to impose a reasonable set-off against payments due under Article 15.

2. If the uncovered Work is not found to be defective, Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Times, or both, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement, and reconstruction. If the parties are unable to agree as to the amount or extent thereof, then Contractor may submit a Change Proposal within 30 days of the determination that the Work is not defective.

14.06 *Owner May Stop the Work*

A. If the Work is defective, or Contractor fails to supply sufficient skilled workers or suitable materials or equipment, or fails to perform the Work in such a way that the completed Work will conform to the Contract Documents, then Owner may order Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of Owner to stop the Work shall not give rise to any duty on the part of Owner to exercise this right for the benefit of Contractor, any Subcontractor, any Supplier, any other individual or entity, or any surety for, or employee or agent of any of them.

14.07 *Owner May Correct Defective Work*

A. If Contractor fails within a reasonable time after written notice from Engineer to correct defective Work, or to remove and replace rejected Work as required by Engineer, or if Contractor fails to perform the Work in accordance with the Contract Documents, or if Contractor fails to comply with any other provision of the Contract Documents, then Owner may, after seven days written notice to Contractor, correct or remedy any such deficiency.

B. In exercising the rights and remedies under this Paragraph 14.07, Owner shall proceed expeditiously. In connection with such corrective or remedial action, Owner may exclude Contractor from all or part of the Site, take possession of all or part of the Work and suspend Contractor's services related thereto, and incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere. Contractor shall allow Owner, Owner's representatives, agents and employees, Owner's other contractors, and Engineer and Engineer's consultants access to the Site to enable Owner to exercise the rights and remedies under this paragraph.

C. All claims, costs, losses, and damages incurred or sustained by Owner in exercising the rights and remedies under this Paragraph 14.07 will be charged against Contractor as set-offs against payments due under Article 15. Such claims, costs, losses and damages will

include but not be limited to all costs of repair, or replacement of work of others destroyed or damaged by correction, removal, or replacement of Contractor's defective Work.

D. Contractor shall not be allowed an extension of the Contract Times because of any delay in the performance of the Work attributable to the exercise by Owner of Owner's rights and remedies under this Paragraph 14.07.

ARTICLE 15 – PAYMENTS TO CONTRACTOR; SET-OFFS; COMPLETION; CORRECTION PERIOD

15.01 *Progress Payments*

A. *Basis for Progress Payments*: The Schedule of Values established as provided in Article 2 will serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to Engineer. Progress payments on account of Unit Price Work will be based on the number of units completed during the pay period, as determined under the provisions of Paragraph 13.03. Progress payments for cost-based Work will be based on Cost of the Work completed by Contractor during the pay period.

B. *Applications for Payments*:

1. At least 20 days before the date established in the Agreement for each progress payment (but not more often than once a month), Contractor shall submit to Engineer for review an Application for Payment filled out and signed by Contractor covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the Site or at another location agreed to in writing, the Application for Payment shall also be accompanied by a bill of sale, invoice, or other documentation warranting that Owner has received the materials and equipment free and clear of all Liens, and evidence that the materials and equipment are covered by appropriate property insurance, a warehouse bond, or other arrangements to protect Owner's interest therein, all of which must be satisfactory to Owner.

2. Beginning with the second Application for Payment, each Application shall include an affidavit of Contractor stating that all previous progress payments received on account of the Work have been applied on account to discharge Contractor's legitimate obligations associated with prior Applications for Payment.

3. The amount of retainage with respect to progress payments will be as stipulated in the Agreement.

C. *Review of Applications*:

1. Engineer will, within 10 days after receipt of each Application for Payment, including each resubmittal, either indicate in writing a recommendation of payment and present the Application to Owner, or return the Application to Contractor indicating in writing Engineer's reasons for refusing to recommend payment. In the latter case, Contractor may make the necessary corrections and resubmit the Application.

2. Engineer's recommendation of any payment requested in an Application for Payment will constitute a representation by Engineer to Owner, based on Engineer's observations of the executed Work as an experienced and qualified design professional, and on Engineer's review of the Application for Payment and the accompanying data and schedules, that to the best of Engineer's knowledge, information and belief:

a. the Work has progressed to the point indicated;

b. the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, the results of any subsequent tests called for in the Contract Documents, a final determination of quantities and classifications for Unit Price Work under Paragraph 13.03, and any other qualifications stated in the recommendation); and

c. the conditions precedent to Contractor's being entitled to such payment appear to have been fulfilled in so far as it is Engineer's responsibility to observe the Work.

3. By recommending any such payment Engineer will not thereby be deemed to have represented that:

a. inspections made to check the quality or the quantity of the Work as it has been performed have been exhaustive, extended to every aspect of the Work in progress, or involved detailed inspections of the Work beyond the responsibilities specifically assigned to Engineer in the Contract; or

b. there may not be other matters or issues between the parties that might entitle Contractor to be paid additionally by Owner or entitle Owner to withhold payment to Contractor.

4. Neither Engineer's review of Contractor's Work for the purposes of recommending payments nor Engineer's recommendation of any payment, including final payment, will impose responsibility on Engineer:

a. to supervise, direct, or control the Work, or

b. for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or

c. for Contractor's failure to comply with Laws and Regulations applicable to Contractor's performance of the Work, or

d. to make any examination to ascertain how or for what purposes Contractor has used the money paid on account of the Contract Price, or

e. to determine that title to any of the Work, materials, or equipment has passed to Owner free and clear of any Liens.

5. Engineer may refuse to recommend the whole or any part of any payment if, in Engineer's opinion, it would be incorrect to make the representations to Owner stated in Paragraph 15.01.C.2.

6. Engineer will recommend reductions in payment (set-offs) necessary in Engineer's opinion to protect Owner from loss because:

a. the Work is defective, requiring correction or replacement;

b. the Contract Price has been reduced by Change Orders;

c. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;

d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible; or

e. Engineer has actual knowledge of the occurrence of any of the events that would constitute a default by Contractor and therefore justify termination for cause under the Contract Documents.

D. *Payment Becomes Due*:

1. Ten days after presentation of the Application for Payment to Owner with Engineer's recommendation, the amount recommended (subject to any Owner set-offs) will become due, and when due will be paid by Owner to Contractor.

E. *Reductions in Payment by Owner*:

1. In addition to any reductions in payment (set-offs) recommended by Engineer, Owner is entitled to impose a set-off against payment based on any of the following:

a. claims have been made against Owner on account of Contractor's conduct in the performance or furnishing of the Work, or Owner has incurred costs, losses, or damages on account of Contractor's conduct in the performance or furnishing of the Work, including but not limited to claims, costs, losses, or damages from workplace injuries, adjacent property damage, non-compliance with Laws and Regulations, and patent infringement;

b. Contractor has failed to take reasonable and customary measures to avoid damage, delay, disruption, and interference with other work at or adjacent to the Site;

c. Contractor has failed to provide and maintain required bonds or insurance;

d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible;

e. Owner has incurred extra charges or engineering costs related to submittal reviews, evaluations of proposed substitutes, tests and inspections, or return visits to manufacturing or assembly facilities;

f. the Work is defective, requiring correction or replacement;

g. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;

h. the Contract Price has been reduced by Change Orders;

i. an event that would constitute a default by Contractor and therefore justify a termination for cause has occurred;

j. liquidated damages have accrued as a result of Contractor's failure to achieve Milestones, Substantial Completion, or final completion of the Work;

k. Liens have been filed in connection with the Work, except where Contractor has delivered a specific bond satisfactory to Owner to secure the satisfaction and discharge of such Liens;

l. there are other items entitling Owner to a set off against the amount recommended.

2. If Owner imposes any set-off against payment, whether based on its own knowledge or on the written recommendations of Engineer, Owner will give Contractor immediate written notice (with a copy to Engineer) stating the reasons for such action and the specific amount of the reduction, and promptly pay Contractor any amount

remaining after deduction of the amount so withheld. Owner shall promptly pay Contractor the amount so withheld, or any adjustment thereto agreed to by Owner and Contractor, if Contractor remedies the reasons for such action. The reduction imposed shall be binding on Contractor unless it duly submits a Change Proposal contesting the reduction.

3. Upon a subsequent determination that Owner's refusal of payment was not justified, the amount wrongfully withheld shall be treated as an amount due as determined by Paragraph 15.01.C.1 and subject to interest as provided in the Agreement.

15.02 *Contractor's Warranty of Title*

A. Contractor warrants and guarantees that title to all Work, materials, and equipment furnished under the Contract will pass to Owner free and clear of (1) all Liens and other title defects, and (2) all patent, licensing, copyright, or royalty obligations, no later than seven days after the time of payment by Owner.

15.03 *Substantial Completion*

A. When Contractor considers the entire Work ready for its intended use Contractor shall notify Owner and Engineer in writing that the entire Work is substantially complete and request that Engineer issue a certificate of Substantial Completion. Contractor shall at the same time submit to Owner and Engineer an initial draft of punch list items to be completed or corrected before final payment.

B. Promptly after Contractor's notification, Owner, Contractor, and Engineer shall make an inspection of the Work to determine the status of completion. If Engineer does not consider the Work substantially complete, Engineer will notify Contractor in writing giving the reasons therefor.

C. If Engineer considers the Work substantially complete, Engineer will deliver to Owner a preliminary certificate of Substantial Completion which shall fix the date of Substantial Completion. Engineer shall attach to the certificate a punch list of items to be completed or corrected before final payment. Owner shall have seven days after receipt of the preliminary certificate during which to make written objection to Engineer as to any provisions of the certificate or attached punch list. If, after considering the objections to the provisions of the preliminary certificate, Engineer concludes that the Work is not substantially complete, Engineer will, within 14 days after submission of the preliminary certificate to Owner, notify Contractor in writing that the Work is not substantially complete, stating the reasons therefor. If Owner does not object to the provisions of the certificate, or if despite consideration of Owner's objections Engineer concludes that the Work is substantially complete, then Engineer will, within said 14 days, execute and deliver to Owner and Contractor a final certificate of Substantial Completion (with a revised punch list of items to be completed or corrected) reflecting such changes from the preliminary certificate as Engineer believes justified after consideration of any objections from Owner.

D. At the time of receipt of the preliminary certificate of Substantial Completion, Owner and Contractor will confer regarding Owner's use or occupancy of the Work following Substantial Completion, review the builder's risk insurance policy with respect to the end of the builder's risk coverage, and confirm the transition to coverage of the Work under a permanent property insurance policy held by Owner. Unless Owner and Contractor agree otherwise in writing, Owner shall bear responsibility for security, operation, protection of the Work, property insurance, maintenance, heat, and utilities upon Owner's use or occupancy of the Work.

E. After Substantial Completion the Contractor shall promptly begin work on the punch list of items to be completed or corrected prior to final payment. In appropriate cases Contractor may submit monthly Applications for Payment for completed punch list items, following the progress payment procedures set forth above.

F. Owner shall have the right to exclude Contractor from the Site after the date of Substantial Completion subject to allowing Contractor reasonable access to remove its property and complete or correct items on the punch list.

15.04 *Partial Use or Occupancy*

A. Prior to Substantial Completion of all the Work, Owner may use or occupy any substantially completed part of the Work which has specifically been identified in the Contract Documents, or which Owner, Engineer, and Contractor agree constitutes a separately functioning and usable part of the Work that can be used by Owner for its intended purpose without significant interference with Contractor's performance of the remainder of the Work, subject to the following conditions:

1. At any time Owner may request in writing that Contractor permit Owner to use or occupy any such part of the Work that Owner believes to be substantially complete. If and when Contractor agrees that such part of the Work is substantially complete, Contractor, Owner, and Engineer will follow the procedures of Paragraph 15.03.A through E for that part of the Work.

2. At any time Contractor may notify Owner and Engineer in writing that Contractor considers any such part of the Work substantially complete and request Engineer to issue a certificate of Substantial Completion for that part of the Work.

3. Within a reasonable time after either such request, Owner, Contractor, and Engineer shall make an inspection of that part of the Work to determine its status of completion. If Engineer does not consider that part of the Work to be substantially complete, Engineer will notify Owner and Contractor in writing giving the reasons therefor. If Engineer considers that part of the Work to be substantially complete, the provisions of Paragraph 15.03 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.

4. No use or occupancy or separate operation of part of the Work may occur prior to compliance with the requirements of Paragraph 6.05 regarding builder's risk or other property insurance.

15.05 *Final Inspection*

A. Upon written notice from Contractor that the entire Work or an agreed portion thereof is complete, Engineer will promptly make a final inspection with Owner and Contractor and will notify Contractor in writing of all particulars in which this inspection reveals that the Work, or agreed portion thereof, is incomplete or defective. Contractor shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

15.06 *Final Payment*

A. *Application for Payment*:

1. After Contractor has, in the opinion of Engineer, satisfactorily completed all corrections identified during the final inspection and has delivered, in accordance with the Contract Documents, all maintenance and operating instructions, schedules, guarantees, bonds, certificates or other evidence of insurance, certificates of

inspection, annotated record documents (as provided in Paragraph 7.11), and other documents, Contractor may make application for final payment.

2. The final Application for Payment shall be accompanied (except as previously delivered) by:

   a. all documentation called for in the Contract Documents;

   b. consent of the surety, if any, to final payment;

   c. satisfactory evidence that all title issues have been resolved such that title to all Work, materials, and equipment has passed to Owner free and clear of any Liens or other title defects, or will so pass upon final payment.

   d. a list of all disputes that Contractor believes are unsettled; and

   e. complete and legally effective releases or waivers (satisfactory to Owner) of all Lien rights arising out of the Work, and of Liens filed in connection with the Work.

3. In lieu of the releases or waivers of Liens specified in Paragraph 15.06.A.2 and as approved by Owner, Contractor may furnish receipts or releases in full and an affidavit of Contractor that: (a) the releases and receipts include all labor, services, material, and equipment for which a Lien could be filed; and (b) all payrolls, material and equipment bills, and other indebtedness connected with the Work for which Owner might in any way be responsible, or which might in any way result in liens or other burdens on Owner's property, have been paid or otherwise satisfied. If any Subcontractor or Supplier fails to furnish such a release or receipt in full, Contractor may furnish a bond or other collateral satisfactory to Owner to indemnify Owner against any Lien, or Owner at its option may issue joint checks payable to Contractor and specified Subcontractors and Suppliers.

B. *Engineer's Review of Application and Acceptance*:

1. If, on the basis of Engineer's observation of the Work during construction and final inspection, and Engineer's review of the final Application for Payment and accompanying documentation as required by the Contract Documents, Engineer is satisfied that the Work has been completed and Contractor's other obligations under the Contract have been fulfilled, Engineer will, within ten days after receipt of the final Application for Payment, indicate in writing Engineer's recommendation of final payment and present the Application for Payment to Owner for payment. Such recommendation shall account for any set-offs against payment that are necessary in Engineer's opinion to protect Owner from loss for the reasons stated above with respect to progress payments. At the same time Engineer will also give written notice to Owner and Contractor that the Work is acceptable, subject to the provisions of Paragraph 15.07. Otherwise, Engineer will return the Application for Payment to Contractor, indicating in writing the reasons for refusing to recommend final payment, in which case Contractor shall make the necessary corrections and resubmit the Application for Payment.

C. *Completion of Work*: The Work is complete (subject to surviving obligations) when it is ready for final payment as established by the Engineer's written recommendation of final payment.

D. *Payment Becomes Due*: Thirty days after the presentation to Owner of the final Application for Payment and accompanying documentation, the amount recommended by Engineer (less any further sum Owner is entitled to set off against Engineer's recommendation,

including but not limited to set-offs for liquidated damages and set-offs allowed under the provisions above with respect to progress payments) will become due and shall be paid by Owner to Contractor.

15.07 *Waiver of Claims*

A. The making of final payment will not constitute a waiver by Owner of claims or rights against Contractor. Owner expressly reserves claims and rights arising from unsettled Liens, from defective Work appearing after final inspection pursuant to Paragraph 15.05, from Contractor's failure to comply with the Contract Documents or the terms of any special guarantees specified therein, from outstanding Claims by Owner, or from Contractor's continuing obligations under the Contract Documents.

B. The acceptance of final payment by Contractor will constitute a waiver by Contractor of all claims and rights against Owner other than those pending matters that have been duly submitted or appealed under the provisions of Article 17.

15.08 *Correction Period*

A. If within one year after the date of Substantial Completion (or such longer period of time as may be prescribed by the terms of any applicable special guarantee required by the Contract Documents, or by any specific provision of the Contract Documents), any Work is found to be defective, or if the repair of any damages to the Site, adjacent areas that Contractor has arranged to use through construction easements or otherwise, and other adjacent areas used by Contractor as permitted by Laws and Regulations, is found to be defective, then Contractor shall promptly, without cost to Owner and in accordance with Owner's written instructions:

1. correct the defective repairs to the Site or such other adjacent areas;

2. correct such defective Work;

3. if the defective Work has been rejected by Owner, remove it from the Project and replace it with Work that is not defective, and

4. satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others, or to other land or areas resulting therefrom.

B. If Contractor does not promptly comply with the terms of Owner's written instructions, or in an emergency where delay would cause serious risk of loss or damage, Owner may have the defective Work corrected or repaired or may have the rejected Work removed and replaced. Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others).

C. In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date if so provided in the Specifications.

D. Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and replaced under this paragraph, the correction period hereunder with respect to such Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.

E. Contractor's obligations under this paragraph are in addition to all other obligations and warranties. The provisions of this paragraph shall not be construed as a substitute for, or a waiver of, the provisions of any applicable statute of limitation or repose.

ARTICLE 16 – SUSPENSION OF WORK AND TERMINATION

16.01 *Owner May Suspend Work*

A. At any time and without cause, Owner may suspend the Work or any portion thereof for a period of not more than 90 consecutive days by written notice to Contractor and Engineer. Such notice will fix the date on which Work will be resumed. Contractor shall resume the Work on the date so fixed. Contractor shall be entitled to an adjustment in the Contract Price or an extension of the Contract Times, or both, directly attributable to any such suspension. Any Change Proposal seeking such adjustments shall be submitted no later than 30 days after the date fixed for resumption of Work.

16.02 *Owner May Terminate for Cause*

A. The occurrence of any one or more of the following events will constitute a default by Contractor and justify termination for cause:

1. Contractor's persistent failure to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment or failure to adhere to the Progress Schedule);

2. Failure of Contractor to perform or otherwise to comply with a material term of the Contract Documents;

3. Contractor's disregard of Laws or Regulations of any public body having jurisdiction; or

4. Contractor's repeated disregard of the authority of Owner or Engineer.

B. If one or more of the events identified in Paragraph 16.02.A occurs, then after giving Contractor (and any surety) ten days written notice that Owner is considering a declaration that Contractor is in default and termination of the contract, Owner may proceed to:

1. declare Contractor to be in default, and give Contractor (and any surety) notice that the Contract is terminated; and

2. enforce the rights available to Owner under any applicable performance bond.

C. Subject to the terms and operation of any applicable performance bond, if Owner has terminated the Contract for cause, Owner may exclude Contractor from the Site, take possession of the Work, incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere, and complete the Work as Owner may deem expedient.

D. Owner may not proceed with termination of the Contract under Paragraph 16.02.B if Contractor within seven days of receipt of notice of intent to terminate begins to correct its failure to perform and proceeds diligently to cure such failure.

E. If Owner proceeds as provided in Paragraph 16.02.B, Contractor shall not be entitled to receive any further payment until the Work is completed. If the unpaid balance of the Contract Price exceeds the cost to complete the Work, including all related claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals) sustained by Owner, such excess will be paid to Contractor. If the cost to complete the Work including such related claims, costs, losses,

and damages exceeds such unpaid balance, Contractor shall pay the difference to Owner. Such claims, costs, losses, and damages incurred by Owner will be reviewed by Engineer as to their reasonableness and, when so approved by Engineer, incorporated in a Change Order. When exercising any rights or remedies under this paragraph, Owner shall not be required to obtain the lowest price for the Work performed.

F. Where Contractor's services have been so terminated by Owner, the termination will not affect any rights or remedies of Owner against Contractor then existing or which may thereafter accrue, or any rights or remedies of Owner against Contractor or any surety under any payment bond or performance bond. Any retention or payment of money due Contractor by Owner will not release Contractor from liability.

G. If and to the extent that Contractor has provided a performance bond under the provisions of Paragraph 6.01.A, the provisions of that bond shall govern over any inconsistent provisions of Paragraphs 16.02.B and 16.02.D.

16.03 *Owner May Terminate For Convenience*

A. Upon seven days written notice to Contractor and Engineer, Owner may, without cause and without prejudice to any other right or remedy of Owner, terminate the Contract. In such case, Contractor shall be paid for (without duplication of any items):

1. completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such Work;

2. expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials, or equipment as required by the Contract Documents in connection with uncompleted Work, plus fair and reasonable sums for overhead and profit on such expenses; and

3. other reasonable expenses directly attributable to termination, including costs incurred to prepare a termination for convenience cost proposal.

B. Contractor shall not be paid on account of loss of anticipated overhead, profits, or revenue, or other economic loss arising out of or resulting from such termination.

16.04 *Contractor May Stop Work or Terminate*

A. If, through no act or fault of Contractor, (1) the Work is suspended for more than 90 consecutive days by Owner or under an order of court or other public authority, or (2) Engineer fails to act on any Application for Payment within 30 days after it is submitted, or (3) Owner fails for 30 days to pay Contractor any sum finally determined to be due, then Contractor may, upon seven days written notice to Owner and Engineer, and provided Owner or Engineer do not remedy such suspension or failure within that time, terminate the contract and recover from Owner payment on the same terms as provided in Paragraph 16.03.

B. In lieu of terminating the Contract and without prejudice to any other right or remedy, if Engineer has failed to act on an Application for Payment within 30 days after it is submitted, or Owner has failed for 30 days to pay Contractor any sum finally determined to be due, Contractor may, seven days after written notice to Owner and Engineer, stop the Work until payment is made of all such amounts due Contractor, including interest thereon. The provisions of this paragraph are not intended to preclude Contractor from submitting a Change Proposal for an adjustment in Contract Price or Contract Times or otherwise for

expenses or damage directly attributable to Contractor's stopping the Work as permitted by this paragraph.

ARTICLE 17 – FINAL RESOLUTION OF DISPUTES

17.01 *Methods and Procedures*

A. *Disputes Subject to Final Resolution*: The following disputed matters are subject to final resolution under the provisions of this Article:

1. A timely appeal of an approval in part and denial in part of a Claim, or of a denial in full; and

2. Disputes between Owner and Contractor concerning the Work or obligations under the Contract Documents, and arising after final payment has been made.

B. *Final Resolution of Disputes*: For any dispute subject to resolution under this Article, Owner or Contractor may:

1. elect in writing to invoke the dispute resolution process provided for in the Supplementary Conditions; or

2. agree with the other party to submit the dispute to another dispute resolution process; or

3. if no dispute resolution process is provided for in the Supplementary Conditions or mutually agreed to, give written notice to the other party of the intent to submit the dispute to a court of competent jurisdiction.

ARTICLE 18 – MISCELLANEOUS

18.01 *Giving Notice*

A. Whenever any provision of the Contract Documents requires the giving of written notice, it will be deemed to have been validly given if:

1. delivered in person, by a commercial courier service or otherwise, to the individual or to a member of the firm or to an officer of the corporation for which it is intended; or

2. delivered at or sent by registered or certified mail, postage prepaid, to the last business address known to the sender of the notice.

18.02 *Computation of Times*

A. When any period of time is referred to in the Contract by days, it will be computed to exclude the first and include the last day of such period. If the last day of any such period falls on a Saturday or Sunday or on a day made a legal holiday by the law of the applicable jurisdiction, such day will be omitted from the computation.

18.03 *Cumulative Remedies*

A. The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder to the parties hereto are in addition to, and are not to be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by Laws or Regulations, by special warranty or guarantee, or by other provisions of the Contract. The provisions of this paragraph will be as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right, and remedy to which they apply.

18.04 *Limitation of Damages*

A. With respect to any and all Change Proposals, Claims, disputes subject to final resolution, and other matters at issue, neither Owner nor Engineer, nor any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, shall be liable to Contractor for any claims, costs, losses, or damages sustained by Contractor on or in connection with any other project or anticipated project.

18.05 *No Waiver*

A. A party's non-enforcement of any provision shall not constitute a waiver of that provision, nor shall it affect the enforceability of that provision or of the remainder of this Contract.

18.06 *Survival of Obligations*

A. All representations, indemnifications, warranties, and guarantees made in, required by, or given in accordance with the Contract, as well as all continuing obligations indicated in the Contract, will survive final payment, completion, and acceptance of the Work or termination or completion of the Contract or termination of the services of Contractor.

18.07 *Controlling Law*

A. This Contract is to be governed by the law of the state in which the Project is located.

18.08 *Headings*

A. Article and paragraph headings are inserted for convenience only and do not constitute parts of these General Conditions.

SUPPLEMENTARY CONDITIONS

SUPPLEMENTARY CONDITIONS

TABLE OF CONTENTS

SUPPLEMENTARY CONDITIONS

GENERAL

These Supplementary Conditions amend or supplement the Standard General Conditions of the Construction Contract (EJCDC C-700, 2013 Edition). All provisions which are not so amended or supplemented remain in full force and effect.

The terms used in these Supplementary Conditions will have the meanings stated in the General Conditions. Additional terms used in these Supplementary Conditions have the meanings stated below, which are applicable to both the singular and plural thereof.

The address system used in these Supplementary Conditions is the same as the address system used in the General Conditions, with the prefix "SC" added thereto.

ARTICLE 1 – DEFINITIONS AND TERMINOLOGY

SC - 1.01

Delete subparagraph 1.01.A.18 in its entirety and insert the following in its place.

18. *Drawings* - The part of the Contract Documents that graphically shows the scope, extent, and character of the Work to be performed by the Contractor, as defined in the Agreement.

Delete subparagraph 1.01.A.47 in its entirety and insert the following in its place.

47. *Work*—The entire construction or the various separately identifiable parts thereof required to be provided under the Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce such construction; furnishing, installing, and incorporating all materials and equipment into such construction; and may include related services such as testing, Start-up, and commissioning, all as required by the Contract Documents.

Add the following paragraph after paragraph 1.01.A.48.:

49. *Startup* - - Coordinated operation of facilities by the Contractor, Subcontractors, Suppliers, and Owner after installation, and testing, programming, and instructional services are complete and operation and maintenance data has been submitted and approved. Startup is considered complete when, in the opinion of the Engineer, the facilities have properly operated for 7 continuous days without significant interruption.

ARTICLE 2 – PRELIMINARY MATTERS

SC – 2.01

Delete Paragraph 2.01.C. in its entirety.

SC - 2.02

Delete paragraph 2.02.A. in it entirety and insert the following in its place:

A. Owner shall furnish to Contractor 5 printed or hard copies of the Project Manual and 5 printed or hard copies of half-scale Drawings, and one copy in electronic portable document format (PDF) Additional copies will be furnished upon request at the cost of reproduction.

B. One set of Drawings in AutoCAD electronic format will be provided to the Contractor. Electronic files will be delivered upon receipt of a signed disclaimer form and signed Owner release. A disclaimer form is included in the Appendix.

ARTICLE 3 –DOCUMENTS: INTENT, REQUIREMENTS, REUSE

SC – 3.01

Delete Paragraph 3.01.B. in its entirety and replace it with the following:

B. It is the intent of the Contract Documents to describe a functionally complete project (or part thereof) to be constructed in accordance with the Contract Documents. Any labor, documentation, services, materials, or equipment that reasonably may be inferred from the Contract Documents or from prevailing custom or trade usage as being required to produce the indicated result will be provided whether or not specifically called for, at no additional cost to Owner.

SC – 3.03

Delete paragraph 3.03.A.3. in its entirety and replace it with the following:

3. Contractor shall not be liable to Owner or Engineer for failure to report any conflict, error, ambiguity, or discrepancy in the Contract Documents unless Contractor knew or reasonably should have known thereof.

SC – 3.04

Add the following subparagraph after paragraph 3.04.A:

1. A request for written interpretation or clarification of the Contract Documents shall be submitted on the Request for Information (RFI) form provided in the Appendix of this Project Manual.

ARTICLE 4 – COMMENCEMENT AND PROGRESS OF THE WORK

SC - 4.01

Delete the last sentence of paragraph 4.01.A. in its entirety and insert the following in its place:

In no event will the Contract Times commence to run later than the 91st day after the day of Bid opening or the 30th day after the Effective Date of the Agreement, whichever date is earlier.

SC – 4.05

Delete paragraph 4.05.A in its entirety and replace with the following:

A. If Owner, Engineer, or other contractors or utility owners performing work for the Owner as contemplated by Article 8, or anyone for whom Owner is responsible delays, disrupts, or interferes with the performance or progress of the Work, then Contractor shall be entitled to an equitable adjustment in the Contract Times. Such an adjustment shall be Contractor's sole and exclusive remedy for the delays, disruption, and interference described in this paragraph. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete Work within the Contract Times. Except as provided for in paragraph 17.01, Contractor shall make no Claim for damages as delay in the performance of the Work occasioned by acts or neglect by Owner or any of its

representatives, including Engineer, or because or any injunction which may be brought against Owner or its representatives, including Engineer, and agrees that any such claim shall be fully compensated for by an extension of time in an amount equal to the time lost due to such delay, and that such time extension shall be Contractor's sole and exclusive remedy for such delay.

Delete paragraph 4.05.G. in its entirety and replace it with the following

G. Contractor must submit notification to Owner and Engineer of a potential delay which results in an adjustment in Contract Price or Contract Times under this paragraph within 10 days of the commencement of the delaying, disrupting, or interfering event.

Add the following as paragraph immediately after paragraph 4.05. G:

H. Owner, Engineer, and their officers, directors, members, partners, employees, agents, consultants, or subcontractors shall not be liable to Contractor for any claims, costs, losses, or damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by Contractor on or in connection with any other project or anticipated project.

ARTICLE 5 – AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS

SC – 5.03

Add the following new paragraphs immediately after paragraph 5.03.B.:

C. The following reports of explorations and tests of subsurface conditions at or adjacent to the Site are known to the Owner:

Report Title	Date of Report	Technical Data
Geotechnical Engineering Report	December 28, 2022	All

D. The following drawings of physical conditions relating to existing surface and subsurface structures at the site (except Underground Facilities) are known to the Owner:

Drawings Title	Date of Drawings	Technical Data
City of Bloomington Utilities Water Works Improvements 1965-1967 Expansion Program	February 1968	All
City of Bloomington Utilities Monroe Water Treatment Facility Administrative Area Expansion/Remodeling	August 1988	All
City of Bloomington Utilities Monroe Water Treatment Plant Expansion	March 1993	All
City of Bloomington Utilities Monroe Water Treatment Plant Residuals Management Facilities	June 2000	All
City of Bloomington Utilities Monroe Water Treatment Plant Improvements	January 2007	All
City of Bloomington Utilities Monroe Water Treatment Plant Filter Rehabilitation	October 2008	All

Drawings Title	Date of Drawings	Technical Data
City of Bloomington Utilities Water Works Improvements 1965-1967 Expansion Program	February 1968	All
City of Bloomington Utilities Monroe Water Treatment Facility Administrative Area Expansion/Remodeling	August 1988	All
City of Bloomington Utilities Monroe Water Treatment Plant Expansion	March 1993	All
City of Bloomington Utilities Monroe Water Treatment Plant Residuals Management Facilities	June 2000	All
City of Bloomington Utilities Monroe Water Treatment Plant Improvements	January 2007	All
City of Bloomington Utilities Monroe Water Treatment Plant Expansion	June 2014	All
City of Bloomington Utilities Monroe Water Treatment Solar Photovoltaic Systems	January 2019	All
City of Bloomington Utilities Monroe Water Treatment Plant Residuals Dewatering Improvements	February 2022	All
City of Bloomington Utilities Monroe Water Treatment Plant Filter Rehabilitation	September 2022	All

E. The drawings itemized in SC-5.03.D. are not part of the Contract Documents, but the "technical data" contained therein upon which Contractor may rely, as expressly identified and established above, are incorporated in the Contract Documents by reference. Contractor is not entitled to rely upon any other information and data known to or identified by Owner or Engineer.

SC – 5.04

Delete paragraph 5.04.D.3 in its entirety and replace it with the following:

3. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, or both, then any such adjustment shall be set forth in a Change Order. However, neither Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors shall be liable to Contractor for any claims, costs, losses, or damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by Contractor on or in connection with any other project or anticipated project.

Delete paragraph 5.04.D.4 in its entirety and replace it with the following:

4. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, or both, no later than 10 days after Owner's issuance of the Owner's written statement to Contractor regarding the subsurface or physical condition in question.

SC – 5.05

Delete Paragraph 5.05.E.2 in its entirety and replace it with the following:

2. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, or both, then any such adjustment shall be set forth in a Change Order. However, neither Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors shall be liable to Contractor for any claims, costs, losses, or damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by Contractor on or in connection with any other project or anticipated project.

Delete Paragraph 5.05.E.3 in its entirety and replace it with the following:

3. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, or both, no later than 10 days after Owner's issuance of the Owner's written statement to Contractor regarding the Underground Facility in question.

SC – 5.06

Delete Paragraph 5.06.G in its entirety and replace it with the following:

G. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times, or both, as a result of such Work stoppage or such special conditions under which Work is agreed to be resumed by Contractor, then within 10 days of Owner's written notice regarding the resumption of Work, Contractor may submit a Change Proposal, or Owner may impose a set-off.

Delete the last sentence of paragraph 5.06.I. in its entirety and replace it with the following:

"Nothing in this paragraph shall obligate Owner to indemnify any individual or entity from and against the consequences of the individual's or entity's own negligence."

Add the following new paragraphs immediately after paragraph 5.06.K.:

L. The following reports regarding Hazardous Environmental Conditions at the Site are known to the Owner:

1. None.

M. The following drawings regarding Hazardous Environmental Conditions at the Site are known to the Owner:

1. None.

ARTICLE 6 – BONDS AND INSURANCE

SC – 6.01

Add the following language at the end of paragraph 6.01.D.:

In addition, Owner will make no further progress payments under the Agreement until Contractor complies with the provisions of this paragraph.

SC – 6.02

Delete paragraph 6.02 in its entirety and refer to Section 00 52 13 for information regarding Risk Allocation and Insurance.

SC – 6.03

Delete paragraph 6.03 in its entirety and refer to Section 00 52 13 for information regarding Risk Allocation and Insurance.

1. In addition to those identified in the General Conditions, the following persons or entities shall be listed as additional insureds:

    a. Donohue & Associates.
    b. Terracon Consultants, Inc.
    c. Bledsoe Riggert Cooper & James
    d. FA Wilhelm Construction Co., Inc.

SC – 6.05

Delete Paragraph 6.05.B. in its entirety and replace it with the following:

B. Notice of Cancellation or Change: All the policies of insurance (and the certificates or other evidence thereof) required to be purchased and maintained in accordance with this Paragraph 6.05 will contain a provision or endorsement that the coverage afforded will not be canceled, materially changed, or renewal refused until at least 30 days prior written notice has been give to purchasing policyholder. Within three days of receipt of any such written notice, the purchasing policyholder shall provide a copy of the notice to each other insured.

ARTICLE 7 – CONTRACTOR'S RESPONSIBILITIES

SC – 7.02

Delete Paragraph 7.02.B in its entirety and replace it with the following:

B. Except as otherwise required for the safety or protection of persons or the Work or property at the Site or adjacent thereto, and except as otherwise stated in the Contract Documents, all Work at the Site shall be performed during regular working hours, Monday through Friday. Contractor will not perform Work on a Saturday, Sunday, or any legal holiday. Contractor may perform Work outside regular working hours or on Saturdays, Sundays, or legal holidays only with Owner's written consent.

SC - 7.03

Add the following new paragraphs after paragraph 7.03.C.:

D. Unless otherwise indicated, design of this Project is based upon the material and equipment named first in the list of Supplier's in a Specification section. Engineer has performed an evaluation of other listed Supplier's material and equipment and has determined it to be equal in quality, function and performance to that of the Supplier named first. When other Supplier's are listed, Contractor may be required to make modifications or adjustments, at Contractor's expense, to coordinate the installation of the furnished material and equipment with associated elements of Work, such as, but not limited to, piping and electrical connections, or support and mounting provisions.

E. For material or equipment listed on the Base Bid Material and Equipment Schedule, Contractor shall provide material and equipment furnished by Supplier A, B, or C as circled on the Bid Form, except Owner may select identified substitute, in lieu of circled Supplier A, B or C. Written application and supporting documentation for review of identified substitutes shall be submitted not later than 2 days after the Effective Date of the Agreement. If the Owner accepts any substitute, the substitute material and equipment shall be provided and the Contract Price will be adjusted by a Change Order executed within 30 days after the

Effective Date of the Agreement, unless mutually agreed upon. The Change Order shall reflect the difference in cost between the installed price for material and equipment furnished by Supplier A, B, or C as circled on the Bid Form, and the installed cost for the substitute. If Owner selects the substitute, the procedures for submission and consideration by Engineer for determining the acceptability of substitutes are set forth in the General Conditions and Supplementary Conditions. Should the substitute not be acceptable, Contractor shall provide material and equipment furnished by Supplier A, B, or C as circled on the Bid Form for the price bid.

SC-7.04

Add the following as the last sentence to Paragraph 7.04.A.

Where the specification or description does not contain or is not followed by words reading "or equal", other items of material or equipment or material or equipment of other suppliers may be submitted to Engineer for review under the circumstances described for "substitute" items in GC – 7.05.

SC-7.05

Add the following new subparagraph immediately after paragraph 7.05.A.3.d:

e. The application for review of a substitute shall be on the Contractor's Request For Substitution form provided in the Appendix of the Contract Documents and included with the submittal. The Installation List included with the Request shall include only installations of the proposed substitute in applications of approximately the same size and complexity, and the same design as those to be furnished for this Project. Include in the Installation List, as a minimum, the owner's name, address, and telephone number; engineer's name, address and telephone number; location and name of project; installation date, startup date, and date of final acceptance by owner; and application of material or equipment. If the experience indicated by the Installation List does not demonstrate at least 5 years of successful operation of the proposed substitute item, Owner may require Contractor and Supplier to furnish, at Contractor's expense, a special performance guarantee with surety bond as required by paragraph 6.05.D of the General Conditions with respect to the substitute. Only the time period between final approval of the proposed material or equipment on the referenced project and the Bid date for this Project will count towards the required satisfactory experience of the proposed substitute item. Engineer will be the sole judge of acceptability of experience, time credited, and whether the special performance guarantee will be required for a substitute item. Engineer will notify Contractor which proposed substitute(s) will require a special performance guarantee with surety bond.

Delete Paragraph 7.05.D. in its entirety and insert the following in its place:

D. Engineer's Cost Reimbursement*:* Contractor will not reimburse Owner for the charges of Engineer for evaluating substitutes. Contractor will reimburse Owner for the charges of Engineer for making changes in the Contract Documents (or in the provisions of any other direct contract with Owner) resulting from the acceptance of any substitute.

Add the following new subparagraph immediately after paragraph 7.05.D.:

1. If a substitute item of material or equipment proposed by Contractor is approved by Engineer, and the substitution requires a change in any of the Contract Documents to adapt the design to the proposed substitute, Contractor shall notify Engineer of the changes and be responsible for the costs involved to revise the design and to make modifications or changes to the construction, including the costs associated with the Work of other contractors due to such variance in design or space requirements. Engineer will prepare redesign and revisions to Drawings and other Contract Documents. Contractor shall reimburse Owner for charges of Engineer for redesign and revisions to Drawings and other Contract Documents.

Reimbursement of Engineer shall be based on Engineer's direct labor costs, indirect labor costs, profit on total labor, and any direct non-labor expenses such as travel and per diem.

SC – 7.12

Delete the second sentence of Paragraph 7.12.C. and insert the following:

The following Owner safety programs are applicable to the Work:

1. Trench Safety System Affidavit (Attachment C to the Agreement)

SC – 7.15

Add the following new paragraph immediately after paragraph 7.15.A.:

B. In emergencies affecting the safety or protection of persons or the Work or property at the site or adjacent thereto, and Contractor cannot be reached, Owner may act to attempt to prevent threatened damage, injury, or loss. Owner will give Contractor and Engineer prompt written notice of such action and the cost of the correction or remedy shall be charged against Contractor. Contractor shall give Engineer prompt written notice if Contractor believes that any significant changes in the Work or variations from the Contract Documents have been caused thereby or are required as a result thereof. If Engineer determines that a change in the Contract Documents is required because of the action taken by Owner in response to such an emergency, a Work Change Directive or Change Order will be issued.

SC – 7.16

Delete Paragraph 7.16.E.3 and replace it with the following:

3. After Engineer has approved a shop drawing or sample, Engineer will not review subsequent submittals of a different manufacturer or Supplier unless Contractor provides sufficient information to Engineer that the approved material or equipment is unavailable, or time of delivery will delay the construction progress. If Contractor requests a change of a previously approved submittal item under one of the above conditions, Contractor shall be responsible for Engineer's charges to Owner for its review time, and Owner may impose a set-off against payments due to Contractor to secure reimbursement for such charges, unless the need for such change is beyond the control of Contractor.

ARTICLE 8 - OTHER WORK AT THE SITE

SC – 8.02

In paragraph 8.02.A. delete the words "Supplementary Conditions" and insert the words "Specifications" in their place.

SC-8.03

Delete paragraph 8.03.A. in its entirety and insert the following paragraph as 8.03.A:

A. If, in the course of performing other work at or adjacent to the Site for Owner, any other contractor working for Owner, or any utility owner causes damage to the Work or to the property of Contractor or its Subcontractors, or delays, disrupts, interferes with, or increases the scope or cost of the performance of the Work, through actions or inaction, then Contractor shall promptly attempt to settle the claim as to all parties through negotiations with such other contractor or utility owner, or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law.

Delete paragraph 8.03.D. in its entirety and insert the following paragraph as 8.03.D

D. If Contractor damages, delays, disrupts, or interferes with the work of any other contractor, or any utility owner performing other work at or adjacent to the Site, through Contractor's failure to take reasonable and customary measures to avoid such impacts, or if any claim arising out of Contractor's actions, inactions, or negligence in performance of the Work at or adjacent to the Site is made by any such other contractor or utility owner against Contractor, Owner, or Engineer, the Contractor (without involving Owner, Engineer, or construction coordinator) shall (1) promptly attempt to settle the claim as to all parties through negotiations with such other contractor or utility owner, or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law, and (2) indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents consultants and subcontractors of each and any of them from and against any such claims, and against all costs, losses and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such damage, delay, disruption, or interference.

ARTICLE 9 – OWNERS RESPONSIBILITIES

SC – 9.13

Add the following new paragraph immediately after paragraph 9.12:

9.13 Site Representative

A. Owner will furnish a Site Representative, assistants, and other field staff to observe performance of the Work. The duties and responsibilities of Owner's Site Representative are described as follows:

1. Become familiar with the Contract Documents to observe the progress and quality of the executed Work, and to determine, in general, if the Work is proceeding in accordance with the Contract Documents.

2. Promptly forward to Engineer, reports from Contractor indicating conflict, error or discrepancy in the Contract Documents to enable Engineer to issue a written clarification or interpretation as provided for in paragraph 10.07 of the General Conditions.

3. Provide Engineer with copy of Site Representatives' daily log.

ARTICLE 10 – ENGINEER'S STATUS DURING CONSTRUCTION

Delete Paragraph 10.03.A. in its entirety and insert the following in its place:

A. Owner will provide a Site Representative whose responsibilities and duties are described in SC - 9.13.

SC - 10.09

Add the following new paragraph immediately after Paragraph 10.09.A.:

B. In the event Engineer determines that Contractor's safety plans, programs, and procedures do not provide adequate protection for Engineer, Engineer may direct its employees to leave the Site or implement additional safeguards for Engineer's protection. If taken, these actions

will be in furtherance of Engineer's responsibility to its own employees only, and Engineer will not assume any responsibility for protection of any other persons affected by the Work. In the event Engineer observes situations which appear to have potential for immediate and serious injury to persons, Engineer may warn the persons who appear to be affected by such situations. Such warnings, if issued, shall be given based on general humanitarian concerns, and Engineer will not, by the issuance of any such warning, assume any responsibility to issue future warnings or any general responsibility for protection of persons affected by the Work.

ARTICLE 11 – AMENDING THE CONTRACT DOCUMENTS; CHANGES IN THE WORK

SC – 11.04

Delete paragraph 11.04.B.2. in its entirety and insert the following in its place:

4. where the Work involved is not covered by unit prices contained in the Contract Documents, then by a mutually agreed lump sum which includes an allowance for overhead and profit in accordance with Paragraph 11.04.C.2; or

SC – 11.05

Add the following new paragraph immediately after paragraph 11.05.B.:

C. Time extensions provided under paragraph 4.05 of the General Conditions will only be allowed for controlling items of Work (critical path).

SC – 11.06

Amend the first sentence or paragraph 11.06.A.1 by striking out the words "30 days" and inserting the words "10 days" in their place.

SC-11.07

Delete paragraph 11.07.B in its entirety and replace with the following:

B. If Contractor refuses to execute a Change Order that is required to be executed under the terms of the Paragraph 11.07.A.2, it shall be deemed to be of full force and effect, as if fully executed.

Add the following new paragraph immediately after subparagraph 11.07.B.:

C. Change Orders will be prepared on the form included in the Appendix of this Project Manual.

ARTICLE 12 – CLAIMS

SC – 12.01

Amend the first sentence or paragraph 12.01.B by striking out both instances of the words "30 days" and inserting the words "10 days" in their place.

ARTICLE 13 – COST OF WORK; ALLOWANCES; UNIT PRICE WORK

SC – 13.03

Delete Paragraph 13.03.E. in its entirety and insert the following in its place:

E. Within 30 days of Engineer's written decision under the preceding paragraph, the unit price of an item of Unit Price Work shall be subject to reevaluation and adjustment under the following conditions:

1. if the total cost of a particular item of Unit Price Work amounts to 5% or more of the Contract Price and the variation in the quantity of that particular item of Unit Price Work performed by Contractor differs by more than 25% from the estimated quantity of such item indicated in the Agreement; and

2. if there is no corresponding adjustment with respect to any other item of Work; and

3. if Contractor believes that Contractor has incurred additional expense as a result thereof; or if Owner believes that the quantity variation entitles Owner to an adjustment in the unit price, either Owner or Contractor may make a Claim for an adjustment in the Contract Price in accordance with Article 10 if the parties are unable to agree as to the effect of any such variations in the quantity of Unit Price Work performed.

ARTICLE 14 - TESTS AND INSPECTIONS; CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK

SC – 14.05

Delete Subparagraph 14.05.C.2. in its entirety and insert the following in its place:

2. If the uncovered Work is not found to be defective, Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Times, or both, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement, and reconstruction. If the parties are unable to agree as to the amount or extent thereof, then Contractor may submit a Change Proposal within 10 days of the determination that the Work is not defective.

ARTICLE 15 – PAYMENTS TO CONTRACTOR; SET-OFFS; COMPLETION; CORRECTION PERIOD

SC – 15.01

Amend the first sentence of subparagraph 15.01.B.1. by striking out the words "20 days" and inserting the words "30 days" in their place.

Amend the first sentence of paragraph 15.01.D.1. by striking out the words "Ten days" and inserting the words "Twenty days" in their place.

SC – 15.03

Add the following new subparagraph immediately after paragraph 15.03.A.:

1. Contractor's request for issuance of a Certificate of Substantial Completion shall occur after Contractor has, in the opinion of the Engineer, satisfactorily completed the systems demonstrations, and delivered all guarantees, operation and maintenance data, certificates of installation services, certificates of instructional services, a complete set of marked up Drawings as specified in Division 1, General Requirements, and other documents. Engineer will not prepare a tentative certificate of Substantial Completion until systems demonstrations are satisfactorily completed in accordance with Section 01 79 10, Systems Demonstrations,

all operation and maintenance (O&M) data has been submitted and approved in accordance with Section 01 78 23, Operation and Maintenance Data, and a satisfactory set of marked up Drawings has been submitted in accordance with Section 01 78 39, Project Record Documents.

Add the following to the end of paragraph 15.03.F.

"The Contractor shall provide a listing of its property that it wishes to remove from the site and obtain Owner's approval before the property is removed. Only property approved by the Owner can be removed from the site. The Contractor shall schedule the removal of the property with the Owner, and shall obtain permission from the Owner to access the site. The Owner has the right to monitor the removal of the property."

SC – 15.06

Add the following new subparagraph immediately after paragraph 15.06.D..:

1. In addition to the liquidated damages set forth in the Agreement, Contractor shall be liable for all additional costs for Engineer's services beyond Substantial and Final Completion dates. Owner will deduct these costs from any monies due or that may become due Contractor or Surety and pay Engineer for said services.

ARTICLE 16 – SUSPENSION OF WORK AND TERMINATION

SC – 16.01

Amend paragraph 16.01.A. by striking out the words "30 days" in and inserting the words "ten days" in their place.

SC - 16.02

Add the following to end of paragraph 16.02.D.

"within no more than 30 days of receipt of said notice."

SC-16.04

Amend paragraphs 16.04.A. and 16.04.B. by striking out the words "30 days" in four places and inserting the words "60 days" in their place and by striking out the words "seven days" in two places and inserting the words "ten days" in their place.

ARTICLE 17 – FINAL RESOLUTION OF DISPUTES

Delete paragraph 17.01.B. in its entirety and insert the following in its place:

B. Final Resolution of Disputes: For any dispute subject to resolution under this Article, Owner or Contractor may:

   1. agree with the other party to submit the dispute to another dispute resolution process.

   2. give written notice of intent to the other party to submit the dispute to a court of competent jurisdiction, or

C. Notwithstanding any applicable statute of limitations, a party giving notice under paragraph 17.01.B shall commence an action on the Claim within one year of giving such notice. Failure to do so shall result in the Claim being time-barred and the action or denial shall become final and binding.

ARTICLE 18 – MISCELLANEOUS

SC – 18.01

Delete Paragraph 18.01.A. in its entirety and revise it to read the following:

A. Whenever any provision of the Contract Documents requires the giving of written notice or the delivery of any Bond, Agreement, Certificate of Insurance or any other item, it will be deemed to have been validly given if:

1. delivered in person, by a commercial courier service or otherwise, to the individual or to a member of the firm or to an officer of the corporation for which it is intended; or

2. delivered at or sent by registered or certified mail, postage prepaid, to the last business address known to the sender of the notice.

SC – 18.09

Add the following new paragraph immediately after paragraph 18.08:

18.09 Lien Waivers:

A. Owner may at any time require Contractor to furnish lien waivers for labor and materials covered by specified Applications for Payment.

END OF SUPPLEMENTARY CONDITIONS

SPECIFICATIONS

DIVISION 01

GENERAL REQUIREMENTS

SECTION 01 11 00
SUMMARY OF WORK

PART 1 – GENERAL

1.01 SUMMARY

A. The Work of this Contract is generally described as general construction of improvements to the water treatment facility including replacement of chemical feed lines throughout the facility, underground yard piping and pipe chase for the chemical feed lines, addition of a second backwash pump, rehabilitation of the Backwash Tank, and ancillary site, structural, electrical, and instrumentation and control improvements to facilitate the implementation of the improvements.

1.02 WORK BY OTHERS

A. Work on Site which will be, or has been executed prior to, or after, start of Work on this Contract and may be concurrent to this Contract, but is excluded from this Contract:

1. Monroe WTP Filter Media Replacement
2. Monroe WTP Solids Dewatering Improvements
3. Monroe WTP Electrical Upgrades

B. Other Work on Site by others may be performed concurrent to this Contract. Contractor is responsible for coordinating Work with other onsite contractors to avoid interferences and encroaching on the limits of other contractors work.

1.03 WORK SEQUENCE

A. Construct Work in accordance with the following requirements and to accommodate operation of existing drinking water treatment facilities during construction period. Coordinate construction progress schedule and operations with Engineer and Owner. Owner reserves right to place facilities taken out of service by Contractor back into service on emergency basis upon notification to Contractor.

B. Distribution of untreated or partially treated drinking water during construction is strictly prohibited.

C. Penalties imposed on the Owner as a result of any violations caused by the actions of the Contractor, his employees, or subcontractors, shall be borne in full by the Contractor, including legal fees and other expenses to the Owner resulting directly or indirectly from the violation.

D. Draining, Cleaning, and Dewatering of Tanks, Channels, Conduits and Piping

1. Unless specified otherwise, draining, cleaning, and dewatering of tanks, channels, conduits, piping, and other facilities and proper disposal of removed solids shall be performed by Contractor as required to complete Work.
2. Unless specified otherwise, Owner will not drain, clean, and dewater facilities to enable Contractor to complete Work.
3. Owner will drain the Backwash Tank. When tanks are made available to Contractor, the tank will be empty. Contractor shall clean and remove remaining material and maintain dewatering of the tanks as required to complete Work.

4. Contractor shall maintain facilities clean and dry as required to complete Work, including control and temporary pumping of leakage from isolation facilities and water resulting from precipitation.
5. Unless specified otherwise, the Contractor shall pump draining, cleaning, and dewatering material to a location as directed by the Engineer.

E. Flow through all plant treatment processes must be maintained at all times except as specified below. Contractor shall plan, schedule, and coordinate Work such that degree of water treatment by plant during construction shall be equal to or exceed degree of water treatment by plant prior to construction. Production rates up to 30 million gallons per day may occur. Average day production rate is approximately 15 million gallons per day.

F. Chemical Feed System Improvements

1. Abandonment of existing chemical feed lines cannot occur until new piping is operational.
2. Install, test and commission new chemical feed piping from the feed point in the Filter Building to the Chemical Building prior to removing and abandoning existing chemical feed piping.
3. Request permission from Engineer and Owner to remove chemical feed lines within the Chemical Building a minimum of 7 days prior to demolition work beginning within the Chemical Building.
4. When performing work within the Chemical Building, no more than one chemical may be out of service at a time.
5. When a chemical system is out of service, coordinate with Owner on the set-up of chemical totes and pumping for temporary chemical supply. Owner will provide the totes and pumps. Contractor is required to run temporary 120v electrical, piping and make the field connections. Owner will provide temporary chemical for no more than the timeframes specified.
6. Replacement of the aqueous ammonia skid and piping within the NHOH Room shall not exceed 7 days. 1 aqueous ammonia feed pump must be operational at all times.
7. Replacement of the caustic skid and piping within NAOH Room shall not exceed 14 days.
8. Replacement of the sodium hypochlorite skid and piping within the NAOC Room shall not exceed 14 days. 2 sodium hypochlorite feed pumps must be operational at all times. 3 feed pumps must be operational from November 1st to April 1st. 1 sodium hypochlorite day tank and 2 sodium hypochlorite day tanks must be operational at all times.

G. Backwash System Improvements

1. Commission Backwash Pump 2 prior to removing the backwash tank from service.
2. Owner will completely empty the backwash tank.
3. Backwash tank shall be out of service for no longer than 30 days.
4. Connection of the new backwash pump suction to the combined filter effluent line, shall not exceed 4 hours.
5. Request permission from Engineer and Owner to make connections to backwash line a minimum of 7 days prior to beginning the connection work.
6. Installation of the 30” valve and connection of the new backwash pump discharge to the backwash line shall occur simultaneously and shall not exceed 24 hours. A consecutive 24 hour window starts when the Owner begins to drain the filters.

H. Electrical outages greater than 4 hours will require temporary power being in place prior to performing outage.

I. For equipment replacement work, do not begin demolition work until new equipment is on-site or until 1 week from guaranteed delivery date of equipment to the site.

J. Possible Construction Sequence. A possible construction sequence showing completion of Work in conformance with the sequences and constraints specified herein is presented in the following paragraphs. Only a part of the Work for this Project is shown. The purpose for presenting this possible construction sequence is to assist the Bidders in understanding the requirements of this Project. Other and more detailed construction sequences to complete the Project within the Contract time limits and in conformance with the specified sequences and constraints may be possible. It is the Contractor's responsibility to develop and prepare the construction sequence and the Progress Schedule.

1. Chemical Feed System Improvements

    a. Set soil erosion and sediment controls.
    b. Run new chemical feed piping in Filter Building, along the exterior of the sedimentation tanks and excavated and construct pipe chase and install piping within the pipe chase.
    c. Install heat tracing for above grade exterior piping.
    d. Pressure test pipelines and test for leaks.
    e. Make field connections to combined filter effluent line and at the exterior of the Chemical Building. Once connections are made and dosing period is verified, begin Systems Demonstration period for the new piping.
    f. After Systems Demonstration period is verified, existing piping can be removed within the Filter Building and abandoned in the site. Systems Demonstration period for the site and Filter Building work shall be completed prior to beginning work in the Chemical Building.
    g. Concurrent with item f. install new PLC panel in preparation to begin work in the Chemical Building.
    h. Once work begins in the Chemical Building, complete replacements of the sodium hypochlorite, sodium hydroxide and aqueous ammonia systems one at a time.
    i. Systems Demonstrations periods will be established for each system after each system is operable.

2. Backwash System Improvements

    a. Install backwash pump and new piping up to their connection points including all electrical connections required.
    b. Complete programming updates to include the second backwash pump.
    c. Disinfect pump, 30" valve and piping prior to making connections.
    d. Remove backwash line for service and install 30" valve and make connections for pump suction and discharge piping.
    e. Perform start-up and testing of pump and piping systems during the connection timeframe. Place backwash pump into service after a successful start-up is completed.
    f. Commence Systems Demonstration period after the pump is placed back into service. Systems Demonstration period shall begin only once the system is operable from SCADA.
    g. Upon commencement of the Systems Demonstration period, remove the backwash tank from service.
    h. Complete coating rehabilitation work and installation of the additional overflow piping.
    i. After proper cure times of the coating, backwash tank can be placed back into service.

K. Access to the plant must be maintained. Construction will need to be done in phases to allow one way traffic through the facility. If a full closure is unavoidable, it must be coordinated with the owner at least 7 days in advance, and less than 24 hours in length.

1.04 CONTRACTOR'S USE OF PREMISES

A. Conduct operations to ensure least inconvenience to Owner and operation of existing facility. Cooperate with Owner during construction operations to minimize conflict and to facilitate Owner's operations.

B. When keys to locked areas are needed to provide access to areas to perform Work, obtain from Owner. Return keys at end of day's Work.

C. Employees of Contractor and Subcontractors involved in Work shall wear identifying button or badge when working in facilities occupied by Owner.

D. Contractor shall provide daily sign-in sheets to the Owner with employees of Contractor and Subcontractor noted on the sign-in sheet.

E. Due to potential health hazards and requirements of the Indiana Department of Environmental Management, and U.S. EPA, existing water treatment facilities must be maintained in operation during the construction of the new facilities. Degree of treatment during construction shall be equal to or exceed efficiency of the facility before construction started.

F. Contractor shall discuss and coordinate with Owner and Engineer prior to removing equipment from service in order to complete Work. Owner will, at Owner's discretion, request equipment to be placed back into service if out of service equipment will cause adverse effects on plant operation.

G. Obtain and pay for use of additional storage or Work areas needed for operations at no additional cost to Owner.

1.05 OWNER OCCUPANCY OF PREMISES

A. Owner will occupy site and existing facilities during entire construction period for conduct of normal operations.

B. Owner reserves right to partially occupy and to place and install equipment in completed areas of facilities, prior to Substantial Completion, provided that such occupancy does not interfere with completion of Work. Such placing of equipment and partial occupancy shall not constitute acceptance of the Work.

C. Partial occupancy shall conform to requirements of General Conditions.

PART 2 – PRODUCTS

(Not Used)

PART 3 – EXECUTION

(Not Used)

END OF SECTION

SECTION 01 21 00
ALLOWANCES

PART 1 – GENERAL

1.01 SUMMARY

A. To provide adequate budget and bonding to cover items not precisely determined prior to bidding, include in the Contract Price the costs or quantities described in this Section.

B. Adjustment of Cost:

1. If cost or quantity is more or less than the specified allowance, Contract Price will be adjusted by Change Order.
2. Submit documentation for the actual costs or quantities after completion of Work. Documentation shall include billing statements and evidence of payment.

C. Designate in schedule of values costs and quantities required under each allowance.

1.02 SPECIFIC ALLOWANCES

A. Section 26 05 43: Allow for lump sum of $50,000 for relocation of two existing duct banks and other conflicting utilities shown on 002-CPEN-1. Dimensions and contents of duct banks are unknown. Contractor shall investigate contents duct banks and coordinate with Engineer/Owner for relocation.

B. All Sections: Allow for lump sum of $100,000 for project improvements not currently identified in the Contract Documents. Improvements could be due to unforeseen conditions, Owner requests or other reasons identified during construction. Project improvements related to this work will be based on issued Work Change Directives identifying specific tasks and agreed to pricing prior to work beginning.

C. Appendix: Allow for lump sum of $69,100 to rehabilitate Sodium Hypochlorite Storage Tank T-1. Rehabilitation shall be performed by Wyn Industries as described in the quotation in the Appendix.

PART 2 – PRODUCTS

(Not Used)

PART 3 – EXECUTION

(Not Used)

END OF SECTION

SECTION 01 23 00
ALTERNATES

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes Alternates to Work defined in Contract Documents.

B. All Alternates described in this Section are required to be reflected on the Bid form as submitted by the Bidder.

C. Do not submit Alternates other than as described in this Section.

1.02 DEFINITIONS

A. Alternate: An amount proposed by Bidder and stated on Bid form for certain Work defined in Bidding Requirements that may be added to or deducted from Contract Price if Owner decides to accept corresponding change in either amount of construction to be completed, or in materials, equipment, or installation methods described in Contract Documents.

B. Cost: Net addition or deduction from Contract Price to incorporate Alternate into Work. No other adjustments will be made to Contract Price.

PART 2 – PRODUCTS

2.01 DESCRIPTION OF ALTERNATES

A. Alternate 1: Work in the Fluoride Room.

1. Replacement of Hydrofluorosilicic Acid piping, fittings, valves, and appurtenances in the Fluoride Room.
2. Pertinent Work specified elsewhere:

a. Piping: Section 40 05 05.
b. Valves: Section 40 05 53.
c. Heat Tracing: Section 40 41 13.
d. Drawings: 220-SM-1, 300-SM-1, 300-SM-2, 300-SM-4, 300-SM-5, 800-R-2, 800-SM-1, 800-SM-2, and 800-SM-3.

B. Alternate 2: Replacement of all lighting fixtures with LED lights in the Chemical Building 800.

1. Replacement of all lighting fixtures with LED lights in the Chemical Building 800.
2. Pertinent Work specified elsewhere:

a. Drawings: 800-R-1, 800-R-2, 800-R-3, 800-R-4, 800-EN-1, 800-EN-2, 800-EN-3, and 800-EN-4.
b. Specification: 26 51 00.

C. Alternate 3: Cleaning and coating of the Backwash Tank

1. Cleaning and coating of the Backwash Tank
2. Pertinent Work specified elsewhere:

a. Drawings: 900-SM-1.

b. Specification: 09 96 00.

3. If Alternate 3 is accepted, add 60 days to the schedule.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Coordination:

1. Modify or adjust affected Work as necessary to integrate Work of selected Alternates into Project.
2. Include as part of each Alternate, miscellaneous devices, accessories, and items incidental to or required for complete installation whether or not indicated as part of Alternate.

B. Execute accepted Alternates under same conditions as other Work of Contract.

END OF SECTION

SECTION 01 29 73
SCHEDULE OF VALUES

PART 1 – GENERAL

1.01 SUMMARY

A. Provide a detailed breakdown of the Contract Price showing amounts and quantities allocated to each of the various parts of the Work, as specified herein and as required by General Conditions.

B. Upon request of Engineer, support amounts and quantities with data substantiating their correctness.

1.02 FORM AND CONTENT OF SCHEDULE OF VALUES

A. Schedule shall be typed on 8-1/2-in. by 11-in. white paper. Contractor's standard forms and automated printout will be considered for approval by Engineer upon request. Include following:

1. Project title.
2. Project location.
3. Owner.
4. Engineer.
5. Engineer's project number.
6. Name and address of Contractor.
7. Contract designation.
8. Date.

B. Identify installed value of Work in sufficient detail to serve as basis for computing values for progress payments during construction.

C. Provide a separate listing of general items, such as bonds, insurance, mobilization, field supervision, construction facilities, allowances, and record documents.

D. Follow Project Manual table of contents as format for listing component items. At a minimum, listing shall include material cost and total installed cost for each Specification Section for each structure as listed in this Section.

1. Identify each line item with number and title of respective Specification Division and Section.
2. Include directly proportional amount of Contractor's overhead and profit.
3. For items on which progress payments will be requested for stored materials, break down value into:

a. Cost of materials, delivered and unloaded.
b. Total installed value.

E. Provide listing of items for sitework and for each structure as follows:

1. Contractor's Overhead.

a. Bonds and Insurance
b. Mobilization
c. Office Support

d. Field Supervision
e. Demobilization

2. Sitework.
3. 150 – Rapid Mix Basin
4. 220 – Settling Basin 2
5. 300 – Filter Building
6. 800 – Chemical Building
7. 900 – Backwash Tank

F. Sum of values listed shall equal total Contract Price.

G. Provide additional breakdown as required by Engineer.

PART 2 – PRODUCTS

(NOT USED)

PART 3 – EXECUTION

(NOT USED)

END OF SECTION

SECTION 01 31 19
PROJECT MEETINGS

PART 1 – GENERAL

1.01 SUMMARY

A. Engineer will conduct preconstruction conference in accordance with the General Conditions and this Section.

B. To enable orderly review during progress of the Work, and to provide for systematic discussion of problems, the Contractor shall conduct progress meetings, construction foreman's meetings, and specially called meetings throughout the construction period. Owner and Engineer may attend meetings. Contractor shall:

1. Prepare agenda.
2. Distribute written notice of specially called meetings a minimum of 1 working day in advance of the meeting date. Notice by electronic mail is acceptable.
3. Make physical arrangements for meetings.
4. Preside at meetings.
5. Record meeting minutes.
6. Prepare formal minutes within 3 working days after meeting and distribute electronic copies to:

    a. Meeting participants.
    b. Affected parties.
    c. Engineer and Owner

1.02 QUALIFICATIONS

A. Representatives of Contractor, Subcontractors, and Suppliers attending the meetings shall be authorized to act on behalf of entity each represents.

B. Revisions to Minutes:

1. Unless published minutes are challenged in writing prior to the next regularly scheduled progress meeting; they will be accepted as properly stating the activities and decisions of the meeting.
2. Challenge to the minutes shall be settled at the regularly scheduled meeting.

PART 2 – PRODUCTS

(NOT USED)

PART 3 – EXECUTION

3.01 PRECONSTRUCTION CONFERENCE

A. Location: To be selected by Owner.

B. Attendance:

1. Contractor's Project Manager.
2. Contractor's Resident Superintendent.
3. Contractor's "hands-on" person designated to submit Shop Drawings to Engineer.

4. Subcontractors' or Suppliers' representatives Contractor may desire to invite or Engineer may request.
5. Owner's representatives.
6. Engineer's representatives.
7. Local utility representatives, if applicable.

C. Agenda:

1. Organizational arrangement of Owner's and Engineer's forces.
2. Organizational arrangement of Contractor's, Subcontractors', and material and equipment Suppliers' forces.
3. Contract Documents, including distribution of required copies.
4. Project safety.
5. Preliminary Construction Progress Schedule.
6. Check of required bonds and insurance.
7. Liquidated damages.
8. Preliminary schedule of Shop Drawing submissions.
9. Procedures for handling submittals.
10. O & M submittals.
11. Channels and procedures for communications, correspondence, and project coordination.
12. Weekly and monthly meetings.
13. Equal opportunity requirements.
14. Laboratory and field testing requirements.
15. Provisions for inventory of material stored on-site or off-site.
16. Schedule of values.
17. Application for progress payments.
18. Field Order and Change Order procedures.
19. Project Record Documents.
20. Posting of required signs and notices.
21. Other business.

3.02 MONTHLY PROGRESS MEETINGS

A. Schedule monthly meetings.

B. Location: Contractor's field office.

C. Attendance:

1. Contractor's Project Manager.
2. Contractor's Resident Superintendent.
3. Affected Subcontractors.

D. Suggested Agenda:

1. Review of minutes of previous meeting.
2. Review of Work progress since previous meeting.
3. Project safety concerns.
4. Field observations, problems, conflicts.
5. Problems impeding Construction Progress Schedule.
6. Review of off-site fabrication, delivery schedules.
7. Corrective measures and procedures to regain conformance with Construction Progress Schedule.
8. Revisions to Construction Progress Schedule.

9. Issues raised by Owner and Engineer.
10. Proposed progress and schedule for succeeding Work period.
11. Coordination of schedules.
12. Review and update of submittal schedule.
13. Maintenance of quality standards.
14. Pending changes and Substitutions.
15. Effect of proposed changes on Construction Progress schedule.
16. Review of Project Record Documents.
17. Other business.

E. Agenda containing specific subjects to be discussed shall be provided to each attendee and to the Owner and Engineer at least 5 working days before the meeting.

3.03 CONSTRUCTION FOREMAN'S MEETING

A. Schedule weekly.

B. Location: Contractor's field office.

C. Attendance:

1. Resident Superintendent.
2. Subcontractors' foremen.

D. Suggested Agenda:

1. Review of Work progress since previous meeting.
2. Proposed progress and schedule for succeeding Work period.
3. Field observations, problems, conflicts.
4. Problems that affect Construction Progress Schedule.

END OF SECTION

SECTION 01 32 16
PROGRESS SCHEDULE
(BAR CHART METHOD)

PART 1 – GENERAL

1.01 SUMMARY

A. Submit preliminary Progress Schedule in accordance with General Conditions.

1.02 SUBMITTALS

A. Three days before the conference to discuss schedules, submit, electronically, preliminary schedule, and subsequent revisions thereof, to Engineer and Owner for review.

B. Three days prior to monthly Project Meetings as required by Section 01 31 19, furnish electrical copies of proposed revised schedule to Owner and Engineer. Furnish revised schedule to Subcontractors as appropriate.

C. In addition to submission requirements defined herein, post progress schedule to document management website.

D. Failure to submit schedules on a timely basis shall be considered cause for withholding progress payments.

1.03 WORKING HOURS

A. Comply with requirements of General Conditions.

B. No Work shall be done between 6:00 p.m. and 7:00 a.m., nor on Saturdays, Sundays or legal holidays without written permission of Owner. Emergency work may be done without prior permission.

C. Such permission may be revoked at any time by Owner if Contractor fails to maintain adequate equipment and supervision for proper prosecution and control of Work. Revocation shall not entitle Contractor to change in Contract Price or Contract Time.

PART 2 – PRODUCTS

(NOT USED)

PART 3 – EXECUTION

3.01 FORM OF SCHEDULE

A. Prepare schedule in form of horizontal bar chart.

1. Provide separate horizontal bar for each trade, activity or operation.
2. Provide continuous vertical line to identify first working day of each week.
3. Scale and space to allow for notations and future revisions.

B. Format of Listings: Chronological order of start of each activity or operation.

3.02 CONTENT OF SCHEDULE

A. Show complete sequence of construction by activity or operation.

B. Show dates for beginning and completion of each major element of construction and installation dates for major equipment items. Include:

a. Each individual task of construction.
b. Procurement of equipment and systems including Shop Drawing submittals, Engineer's review of submittals, shop tests, and delivery dates.
c. Identification of Work that will affect existing plant operations.
d. Services of manufacturer's representatives.
e. Startup dates for major equipment.
f. Field tests.
g. Dates of Substantial and Final completion.
h. Subcontractor Work items.
i. Allowance for inclement weather.
j. MBE, WBE, and SBE activities.
k. O&M data activities.
l. Contractor-provided training.

C. Show projected percentage of completion for each activity as of first day of each month.

3.03 REVISIONS TO SCHEDULE

A. Each month Contractor shall receive update information from Subcontractors and Suppliers which shall be included in current schedule. Revised schedule shall indicate changes such as:

1. Major changes in scope.
2. Activities modified since previous submittal.
3. Revised projections of progress and completion.
4. Other identifiable changes.

B. Provide narrative report to define following:

1. Problem area and anticipated delays and their impact on schedule.
2. Corrective action recommended and its effect.

3.04 MONTHLY PROGRESS MEETINGS

A. Once each month, in accordance with Section 01 31 19, Progress Schedule will be reviewed. Progress will be reviewed:

1. To identify those activities started and completed during previous period.
2. For remaining duration required to complete each activity started, but not completed.
3. For durations of selected activities not yet started.
4. For effect of Change Orders and proposed sequencing.

B. Update schedule accordingly.

3.05 DELAYS AND RECOVERY

A. If, at any time during the Project, Contractor fails to complete activity by its latest scheduled completion date, Contractor shall, within 5 working days, submit to Engineer written statement as to how and when work force will be reorganized to return to current Progress Schedule.

B. If, during schedule review meetings, it becomes apparent that milestone completion dates or times established in Section 01 11 00 or Contract completion dates will not be met due to a delay, disruption, or interference caused by or within the control of Contractor, Contractor shall take some or all of the following actions:

1. Increase construction staffing in such quantities and crafts as shall eliminate backlog of Work.
2. Increase number of working hours per shift, shifts per day, work days per week, amount of construction equipment or combination of foregoing sufficient to substantially eliminate backlog of Work.
3. Reschedule Work activities to achieve concurrency of accomplishment.

C. Under no circumstances will addition of equipment or construction forces, increasing working hours or other method, manner or procedure to return to current Progress Schedule be considered justification for Contract modification or treated as acceleration.

END OF SECTION

SECTION 01 32 33
CONSTRUCTION PHOTOGRAPHS

PART 1 – GENERAL

1.01 SUMMARY

A. Provide digital-format photographs taken at the specified stages during construction, and in accordance with provisions of this Section.

B. Provide color video of existing facilities taken before commencement of construction.

1.02 SUBMITTALS

A. Submit digital photographs on electronic media acceptable to the Engineer. Digital photographs shall be common retrievable format as specified by Engineer during Preconstruction Conference. Submit with each application for payment.

B. Submit color video of existing facilities using electronic media and format acceptable to the Engineer. Submit prior to commencement of construction.

C. In addition to submission requirements described above, post digital photographs and color video to Document Management Web Site. Organize files in similar manner to Contract Drawings (sitework, and by structure).

PART 2 – PRODUCTS

2.01 PHOTOGRAPHS

A. Provide electronic color prints:

1. Electronic files shall be in JPG, TIFF, or other commonly used format. Files shall be named to adequately describe the photo without the need to open the file.
2. Project name.
3. Engineer’s project number.
4. Orientation of view.
5. Date and time of photograph.
6. Photograph number.
7. Contractor’s name and address.

B. Submit approved electronic storage with the appropriate information shown under paragraph 2.01 A. above.

PART 3 – EXECUTION

3.01 PHOTOGRAPHIC REQUIREMENTS

A. Take photographs at each major stage of construction.

1. Before commencement of construction.
2. At intervals sufficient to record construction progress but no less than at monthly intervals during construction of facilities. Photographs need show only new Work for that month.

B. Make each photograph clear, in focus, with high resolution and sharpness, and with minimum distortion.

3.01 VIDEO REQUIREMENTS

A. Perform video recording to provide a measure of required restoration. Take care to record all existing conditions which exhibit deterioration, imperfections, structural failures, or situations that would be considered substandard.

B. Owner and Engineer shall be notified a minimum of 48 hours in advance of when the video recording is to occur so they can be present if desired. Videotaping shall include all areas affected by construction including, but not necessarily limited to:

1. All surrounding buildings and structures impacted by construction (internal and external video)
2. External site areas where improvements are being performed.

C. Do not perform video recording during periods of precipitation, mist, fog, or when the ground is covered in snow. Only record when sufficient sunlight is present to properly illuminate the subjects of recording.

D. Perform audio notes during video recording. Audio portion shall reproduce precise and concise explanatory notes by the camera operator with proper volume, clarity and freedom of distortion.

E. At the start of production and at the beginning of a new site feature, building, basement or other marker, read an identification summary into the recording while using a wide-angle view of the video to display numeric displays for visual record. This summary shall include:

1. Tape number.
2. Project name.
3. Job location.
4. Positional location at start of recording.
5. Date and time.
6. Weather.
7. Direction of camera.
8. Other notable conditions.

3.02 VIEWS

A. Make photographs from three separate locations around Work and for each major structure.

B. Select locations to provide diversified overall views of Work, from positions that are expected to remain accessible throughout progress of Work. Locations shall adequately illustrate condition of construction and state of Project.

C. When directed by Engineer, because of stage of construction, change one or more locations to new locations inside or outside structure.

END OF SECTION

SECTION 01 33 00
SUBMITTAL PROCEDURES

PART 1 – GENERAL

1.01 SUMMARY

A. Requirements for Work-related (non-administrative) submittals including Substitutes and "Or-Equal" items, Shop Drawings, product data, Samples, test results, operating and maintenance data, and other miscellaneous Work-related submittals.

1. Submittals for certification of installation, instructional, and post-startup services are specified in Section 01 61 00.
2. Submittals for operation and maintenance data are specified in Section 01 78 23.
3. Submittals for record drawings are specified in Section 01 78 39.

B. Administrative Submittals: Procedures concerning items such as listing of manufacturers, Suppliers, Subcontractors, Progress Schedule, bonds, payment applications, insurance certificates, Schedule of Values, and photographs are specified elsewhere.

C. Work–Related Submittals:

1. Substitute and "Or-Equal" Items:

a. Includes material or equipment described in Paragraph 7.04 of General Conditions, Article 7 of the Supplementary Conditions, and Section 01 61 00 which Contractor requests Engineer to accept, after Effective Date of the Agreement.

2. Shop Drawings:

a. As defined in Paragraph 1.01.A.37 of the General Conditions, and in particular includes technical data and drawings specifically prepared for this Project, including fabrication and installation drawings, diagrams, data sheets, schedules, templates, patterns, reports, instructions, design mix formulas, measurements, and similar information not in standard printed form.

3. Product Data:

a. Includes standard catalog type printed information on manufactured materials, equipment and systems that has not been specifically prepared for this Project, including manufactures' product specifications, catalog cut sheets, standard wiring diagrams, printed performance curves, mill reports, and standard color charts.

4. Samples:

a. As defined in Paragraph 1.01.A.34 of the General Conditions, and in particular includes fabricated and manufactured physical examples of materials, products, and units of Work, including complete units, partial cuts of manufactured or fabricated Work, swatches showing color, texture, and pattern, and units of Work to be used for independent inspection and testing.
b. Mock-ups are special forms of Samples too large or otherwise inconvenient for handling in manner specified for transmittal of Sample submittals.

5. Test Results:

a. Includes source and field quality inspection and test reports, actual performance curves, and certifications of results prepared specifically for equipment, material, and systems provided for this Project.

6. Miscellaneous Submittals:

a. Work-related submittals that do not fit in previous categories, including schedules, guarantees, warranties, certifications, maintenance agreements, workmanship bonds, survey data and reports, physical work records, copies of industry standards, field measurements, extra materials, keys, and similar information, devices, and materials applicable to Work.

PART 2 – PRODUCTS

(NOT USED)

PART 3 – EXECUTION

3.01 DOCUMENT MANAGEMENT WEB SITE – ELECTRONIC DOCUMENT SUBMISSION

A. General

1. Document Management Web Site Supplier:

a. eCommunication, by Eastern Engineering
b. Or Approved Equal.

2. Software tool specifically designed for construction related document management.
3. Primary means of submittal shall be electronic.
4. Provide web based document storage, notification, and transfer.
5. Contractor to include costs to set up and to maintain site throughout the duration of the Project.

B. Minimum System Features.

1. Defined work flow directed submission, review, and approval process for various types of contract related documents. Work flow process shall be specific to type of document. Include specific work flow process for:

a. Requests for substitutes.
b. Shop drawings and product data.
c. Test results.
d. Operation and Maintenance data.
e. Request for Proposals
f. Request for Information
g. Work Directive Changes
h. Pay requests, both draft and final versions.
i. Guarantees, Warranties, Maintenance Agreements, and Workmanship Bonds
j. Survey Data
k. Certifications
l. Closeout Submittals.
m. Miscellaneous Project related documents including

1) Contract Documents - plans, specifications, and addenda.
2) Project schedule.

3) Schedule of Values,
4) Permits,
5) Project forms for document transmittal,
6) Construction photographs and video,
7) Inspection reports,
8) Project meeting minutes,
9) Contact information for each team member,

n. Add additional categories as required by Project specific needs at no additional cost to Owner.

2. Defined work flow roles, responsibilities, and capabilities for defined teams including:

a. Owner
b. Engineer
c. Contractor
d. Add additional teams as required by Project specific needs. Examples:

1) Sub Contractor

3. Activities listed below shall be available based on team membership and agreed to team based roles, and agreed to work flow process for a given category of activity:

a. View items
b. Submit new item.
c. Add files
d. Sign and annotate files
e. Process item
f. Send item back to previous step
g. Forward the item
h. Share the item

4. All submittals shall be posted in a searchable, bookmarked PDF format with the exception of Requests for Information (RFIs). RFIs shall be posted in Microsoft Word format. Maximum file size for submission shall be 50 MB. Submittals larger than 50 MB should be submitted as separate files within the same submittal.
5. Include tools to allow basic mark-up and annotation of files.
6. Provide email notification that submittal, RFI, or other item needs the attention of a team member.
7. Active item list of items requiring attention based on team member.
8. Ability of team members to add signature (PNG) or action stamp to files, based on assigned user rights.
9. Document library listing all closed documents posted on site, with ability of team members to view, print, or save items based on assigned user rights.
10. Ability to create and generate logs and reports.
11. Ability to view and download stored documents.

C. Provide System Set Up With Input From the Owner and Engineer.

1. Obtain and input email address of all project members intended to receive notification of submittal availability. Obtain and configure passwords to limit access to site. Include up to 20 persons for distribution and access.
2. Modify system configuration as required for project specific requirements throughout the duration of the Project.

D. Provide Training For All Team Members on Use of the System.

1. Initial training sessions shall consist of a minimum of two (2) one (1) hour sessions. Each session shall be repeated once to accommodate team member availability.
2. Coordinate training dates and times at least one week in advance of proposed training dates.
3. Have training manuals available at least one day prior to training session.
4. Training shall occur in a mutually agreed to location, or may be offered via web based interactive session.
5. Provide additional follow-up training as needed at no additional cost to Owner.

E. Security:

1. Cloud hosted in off-site Tier-1 environment.
2. Include daily back-ups and redundant disk arrays (RAID 6).
3. Enterprise level firewall, monitored for intrusion, spam and virus, and physical security.
4. Capability for encrypted data transmission.

F. Project Closeout, File Retention, and Document Delivery:

1. Within 4 weeks of final closeout of the Project, all project files present on the Document Management Web Site shall be archived for long term storage.
2. Archived files shall be linked within a menu driven file structure accessible using Adobe Acrobat. Files shall be archived using the same file names and within the same file structure used on the web site interface.
3. Archived files shall be delivered on thumb drive or DVD. Provide up to ten (10) copies, and deliver to Owner, Engineer, and Contractor.

3.02 SUBMITTAL PROCEDURES

A. Scheduling:

1. Provide preliminary and final schedule of submittals in accordance with the General Conditions indicating time requirements for coordination of submittals with performance of Work.
2. Times scheduled shall indicate completion of submittal approval process for Substitute and “Or-Equal” items, Shop Drawings, product data, and Samples not later than 60 days prior to beginning systems demonstrations specified in Section 01 79 10. Completion of submittal process for above submittals will have been achieved when submittals have been returned to Contractor with submittal action of either “Approved” or “Approved As Noted”.
3. Adjust schedule of submittals periodically to reflect revisions to Progress Schedule.

B. Coordination:

1. Coordinate preparation and processing of submittals with performance of Work. Coordinate each submittal with other submittals and related activities such as substitution requests, testing, purchasing, fabrication, delivery, and similar activities.
2. Coordinate submission of different units of interrelated Work so submittal will not be delayed by Engineer’s need to review related submittal. Engineer may withhold action on submittal requiring coordination with other submittals until related submittals are provided.
3. Prepare and transmit each submittal sufficiently in advance of scheduled performance of related Work and other applicable activities.

C. Submittal Preparation:

1. Stamp and sign each submittal certifying to review and approval of submittal, verification of material and equipment, field measurements, field construction criteria, and coordination of information with Contract Documents in accordance with paragraph 7.16 of the General Conditions.
2. Submittals shall contain sufficient detail to confirm compliance with the requirements of the respective specification section. Submittals shall not contain excessive, non-pertinent information.
3. Submittals shall be complete for all material and equipment specified in each section. Partial submittals are not acceptable.
4. Transmittal Form: Use CONTRACTOR'S SUBMITTAL TRANSMITTAL form included in Appendix. Identify following:

    a. Date
    b. Transmittal and Submittal number
    c. Project
    d. Name and signature of Contractor:
    e. If submittal is for substitute, identify as "Substitute" on transmittal.
    f. Specification section and/or Drawing numbers.
    g. Description of submittal (i.e. equipment identification numbers, motor numbers, etc.)
    h. Variations from Contract Documents

5. The electronic submittal shall be in searchable, bookmarked PDF format.
6. Electronic submittal document shall be created with OCR (Optical Character Recognition) to allow for full alphanumeric recognition of printed characters

D. Resubmittal Preparation:

1. Comply with requirements for Submittal Preparation above, and in addition:

    a. Identify on transmittal form submittal is a resubmission.
    b. Make corrections or changes in submittal required by Engineer's notations on returned submittal.
    c. On transmittal or separate page, answer or acknowledge in writing notations or questions indicated on Engineer's transmittal form of returned submittal.

        1) Identify each response by question or notation number established by Engineer.
        2) If Contractor does not respond to each notation or question, resubmission will be returned without action by Engineer until Contractor provides written response.

    d. Contractor-initiated revisions or variations:

        1) On transmittal form, identify variations or revisions from previously reviewed submittal.

3.03 SPECIFIC SUBMITTAL REQUIREMENTS

A. General:

1. Comply with requirements specified below for each indicated type of submittal. Specific submittal requirements for individual units of work are specified in applicable Specification section.
2. If Engineer has responded to Request for Information submitted by Contractor, include Engineer's response with submittal.

B. Requests for Substitutes:

1. Collect data for items to be submitted for review as Substitute into one submittal for each item of material or equipment in accordance with paragraph 7.06 of the General and Supplementary Conditions.
2. Include completed CONTRACTOR'S REQUEST FOR SUBSTITUTION form as required by Supplementary Conditions. Use the form included in the Appendix.
3. Submit with other scheduled submittals for material and equipment allowing time for Engineer to evaluate additional information required to be submitted.
4. If Contractor requests to substitute for materials or equipment specified, but not identified in Specification as requiring submittal, Contractor shall indicate substitution in Submittal Schedule.

C. Shop Drawings:

1. Maximum size 22 in. by 34 in.
2. Submit graphic information at accurate scale with name of preparer indicated.
3. Show dimensions and note which are based on field measurements.
4. Indicate compliance with standards and notation of coordination requirements.
5. Highlight, encircle or otherwise indicate variation from Contract documents or previous submittals and revisions on resubmittals.
6. Do not use Engineer's Drawings as Shop Drawings.
7. Provide blank space for Contractor stamps.
8. Provide 4-in. by 8-in. blank space for Engineer stamps.

D. Product Data:

1. Collect required data into single submittal for each unit of Work or system. Where product data includes information on several similar materials or equipment, some of which are not require for use in Project, mark copies to show which items are not applicable to Project.

E. Samples:

1. Provide Samples physically identical with proposed materials and equipment to be incorporated into work. Where variations in color, pattern, and texture are inherent in product, submit multiple units (not less than 3) showing approximate limit of variations.
2. Provide full set of option Samples where selection by Owner or Engineer is required.
3. Include information with Sample to show generic description, source, product name, manufacturer, limitations, and compliance with standards.
4. Submit Samples with other related elements of work.
5. Submit two (2) sets of Samples where Specifications indicate Engineer's selection of color, pattern, texture or similar characteristics from manufacturer's range of standard choices is necessary. Neither set will be returned.
6. Maintain set of Samples at Project site, in suitable condition and available for quality control comparisons throughout course of Work.

F. Test Results:

1. Identify each test by Specification section and type of test.
2. Submittal is to confirm that results of tests verify materials, products, and systems comply with Contract Documents and are not for approval.

G. Miscellaneous:

1. Guarantees, Warranties, Maintenance Agreements, and Workmanship Bonds:

    a. Refer to Specification sections for requirements.
    b. Provide 2 executed copies. Provide 2 additional copies where required for operation and maintenance data.

2. Survey Data:

    a. Refer to Specification sections for requirements of property surveys, building or structure condition surveys, field measurements, quantitative records of actual work, damage surveys, and similar data.

3. Certifications:

    a. Refer to Specification sections for requirements.

4. Closeout Submittals;

    a. Refer to Specification sections for requirements of spare parts, extra and overrun stock, maintenance tools and devices, keys, and similar units to be submitted.

3.04 ACTION ON SUBMITTALS

A. General:

1. Except for submittals for record and similar purposes, where action and return is not required or requested, Engineer will review each submittal, mark the appropriate action, and return.
2. Where submittal must be held for coordination, Engineer will so advise Contractor without delay.
3. Engineer will stamp each submittal with uniform, self-explanatory action stamp, appropriately marked with submittal action.

B. Unsolicited Submittals:

1. Engineer will return unsolicited submittals without reviewing.

C. Action Stamp:

1. Marking: “Approved”

    a. Work covered by submittal may proceed provided it complies with Contract Documents. Acceptance of Work depends on that compliance.

2. Marking: “Approved As Noted”

    a. Work covered by submittal may proceed provided it complies with Engineer’s notations or corrections on submittal and with Contract Documents. Acceptance of work depends on that compliance. Resubmittal not required.

3. Marking: “Revise and Resubmit”

    a. Do not proceed with Work covered by submittal.
    b. Revise submittal or prepare new submittal in accordance with Engineer’s notations.

4. Marking: “Not Approved”

    a. Work covered by submittal does not comply with Contract Documents. Do not proceed with Work covered by submittal.
    b. Prepare new submittal complying with Contract Documents.

5. Marking: “No Action Required”

    a. Document has not been reviewed and is only filed for record purposes.

D. General Distribution:

1. Unless required elsewhere, provide distribution of submittals to Subcontractors, Suppliers, governing authorities, and others as necessary for performance of Work.
2. Provide copies of submittals bearing Engineer’s action stamp to:

    a. Job site file.
    b. Record documents file.

END OF SECTION

SECTION 01 35 16
ALTERATION PROJECT PROCEDURES

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Cutting and patching.
2. Alterations to existing buildings or structures.
3. Demolition, removal, and abandonment of existing facilities.

B. Work Includes:

1. Cutting, moving or removal of items as shown on Drawings.
2. Cutting, moving or removal of items as necessary to provide access to allow alterations and new Work to proceed.
3. Cutting, moving or removal of items not shown to be cut, moved or removed, but which must be cut, moved or removed to allow new Work to proceed.
4. Patching or reinstalling Work or items which are to remain in finished Work.
5. Removal of existing surface finishes as needed to install new Work and finishes.
6. Removal of abandoned items.
7. Salvage of material and equipment as noted.
8. Demolition of structures.
9. Removal of portions of structures or utilities.
10. Abandonment of utilities.

1.02 SUBMITTALS

A. Test Results:

1. Facility condition surveys.

B. Miscellaneous Submittals:

1. Alteration and demolition schedule and operational sequence.

C. Submit in accordance with Section 01 33 00.

1.03 QUALITY ASSURANCE

A. Conform to requirements of regulatory agencies and utility companies.

1.04 PROTECTION AND CONTINUITY OF OPERATIONS AND UTILITIES

A. Perform Work with trades qualified to perform Work in manner causing least damage to each type of Work.

B. Protect existing finishes, equipment, and adjacent Work which is to remain, from damage.

C. Protect existing and new Work from weather and extremes of temperature.

D. Do not pile material to endanger building or structure.

E. Structural stability of structures adjacent to or affected by Work shall be Contractor's responsibility. Provide shoring, needling, and bracing to keep buildings or structures structurally secure and free of damaging deflection or settlement.

F. Do not close or obstruct streets, walks, or other facilities occupied and used by Owner and public without prior written permission from Owner and others having jurisdiction.

G. Notify utilities prior to razing operations to permit them to disconnect, remove, or relocate equipment serving existing facilities.

H. Protect existing utilities so they will continue to function during and after construction. Where interference with facilities occurs, cooperate with owner of utility and, if necessary, alter utility or facility to eliminate interference.

I. Service Continuity:

1. Perform Work so as not to interfere with Owner's operations.
2. Provide and maintain continuous electrical, plumbing, and HVAC services to functioning portions of facilities during hours normally in use.
3. Temporary outages are permitted during cutover work at such times and places as can be pre-arranged with Engineer and Owner. Keep such outages to minimum number and length. Make no outages without prior approval.
4. Remove temporary equipment and materials when no longer required.

J. Plant Operation:

1. Maintain continuity of plant operation to functioning portions of existing plant.
2. Temporary shutoff is permitted during cutover Work at such times and places as can be pre-arranged with Engineer and Owner. Keep such shutoffs to minimum number and length. Once Work has started on temporary shutoff, continue until Work is complete. Make no shutoffs without prior approval.
3. Remove temporary equipment and materials when no longer required.

1.05 TEMPORARY ELECTRICAL AND MECHANICAL SERVICES

A. Comply with Section 01 52 00.

B. Electrical:

1. Maintain existing electrical service to existing equipment until removed from service.
2. Provide temporary electrical connections to new equipment if permanent wiring is not complete and equipment is required to be placed into service to continue operation of facility.
3. Provide temporary electrical connections to temporary equipment or existing equipment that has been relocated but is required to continue operation of facility.

C. Mechanical:

1. Maintain existing interior work area above 60°F.
2. Provide weather protection, waterproofing, heat, and humidity control to prevent damage to remaining existing and new Work.
3. Where existing ventilation systems are to be replaced, either the supply or exhaust/return shall remain operational at all times to ensure minimum ventilation is provided. Where this is not possible, temporary ventilation shall be provided.

PART 2 – PRODUCTS

2.01 SALVAGED MATERIALS

A. Whenever used in the Documents, the term “salvage” shall indicate material or equipment to be retained by the Owner or to be reused in the Work.

B. Salvage sufficient quantities of cut or removed material to replace damaged Work of existing construction or patch new Work when material not readily obtainable on current market.

C. Salvage material and equipment to be retained by Owner or to be reused in Work:

1. NAOC, NAOH, and NHOH feed pumps.

D. Salvaged materials and equipment shall be relocated on-site where indicated by Engineer.

E. Prior to commencement of removal activities associated with the salvaging of equipment for either reuse by Owner, or reuse in Work, an inspection shall be completed by the Contractor, with the Owner and Engineer present. The inspection shall identify condition of components to be salvaged and itemize known or observed deficiencies. During the inspection, each component shall be photographically logged. A Salvaged Equipment Condition Report shall be submitted for approval by Owner and Engineer identifying condition of each component as “Good” or “Damaged”. Components identified as Damaged shall contain a description of extent of damage. Photo log shall be submitted electronically with file names matching equipment tag.

F. Items to be salvaged for either reuse by Owner, or reuse in Work shall be removed with care to protect the existing condition of the component and ensure component can be reused in a different service. To the greatest extent possible, individual salvaged items shall be removed in one piece. Large items that have bolted connections may be disassembled to facilitate removal but must be reassembled to same condition at location of storage. If disassembled location contained a gasketing material, a new gasket shall be provided and installed, reuse of the existing gasket will not be permitted unless specifically approved by Engineer.

2.02 PRODUCTS FOR PATCHING, EXTENDING, AND MATCHING

A. Provide same products, salvaged materials, types of construction or finish as that in existing structure, as needed to patch, extend or match existing Work.

B. If requested by Engineer or Owner, Contractor to provide samples of materials and details of installation a minimum of thirty (30) days prior.

PART 3 – EXECUTION

3.01 PREPARATION

A. Prior to alteration or demolition of facilities, accomplish following:

1. Owner release of facility.
2. Electrical, HVAC, process, and plumbing services rerouted or shut off outside area of Work.
3. Salvage items scheduled for reuse in new Work or scheduled to be delivered to Owner.
4. Survey and record condition of existing facilities to remain in-place that may be affected by Work. After Work complete, survey conditions again and restore facilities to original condition at no additional cost to Owner. Conduct surveys in presence of Engineer.

5. Perform video recording, in accordance with Section 01 32 33, to provide a measure of required restoration. Take care to record all existing conditions which exhibit deterioration, imperfections, structural failures, or situations that would be considered substandard.

B. Where new Work is to be installed or suspended concealing existing surfaces or spaces, Contractor shall remove foreign substances such as grease, sludge, and odoriferous material before starting Work.

C. Where surfaces are to remain exposed, Contractor shall remove foreign substances such as grease, sludge, and odoriferous material.

D. Coordinate alteration and demolition Work so new construction installed before, during, and after Work may commence without undue delay.

3.02 TEMPORARY ENCLOSURES

A. Provide temporary weather tight enclosure for successive areas of buildings as Work progresses. To provide:

1. Acceptable working conditions.
2. Weather protection for materials.
3. Allow for effective temporary heating.
4. Prevent entry of unauthorized persons.

B. Provide temporary enclosures to separate Work areas from areas of existing buildings occupied by Owner to prevent penetration of dust or moisture into occupied areas, to prevent damage to existing equipment, and to protect Owner's employees and operations.

C. Use framing and sheet materials complying with structural and fire rating requirements of applicable codes and standards.

D. Relocate as required by progress of construction, by storage or work requirements, and to accommodate requirements of Owner.

E. Remove temporary enclosures when no longer required.

3.03 CUTTING AND PATCHING

A. Cut finish surfaces such as masonry, tile, plaster, or metals, by methods to terminate surfaces in smooth, straight line at natural point of division. Make cuts parallel with walls and/or floors.

B. Make joints and finishes match adjacent or similar work.

C. Do not cut or notch structural members without specific written approval of Engineer.

D. At request of Engineer or Owner, Contractor shall prepare mockup of proposed materials to be used in locations adjacent to, connecting, or patching into existing surfaces to remain. Owner shall approve of appearance and match prior to Contractor's installation of permanent Work.

3.04 REMOVAL OPERATIONS

A. Remove concrete, steel and masonry to extent indicated on Drawings.

B. Remove equipment and appurtenances to extent indicated on Drawings.

C. Remove utilities and piping to elevations and locations shown on Drawings and plug and seal permanently with steel cap, concrete plug, or other approved method in accordance with specified abandonment procedures.

D. Remove abandoned utilities and underground piping within influence zone of proposed structures or piping.

E. Where existing materials and equipment are removed or relocated, remove materials no longer used such as studs, straps, conduits, ducts, junction boxes, pull boxes, wires, anchors, and supports. Remove or cut off concealed or embedded materials and equipment to at least 1 in. below final finished surface. Patch floors and walls to match existing.

F. Repair affected surfaces to conform to type, quality, and finish of adjacent surfaces.

G. Dispose of removed items as specified herein.

3.05 DEMOLITION OPERATIONS

A. Demolish existing structures including superstructure, foundation, footings, piles, utility drains, and other piping 18 in. below finished grade in landscaped areas, 36 in. below finished grade in paved areas, or as shown on Drawings.

B. Provide drainage for structures demolished by cutting openings in floors of structures remaining in-place. Holes shall be 6 in. dia minimum, spaced at 20-ft centers maximum (minimum of 2 each confined area). Notify Engineer prior to backfilling structure remaining. Fill in accordance with Section 31 23 00.

C. Demolish existing structures and their entire foundations when noted on the Drawings or when the existing structures fall within the influence zone of new structures as defined in Section 31 23 00.

D. Plug or cap utility drains and other piping in accordance with specified abandonment procedures.

E. Dispose of demolition debris as specified herein.

3.06 ABANDONMENT OPERATIONS

A. Abandon utilities and piping within limits noted. Fully disconnect from portions of utility or piping remaining in service.

B. Remove portions of utility or piping being abandoned within influence zone of proposed structures or piping.

C. Provide compatible cap for pressurized piping. Provide thrust blocks for caps unless piping has fully restrained joints.

D. Provide concrete plugs for gravity piping. Plug shall be Class B concrete in accordance with Section 03 30 00.

E. If piping is over 12-inches in diameter, fill existing pipe to be abandoned with low viscosity flowable fill. The 28-day compressive strength of flowable fill shall not be less than 50 psi.

3.07 RESTORATION

A. Where existing partitions are removed, patch floors, walls, and ceilings with finish materials matching existing to provide smooth planes without breaks, steps, or bulkheads. Trim and refinish doors as necessary to clear new floors or flooring material.

1. Where change of plane of 2 in. or more occurs, notify Engineer and request direction.

B. Patch and replace portions of existing finished surface damaged by Contractor's operations.

1. Provide adequate support of substrate prior to patching finish.
2. Refinish patched portions of painted or coated surfaces to produce uniform color and texture over entire surface.
3. When existing surface finish cannot be matched, refinish entire surface to nearest intersection.

C. When new Work abuts or finishes flush with existing Work, transition shall match existing adjacent Work in texture and appearance so patch or transition is not visible at a distance of 6 feet.

D. When smooth transition is not possible, terminate existing surface along straight line at natural division, and provide appropriate trim.

E. Clean and repair damage caused by installation or by use of temporary facilities.

1. Remove foundations and underground installations used for construction aids.
2. Grade areas affected by temporary installations to required elevations and slopes.

F. Restore existing facilities used for temporary purposes to specified, or original, condition.

3.08 CLEANING

A. Perform periodic cleaning and final cleaning as specified in Section 01 74 00.

1. Clean Owner-occupied areas daily.
2. Clean spillage, overspray, and heavy collection of dust in Owner occupied areas immediately.

B. At completion of alteration and demolition Work in each area, provide final cleaning and return space to condition suitable for use by Owner.

3.09 DISPOSAL

A. Remove debris from site each day.

B. Equipment and materials not scheduled to be salvaged or reused in new Work shall become property of Contractor to be disposed of in accordance with applicable laws.

C. Debris and other undesirable and unsalvageable material resulting from alteration and demolition operations shall be legally disposed offsite.

END OF SECTION

SECTION 01 41 00
REGULATORY REQUIREMENTS

PART 1 – GENERAL

1.01 PERMITS

A. Contractor shall obtain the following permits:

1. Other Permits required for construction of the Work which are not listed as being provided by Owner.
2. Contractor shall be responsible for application fees, bond costs, coordination with permitting agencies and review or inspection fees charged by permitting agencies when Contractor obtains permit.
3. Annual or licensing fees which may be charged by permitting agencies for placement of facilities shall be paid for by the Owner.

B. Comply with requirements of permits obtained by Owner. Permits obtained by Owner include:

1. Indiana Department of Environmental Management, Application for Construction Permit for Public Water System.

1.02 NOTICES

A. Provide notices in accordance with requirements of General Conditions and applicable construction permits to following agencies or individuals and to others as required elsewhere in Contract Documents.

1. Engineer:

a. Notice: 10 working days prior to start of construction.
b. Notice: 5 days prior to start of additional crews.

2. Fire, Police, and Sheriff's Department:

a. Notice: 24 hr minimum, or as required by local agencies, prior to closing streets or performing operations affecting vehicular traffic.

3. Utilities: for work which requires excavation.

a. Notice: 72 hr minimum.

4. Others as required in Contract Documents.

1.03 REGULATIONS

A. Comply with local, state, and federal laws, rules, ordinances, and regulations. Give Engineer notice of variations in accordance with General Conditions.

END OF SECTION

SECTION 01 45 29
TESTING LABORATORY SERVICES

PART 1 – GENERAL

1.01 SUMMARY

A. Testing and inspecting to be provided by the Contractor.

B. Provide the services of a testing laboratory approved by Owner.

C. Provide all tests and inspections required by governmental agencies having jurisdiction and required by provisions of the Contract Documents.

D. Perform additional tests as required by Engineer.

E. Perform additional inspections, sampling, and testing required when initial tests indicate Work does not comply with Contract Documents.

F. Specified inspections and/or tests may be waived only by the specific approval of Engineer, and such waivers will result in credit to the Owner equal to normal cost of such inspection and/or test.

1.02 PAYMENT

A. Include within the Contract Price an amount sufficient to cover all testing and inspecting required under this Section, and to cover all testing and inspecting required by governmental agencies.

B. The Owner will pay for additional testing and inspecting specifically requested by the Engineer when such tests indicate conformance with Contract Documents.

C. When additional tests requested by Engineer, or initial tests, indicate noncompliance with the Contract Documents, all inspection, sampling, and testing and subsequent retesting occasioned by the noncompliance shall be performed by the testing laboratory and the costs thereof shall be paid by the Contractor.

1.03 SUBMITTALS

A. Upon completion of each test and/or inspection, promptly submit written report of each test and inspection; one copy each to Engineer, Owner, material supplier, and Contractor, and one copy to record documents file. Each report shall include following:

1. Date issued.
2. Project title and number.
3. Testing laboratory name, address, and telephone number.
4. Name and signature of laboratory inspector.
5. Date and time of sampling or inspection.
6. Temperature and weather conditions if test performed in field.
7. Date of test.
8. Identification of product and Specification section.
9. Location of sample or test in Project.
10. Type of inspection or test.
11. Results of tests and compliance with Contract Documents.
12. Interpretation of test results, when requested by Engineer.

1.04 QUALIFICATIONS OF LABORATORY

A. Meet requirements of ASTM E329.

B. Authorized to operate in state where Project located.

C. Testing equipment calibrated at reasonable intervals by devices of accuracy traceable to either the National Bureau of Standards or other accepted values of natural physical constants.

PART 2 – PRODUCTS

(NOT USED)

PART 3 – EXECUTION

3.01 TAKING SPECIMENS AND TESTING

A. Except as may be specifically otherwise approved by Engineer, testing laboratory shall secure and handle all samples and specimens for testing and conduct testing.

B. Comply with specified standards.

3.02 COOPERATION WITH TESTING LABORATORY

A. Provide access to the Work at all times and at all locations where the Work is in progress. Provide facilities for such access to enable the laboratory to perform its functions properly.

B. Notify laboratory sufficiently in advance of operations to allow laboratory assignment of personnel and scheduling of tests.

1. When tests or inspections cannot be performed due to lack of such notice, reimburse Owner for laboratory personnel, travel expenses, and cost of test normally incurred.

END OF SECTION

SECTION 01 52 00
CONSTRUCTION FACILITIES

PART 1 – GENERAL

1.01 SUMMARY

A. Temporary construction facilities required for the Work, including, but not limited to:

1. Utilities including lighting and electricity, heat, and water.
2. Sanitary facilities.
3. Fire protection.
4. Roads.
5. Security fencing.
6. Enclosures.
7. Parking.
8. Project signs.
9. Field office for Contractor's personnel.

B. Maintain temporary facilities in proper and safe condition throughout progress of Work.

C. Comply with federal, state, and local codes and regulations, and utility company requirements.

1.02 LAYOUT OF TEMPORARY FACILITIES

A. Before starting Work, submit to Engineer, for approval, proposed layout of temporary facilities.

B. Should Contractor require space in addition to that shown on Drawings, Contractor shall make arrangements for storage of materials and equipment in locations off Site.

PART 2 – PRODUCTS

2.01 TEMPORARY LIGHTING AND ELECTRICITY

A. General:

1. Temporary lighting shall be sufficient to enable Contractor and Subcontractors to complete Work and enable Engineer to observe Work. Illumination shall meet or exceed state code requirements.

B. Temporary electric power may be obtained from Owner's electrical system as follows:

1. Make arrangements with Owner for temporary electricity.
2. No charge will be made for electricity obtained from Owner's electrical system and used for construction.
3. Provide electrical protection to prevent disruption of plant power from over-current, ground faults, and short circuits.
4. If Contractor requires more than Owner's supply available, Contractor shall obtain an additional source of electric power and pay all costs for power from additional source.

C. Contractor's responsibilities:

1. Provide, maintain, and remove temporary electric service facilities.

2. Provide temporary electric systems and components in conformance with requirements of National Electric Code and local authorities.
3. Facilities exposed to weather shall be weatherproof type.
4. Enclosures shall be locked to prevent unauthorized access.
5. Provide lamps, wiring, switches, sockets, and similar equipment required for temporary lighting and power tools.
6. Provide electric service to temporary offices.

2.02 TEMPORARY HEAT

A. General:

1. Provide heating required for cold weather protection until structure is enclosed.
2. Provide heating required after enclosure of structure.
3. Except as otherwise called for, temperature shall be kept between 50°F and 75°F.
4. Heat shall be warm air from oil or gas-fired portable heaters suitably vented to outside or with electric heating equipment.
5. Open salamander type heaters are not permitted.

B. Contractor's responsibilities:

1. Provide temporary heat, pay fuel costs, and maintain heating units.
2. Provide adequate heat to all parts of structure.
3. Repair or replace materials damaged because of lack of heat.
4. Provide throwaway filters if permanent system used for temporary heat.
5. All temporary heating and ventilation components shall be suitable for the hazardous classification to which they serve.

2.03 WATER FOR CONSTRUCTION

A. Owner will provide place for temporary connection to potable water source at Site.

1. Provide temporary piping and pumping facilities required to bring water to point of use.
2. Owner will provide water at no cost to Contractor.

B. Contractor shall supply any water required for construction beyond the capacity that Owner can supply. Water is available from hydrants.

1. Secure permission from water utility, obtain necessary permits, and notify Engineer and Fire Department before obtaining water from fire hydrants. Make arrangements and pay costs for water, for connecting to hydrants, and for temporary piping required to transport water to point of use.
2. Connection to hydrants shall prevent backflow to system. Use only special hydrant operating wrenches to open hydrants. Make certain hydrant valves are open full. If hydrants are damaged, Contractor shall be responsible and shall notify appropriate agency so damage can be repaired as quickly as possible. Fire hydrants shall be completely accessible to Fire Department at all times.

2.04 WATER FOR TESTING

A. Unless specifically stated otherwise in Specifications, Owner shall provide water necessary for testing. Comply with requirements specified under WATER FOR CONSTRUCTION in this Section.

2.05 SANITARY FACILITIES

A. Do not use existing sanitary facilities.

B. Provide temporary sanitary facilities conforming to state and local regulations, in sufficient numbers for use of Contractor's and Subcontractor's employees.

C. Maintain in sanitary condition and properly supply with toilet paper.

2.06 TEMPORARY FIRE PROTECTION

A. Provide and maintain minimum of one fire extinguisher on each floor of each building, and other fire protection equipment and devices as would be reasonably effective in extinguishing fires during early stages by personnel at Site.

2.07 TEMPORARY SITE AND OTHER ROADS

A. Construct and maintain temporary roadways in snow free, ice free, and driveable condition.

B. Maintain existing roads used during construction free from accumulation of dirt, mud, and construction debris. Roads shall be considered "maintained" when material has been removed by a sweeper. Multiple sweeper passes may be required to clean the existing surfaces sufficiently in Engineers opinion. Aggregate surfaced roads and drives will be considered "maintained" when dirt and soil contaminants in excess of 1" diameter have been removed and the total volume of contaminants remaining is estimated to be less than ¼ cubic foot. Contractor shall control dust from operations in all circumstances. Comply with dust control provisions in Section 01 57 19.

C. Temporary granular paving used prior to final paving shall be maintained in smooth condition. Ruts, holes, washboarding, or other surface deformities shall be corrected immediately by filling or scraping. All maintenance work to maintain traffic on existing roads shall be finished with a vibratory roller to recompact the surface.

D. Contractor shall repair or replace existing roads to original or better condition prior to Final Completion. Survey and record condition of existing roads prior to construction.

2.08 CONTRACTOR'S STAGING AND WORK AREA

A. Construct and maintain staging area at location shown on Drawings.

B. Prepare staging area as specified in Section 31 10 00. Provide minimum of 4-inches crushed stone surface.

C. Work Area:

1. Limit construction operations and storage of equipment and materials to areas shown on Drawings and as determined by Engineer.
2. Except as provided herein, no sidewalk, private property, or other area adjacent to Site shall be used for storage of Contractor's equipment and materials unless prior written approval is obtained from legal owner of the respective locations.
3. A reasonable amount of structural and other type material to be used during construction may, with written approval of agency having jurisdiction, be stored in streets or highways adjacent to Site, but only to an extent that is absolutely necessary to avoid delay in construction. A copy of written approval shall be submitted to Engineer. Such materials will not be allowed to accumulate but shall be replenished from day to day as required.

Permission to store materials shall be revocable at any time. Contractor, if so ordered, shall immediately upon receipt of order, or within a time to be therein stated, remove such materials.

4. Contractor shall maintain staging areas during construction in a manner that will not obstruct operations on any street areas. Work shall proceed in an orderly manner, maintaining construction Site and staging area free of debris and unnecessary equipment or materials.

2.09 SECURITY

A. Security will not be provided by Owner.

B. Contractor shall be responsible for loss or injury to persons or property where Work is involved and shall provide security and take precautionary measures to protect Contractor's and Owner's interests.

C. Provide and maintain temporary fencing of design and type needed to prevent entry onto Site by public.

2.10 ENCLOSURES

A. Provide and maintain all enclosures, scaffolds, tarpaulins, canopies, warning signs, steps, platforms, bridges, and other temporary construction necessary for proper completion of Work.

2.11 PARKING

A. Staging area and designated areas within construction limits may be used for parking of construction personnel's private vehicles and Contractor's lightweight vehicles.

B. Do not allow heavy vehicles or construction equipment in parking areas.

C. Make arrangements for additional parking off site as required.

2.12 PROJECT SIGNS

A. Provide signs suitably supported and erected on Site.

1. One painted sign, 48 sq ft area, bottom 6 ft above ground.
2. Sign to contain the Project Title, Owner logo, and name of Owner as indicated on the Contract Documents, Name of Engineer, and Name of Contractor
3. Erect supports and framing on secure foundation, rigidly braced and framed to resist wind loadings. Install sign surface plumb and level, with butt joints, anchor securely.
4. Paint exposed surfaces of sign, supports, and framing.
5. One sign, no larger than 3-ft by 4-ft, lettered as required by Engineer, to identify Engineer's field office.

B. Submit planned sign for Engineer review within fifteen (15) days after date of Notice to Proceed. Locate signs where designated by Engineer within fifteen (15) days of approval.

C. Do not place other signs on Site except name of respective Subcontractors on their field offices.

D. Maintain signs and supports throughout Project. Clean and repair deterioration and damage.

2.13 CONTRACTOR'S FIELD OFFICES AND BUILDINGS

A. If required by Contractor, erect where designated by Engineer, and maintain temporary field office and tool and storage buildings for Contractor's use.

B. Buildings shall be neat and well constructed, surfaced with plywood, siding, masonite, or other similar material, well painted and void of advertisements.

PART 3 – EXECUTION

3.01 GENERAL

A. Maintain and operate systems to ensure continuous service for duration of construction.

B. Modify and extend systems, as Work progress requires.

C. Material and Equipment provided as part of the project shall not be used for any temporary services.

3.02 REMOVAL

A. Completely remove temporary materials, equipment, signs, and structures when no longer required.

B. In unfinished areas, clean and repair damaged caused by temporary installations or use of temporary facilities, restore drainage, evenly grade, and seed or plant as necessary to provide appearance equal to or better than original.

C. In finished areas, restore existing or permanent facilities used for temporary services to specified, or original condition.

3.03 DAMAGE TO EXISTING PROPERTY

A. Contractor is responsible for replacing or repairing damage to existing buildings, structures, sidewalks, roads, parking areas, and other existing assets.

B. Contractor shall have option of having Owner contract for such Work and have cost deducted from Contract Price.

3.04 OWNER'S USE

A. Upon acceptance of Work, or portion of work defined and certified as Substantially Complete by Engineer, and Owner commences full-time successful operation of facility or portion thereof, Owner will pay cost for utilities used for Owner's operation. Contractor shall continue to pay for utilities used until final acceptance of Work, except as provided herein. However, heat for building as required for construction purposes shall still be paid by Contractor unless, due to occupancy by Owner, more heat shall be required due to increased temperature or lengthened duration, in which case Owner will bear difference in cost.

END OF SECTION

SECTION 01 57 19
TEMPORARY ENVIRONMENT CONTROLS

PART 1 – GENERAL

1.01 SUMMARY

A. General requirements pertaining to abatement and control of environmental pollution arising from activities of Contractor and Subcontractors in performance of the Work of the Contract.

B. Contractor, in executing Work, shall maintain work areas free from environmental pollution that would be in violation of federal, state or local regulations.

PART 2 – PRODUCTS

(NOT USED)

PART 3 – EXECUTION

3.01 GENERAL

A. The land resources within boundaries of the Project, but outside the limits of permanent Work performed under this Contract shall be preserved in their present condition or be restored to a condition after completion of construction that will appear to be natural and not detract from the appearance of the Project.

B. Insofar as possible, confine activities to pertinent areas defined on the Drawings or elsewhere in the Contract Documents.

1. Return construction areas to their preconstruction elevations except where surface elevations are otherwise noted to be changed.
2. Maintain natural drainage patterns.
3. Conduct construction activities in such a manner that ponding of stagnant water conducive to mosquito breeding habitat will not occur at any time.

C. Land resources:

1. Do not remove, cut, deface, injure, or destroy trees or other vegetation outside the Work area limits.
2. Do not remove, cut, deface, injure, or destroy trees or other vegetation inside the Work area limits, designated to be preserved, except as permitted by Engineer.
3. Land resources damaged by Contractor shall be promptly replaced or repaired to the approval of Engineer at Contractor's expense.

3.02 ARCHAEOLOGICAL FINDS DURING CONSTRUCTION

A. There are no known archaeological remains at the Project site.

B. Should skeletons, artifacts, or other archaeological remains be uncovered:

1. Suspend operations of this Contract at the site of discovery.
2. Continue operations in other areas.
3. Notify Engineer immediately of the finding.

C. Should the discovery site require archaeological studies resulting in delays and/or additional work, Contractor will be compensated by an adjustment under pertinent provisions of the

Contract.

3.03 PROTECTION OF STORM SEWERS

A. Prevent construction materials, concrete, earth or other debris from entering existing storm sewers or sewer construction.

3.04 PROTECTION OF WATERWAYS

A. Observe rules and regulations of State of Indiana and agencies of U.S. government prohibiting pollution of lakes, streams, rivers or wetlands by dumping of refuse, rubbish, dredge material or debris.

B. Disposal of materials into waters of state is prohibited on this project.

3.05 DISPOSAL OF EXCESS EXCAVATED AND OTHER WASTE MATERIALS

A. Excess excavated material not required or suitable for backfill and other waste material shall be disposed of in accordance with federal, state, and local regulations.

B. Provide watertight conveyance of liquid, semi-liquid or saturated materials which tend to bleed during transport. Liquid loss from transported materials is not permitted, whether being delivered to construction site or hauled away for disposal.

3.06 PROTECTION OF AIR QUALITY

A. Minimize air pollution by requiring use of properly operating combustion emission control devices on construction vehicles and equipment and encourage shutdown of motorized equipment not in use.

B. Do not burn trash on Site.

C. If temporary heating devices are necessary for protection of Work, they shall not cause air pollution.

3.07 THAWING OF FROZEN GROUND

A. Obtain permit from appropriate authority before building fire to thaw frozen ground and comply with conditions of permit.

B. Use fuel which does not create air pollution or inconvenience public.

C. Engineer reserves right to prohibit fires for thawing frozen ground whenever deemed undesirable.

3.08 USE OF CHEMICALS

A. Chemicals used during project construction or furnished for project operation, whether herbicide, pesticide, disinfectant, polymer, reactant or of other classification, shall be approved by U.S. EPA or U.S. Department of Agriculture or any other applicable regulatory agency.

B. Use and disposal of chemicals and residues shall comply with manufacturer’s instructions.

3.09 NOISE CONTROL

A. Conduct operations to cause least annoyance to residents in vicinity of Work and comply with applicable local ordinances.

B. Equip construction equipment and other apparatus with mechanical devices necessary to minimize noise.

C. Equip compressors with silencers on intake lines.

D. Equip gasoline or oil-powered equipment with silencers or mufflers on exhaust lines.

E. Line storage bins and hoppers with material that will deaden sounds.

F. Route vehicles carrying rock, concrete, or other material over such streets as will cause least annoyance to public and do not operate on public streets between hours of 6:00pm and 7:00am, nor on Saturdays, Sundays or legal holidays, unless approved by Owner.

3.10 DUST CONTROL

A. Take special care in providing and maintaining temporary roads, Owner's existing roads, and public roads used during construction operations in clean, dust free condition.

B. Comply with local regulations for dust control. If Contractor's dust control measures are considered inadequate by Engineer, Engineer may require Contractor to take additional dust control measures.

3.11 FUELS AND LUBRICANTS

A. Comply with local, state, and federal regulations concerning transportation and storage of fuels and lubricants.

B. Fuel storage area location shall be approved by Owner prior to installation.

C. Report spills or leaks from fueling equipment or construction equipment to Owner and cleanup as required.

D. Owner may require Contractor to remove damaged or leaking equipment from Site.

END OF SECTION

SECTION 01 61 00
COMMON PRODUCT REQUIREMENTS

PART 1 – GENERAL

1.01 SUBSTITUTE AND “OR EQUAL” ITEMS

A. When equipment or material is specified by naming one or more manufacturers or suppliers followed by words “No Substitute is Permitted”, Contractor shall provide one of the named manufacturers or suppliers.

B. ”Or Equal” Items: For material or equipment specified by naming one or more suppliers or manufacturers followed by the words “Or Equal”, Contractor shall make submittal in accordance with Section 01 33 00. Engineer will review submittal in accordance with Supplementary Conditions.

C. Substitute Items:

1. For material or equipment specified by naming one or more suppliers or manufactures and not followed by the words “Or equal” or “No Substitute is Permitted”, Contractor shall submit “Request for Substitution” in accordance with General Conditions for material or equipment not specifically named.
2. Requests for Substitution will be considered by Engineer, subject to Contractor’s representations and review provisions of Contract Documents, when one or more of the following conditions are satisfied.

    a. Where required equipment or material cannot be provided within Contract Time, but not as result of Contractor’s failure to pursue Work promptly or coordinate various activities properly.
    b. Where packaging of several items of equipment from single source will provide maintenance and coordination advantages to Owner.
    c. When Contractor proposes to provide Owner with cost savings.

3. If Engineer approves Contractor’s Request for Substitution, Contractor shall make submittal in accordance with Section 01 33 00.

D. Conditions Which Are Not Substitutions:

1. Contractor options provided for in Specifications.
2. Revisions to Contract requested by Owner or Engineer.
3. Contractor’s determination of and compliance with governing regulations, except as provided for in Contract Documents.

1.02 REUSE OF EXISTING MATERIAL

A. Except as specifically indicated or specified, do not use removed materials and equipment in new Work. All material and equipment incorporated into the Work shall be new, and as specified, except as otherwise provided in the Contract Documents.

B. For material and equipment specifically indicated or specified to be reused in new Work:

1. Use special care in removal, handling, storage, and reinstallation to ensure proper function in completed Work.
2. Provide for transportation, storage, and handling of products which require off-site storage, restoration, or renovation.

1.03 MANUFACTURER'S INSTRUCTIONS

A. Installation of equipment and materials shall comply with manufacturer's written instructions. Maintain one set of complete instructions at job site. Distribute printed copies of instructions to parties involved in installation, including 1 copy to Engineer. Provide 1 electronic copy as a searchable, bookmarked PDF document to the Engineer.

B. Handle, store, install, connect, clean, condition, and adjust materials and equipment in accordance with manufacturer's written instructions and in conformance with Specifications.

C. If job conditions or specified requirements conflict with manufacturer's written instructions, consult Engineer for further direction. Do not proceed with Work without written instruction of Engineer.

1.04 TRANSPORTATION AND HANDLING

A. Arrange deliveries of material and equipment in accordance with Construction Progress Schedule.

B. Deliver materials and equipment in undamaged condition, in manufacturer's original containers or packaging, with identifying labels intact and legible.

C. Protect bright-machined surfaces, such as shafts and valve faces, with heavy coat of grease prior to shipment.

D. Immediately upon delivery, inspect shipments to ensure compliance with Contract Documents and approved submittals, and products have been protected and are undamaged.

E. Provide equipment and personnel to handle materials and equipment by methods recommended by manufacturer to prevent soiling or damage to materials or equipment, or packaging.

1.05 STORAGE, PROTECTION, AND MAINTENANCE

A. Store, protect, and maintain material and equipment in accordance with manufacturer's written instructions.

B. Temporary storage areas and buildings shall conform to Section 01 52 00.

C. Owner assumes no responsibility for damage or loss due to storage of materials and equipment.

D. Interior Storage:

1. Store with seals and labels intact and legible.
2. Store materials and equipment subject to damage by elements in weather tight enclosures.
3. Maintain temperature and humidity within ranges required by manufacturer.

E. Exterior Storage:

1. Store fabricated materials and equipment above ground, on blocking or skids, to prevent soiling or staining. Cover materials and equipment subject to deterioration with impervious sheet coverings. Provide ventilation to avoid condensation.

2. Store loose granular materials in well-drained area on solid surfaces to prevent mixing with foreign matter.
3. Store materials such as pipe, reinforcing steel, structural steel, and equipment on pallets or racks, off ground.

F. Inspection and Maintenance:

1. Arrange storage to provide easy access for inspection, maintenance, and inventory.
2. Make periodic inspections of stored materials and equipment to ensure materials and equipment maintained under specified conditions are free from damage or deterioration, and coverings are in place and in condition to provide required protection.
3. Perform maintenance on stored material and equipment in accordance with manufacturer's written instructions and in presence of Owner and Engineer.

a. Notify Engineer 24 hours before performing maintenance.
b. Submit report of completed maintenance to Engineer with each Application for Payment.
c. Failure to perform maintenance, to notify Engineer, or to submit report may result in rejection of material or equipment.

G. Assume responsibility for protection of completed construction and repair and restore damage to completed Work.

H. Wheeling of loads over finished floors, with or without plank protection, not permitted in anything except rubber-tired wheelbarrows, buggies, trucks or dollies. This applies to finished floors and exposed concrete floors, as well as those covered with other applied surfacing.

I. Where structural concrete is also finished surface, avoid marking or damaging surface.

1.06 SPECIAL TOOLS AND LUBRICATING EQUIPMENT

A. Furnish, in accordance with manufacturer's recommendations, special tools and lubricating equipment required for checking, testing, parts replacement, and maintenance.

B. Instruct Owner's operating personnel in operation, repair, and maintenance of equipment and use of special tools.

1.07 LUBRICATION

A. Where lubrication is required for proper operation of equipment, incorporate necessary and proper provisions in equipment in accordance with manufacturer's requirements. Where possible, lubrication shall be automated and positive.

B. Where oil is used, reservoir shall be of sufficient capacity to supply unit for 24-hr period.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Conform to applicable Specifications and standards. Comply with size, make, type, and quality specified or as approved on submittals.

B. Design, fabricate, and assemble in accordance with engineering and shop practices standard with industry.

C. Manufacture like parts of duplicate units to standard sizes and gauges, to be interchangeable. Two or more items of same kind shall be identical, by same manufacturer.

D. Material and equipment shall be suitable for service conditions. Design so working parts are readily accessible for inspection and repair, and easily duplicated and replaced.

E. Equipment capabilities, sizes, and dimensions shown or specified shall be adhered to, unless specifically approved in accordance with General Conditions.

F. Equipment shall be adapted to best economy in power consumption and maintenance. Parts and components shall be portioned for stresses occurring during continuous or intermittent operation, and for additional stresses occurring during fabrication or installation.

G. Do not use material or equipment for purpose other than for which it is designed or specified. Equipment shall not be used for any purpose, or any reason until manufacturer has completed installation services.

PART 3 – EXECUTION

3.01 GENERAL

A. Include and pay for Supplier's services, including, but not limited to, those specified.

B. Workday is defined as an 8-hr period during a calendar day. Workday for purposes of this section does not include travel to and from the Project Site.

3.02 INSTALLATION SERVICES

A. Where installation services are called for in Specifications, provide competent and experienced technical representatives of manufacturers' equipment and systems to resolve assembly or installation procedures attributable to, or associated with, equipment furnished.

B. After equipment installation, manufacturer's representative shall inspect equipment for proper installation in accordance with manufacturer's instructions, equipment has been serviced with the proper lubricants, applicable safety equipment has been properly installed, and that proper electrical and mechanical connections have been made.

C. Manufacturer's representative shall assist Contractor in performing functional testing.

D. Perform functional testing to determine if equipment has been installed correctly and operates as intended. Functional testing shall include, but not be limited to, checking for proper rotation, alignment, speed, excessive vibration, and noisy operation. Equipment adjustment and calibration shall be performed to conform with Specifications, manufacturer's requirements and instructions, and industry standards.

E. Provide "Certificate of Installation Services" stating that equipment has been properly installed, that functional testing has been performed, that proper adjustment and calibration has been made, and that equipment is ready for Startup and Systems Demonstration. Use form in Appendix and furnish two copies to Engineer.

3.03 INSTRUCTIONAL SERVICES

A. Provide in accordance with Section 01 79 30 – Instructional Services.

3.04 SYSTEMS DEMONSTRATIONS SERVICES

A. Provide manufacturers' and Suppliers' services as required to successfully complete the Work specified in Section 01 79 10 – Systems Demonstrations.

3.05 POST STARTUP SERVICES

A. After equipment or system has been in operation for at least 2 months, but not longer than 3 months, each equipment manufacturer or authorized equipment representative shall make a final inspection where so required by Specifications. Final inspection will provide assistance to Owner's personnel in making adjustments or calibrations required to ensure equipment or system is operating in conformance with design, manufacturer, and specifications.

B. Provide "Certificate of Post Startup Services" cosigned by Owner and equipment representatives, verifying this service has been performed. Use form in Appendix and furnish 2 copies to Owner.

END OF SECTION

SECTION 01 74 00
CLEANING AND WASTE MANAGEMENT

PART 1 – GENERAL

1.01 SUMMARY

A. Perform cleaning throughout construction period and at completion of Work.

B. Refer to Specification sections for specific cleaning products or Work.

C. Conduct cleaning and disposal operations to comply with codes, ordinances, regulations, and anti-pollution laws.

PART 2 – PRODUCTS

2.01 CLEANING MATERIALS AND EQUIPMENT

A. Use only the cleaning materials and equipment which are compatible with the surface being cleaned, as recommended by the manufacturer of the material.

B. Use only those cleaning materials which will not create hazards to property and persons.

PART 3 – EXECUTION

3.01 DURING CONSTRUCTION

A. Comply with General Conditions.

B. Provide on-site containers for collection and removal of waste materials, debris, and rubbish in accordance with applicable regulations.

C. As required preparatory to installation of succeeding materials, clean the structures or pertinent portions thereof to the degree of cleanliness recommended by the manufacturer of the succeeding material, using equipment and materials required to achieve the necessary cleanliness.

D. Following the installation of finish floor materials, clean the finish floor daily (and more often if necessary) at all times while work is being performed in the space in which finish materials are installed.

3.02 FINAL CLEANING

A. Remove grease, mastic, adhesives, dust, dirt, stains, fingerprints, labels, and other foreign materials from exposed interior and exterior surfaces.

B. Wash and shine glazing and mirrors.

C. Polish glossy surfaces to clear shine.

D. Ventilating Systems:

1. Clean permanent filters and replace disposable filters if units were operating during construction.
2. Clean ducts, blowers, and coils if units were operated without filters during construction.

E. Electrical Systems:

1. Leave electrical equipment rooms broom clean.
2. Clean interior of panel cabinets, pull boxes, and other equipment enclosures.
3. Clean lighting fixtures, lamps, and other electrical equipment soiled during installation.
4. Touch-up paint or repaint finishes on electrical items delivered to Project with finished coat of paint. Engineer will make final determination of items to be repainted or touched-up.

F. Vacuum carpeted areas. Broom clean interior hard surface floors and exterior paved surfaces. Rake clean other surfaces of grounds.

G. Clean out existing or new sewers to remove sediment and other materials that have entered during construction.

H. Clean roads and streets used as haul roads during construction of accumulated material. Clean paved streets with water.

I. Prior to Final Completion or Owner occupancy, Contractor, with Engineer and Owner, shall conduct inspection of exposed interior and exterior surfaces and work areas to verify Work and Site is clean.

3.03 CLEANING DURING OWNER'S OCCUPANCY

A. Should the Owner occupy the Work or any portion thereof prior to its completion by the Contractor and acceptance by the Owner, responsibilities for interim and final cleaning shall be as determined by Engineer in accordance with the General Conditions.

3.04 CLEANING AND DISINFECTING OF POTABLE WATER RESERVOIRS

A. Clean thoroughly, using water under pressure, before disinfecting.

1. Isolate tank from system to avoid possibility of contaminating materials entering distribution system.
2. Cleaning shall:

a. Remove deposits of foreign matter.
b. Remove growths.
c. Clean walls, floor, and ceiling.
d. Avoid damage to tank.
e. Avoid contamination by workers and equipment.

3. Water used in cleaning tank shall be wasted before adding chlorinating agent.

B. After cleaning complete and before acceptance and placing tank into service, disinfect tank.

1. 24 hrs before filling tank, place water containing 50ppm chlorine in tank to depth that, when tank is full, resultant chlorine concentration shall be no less than 2ppm.
2. Fill tank.
3. Full tank shall stand for 24 hrs, after which tank may be put into service, providing safe samples obtained by Owner. Drain water used to disinfect tank as required to put tank into service.
4. If safe samples are not obtained using above procedure, add additional chlorine to full tank in amounts necessary to obtain safe sample.
5. Cost of water and chlorine for rechlorination of tank, if first attempt does not test safely,

shall be Contractor’s responsibility.

3.05 CLEANING OF TANKS

A. Wet wells, tanks, and basins shall be washed down and swept before water is allowed to enter.

END OF SECTION

SECTION 01 78 23
OPERATION AND MAINTENANCE DATA

PART 1 – GENERAL

1.01 SUMMARY

A. To aid the continued instruction of Owner's operating and maintenance personnel, and to provide a positive source of information regarding products incorporated into the Work, furnish, and deliver the Operation and Maintenance (O&M) data described in this Section and as specified in other sections of these Specifications.

B. Engineer's review and acceptance of O&M data will be only for conformance with requirements of this section, for form of submittal and organization of data and completeness of information provided, but not for technical content or coordination between individual suppliers. Engineer will be sole judge of completeness of data.

1.02 PAYMENTS

A. Progress payments for equipment delivered, stored, or installed under these Contract Documents will not be made until copies of O&M data delivered to and approved by Engineer.

B. Progress payments for control systems packaged with equipment will not be made until O&M data incorporated into equipment and control system manual delivered to and approved by Engineer.

1.03 REVIEW SUBMITTALS

A. Submit electronic copy of complete O&M data to document management website for approval by Engineer within 30 days after Contractor receives approved Shop Drawings for equipment. The electronic formatted data shall contain all the information to be bound in O&M manuals. The information provided shall comply with the following requirements:

1. The O&M manual shall be in searchable, bookmarked PDF format.
2. Electronic O&M document shall be created with OCR (Optical Character Recognition) to allow for full alphanumeric recognition of printed characters.
3. Submit in accordance with Section 01 33 00.

B. Electronic Media Label: Label each with "OPERATION AND MAINTENANCE INSTRUCTIONS" and following:

1. Project Title: Monroe WTP Improvements: Chemical Feed Line Replacement and Backwash System Pump Addition and Tank Rehabilitation
2. Name of equipment as set forth in Contract Documents.
3. Specification section number for equipment as set forth in Contract Documents.

C. Submit in accordance with Section 01 33 00.

1.04 FINAL SUBMITTAL

A. After approval of the review submittal, submit 3 paper copies and 2 copies on electronic media of complete O&M data.

B. Paper Copy Format:

1. Size: 8-1/2 in. by 11 in., or 11 in. by 17 in. folded, with standard 3-hole punching.
2. Paper: 20-lb minimum, white.
3. Text: Manufacturer's printed data or typewritten.
4. Drawings:

    a. Bind in text.
    b. Fold larger drawings and place in text page size envelope bound into binder. Place identification on outside of envelope.

5. Provide tabbed section dividers.

    a. Provide title of section on divider.
    b. Provide tab index in Table of Contents.

6. Cover: Label each submittal cover with "OPERATION AND MAINTENANCE INSTRUCTIONS" and following:

    a. Project Title: Chemical Feed Line Replacement and Backwash System Pump Addition and Tank Rehabilitation
    b. Names of applicable buildings or structures as shown on Drawings in which equipment is located.
    c. Name of equipment as set forth in Contract Documents.
    d. Specification section number for equipment as set forth in Contract Documents.

7. Binders:

    a. Bind each submittal into a D-ring commercial quality binder with durable and cleanable plastic covers.
    b. Filled to not more than 75% of capacity.
    c. When multiple binders used, contents shall be organized into related groupings and each binder cover shall bear identification of specific content.
    d. Label spine of binder with "OPERATION AND MAINTENANCE INSTRUCTIONS" and following:

        1) Project Title: Chemical Feed Line Replacement and Backwash System Pump Addition and Tank Rehabilitation
        2) Name of equipment as set forth in Contract Documents.
        3) Specification section number for equipment as set forth in Contract Documents.

8. Page number submittals.

C. Electronic media copy format shall be as defined above.

1.05 QUALITY ASSURANCE

A. In preparing data required by this section, use only personnel thoroughly trained and experienced in operation and maintenance of the described items, completely familiar with the requirements of this section, skilled in technical writing to the extent needed for communicating the essential data, and skilled in drafting to prepare required drawings.

PART 2 – PRODUCTS

(NOT USED)

PART 3 – EXECUTION

3.01 GENERAL

A. Review O&M submittal and complete Form 1 to Section 01 78 23, CONTRACTOR SUBMITTAL FORM, in its entirety indicating requirements of this section have been met. Engineer will reject submittals without completed Form 1.

3.02 GENERAL CONTENT OF DATA

A. Each submittal shall contain equipment data pertaining to not more than one Specification section number indicated in Contract documents.

B. Title Sheet: First page inside cover listing following:

1. Title: OPERATION AND MAINTENANCE INSTRUCTIONS.
2. Project Title: Chemical Feed Line Replacement and Backwash System Pump Addition and Tank Rehabilitation
3. Names of applicable buildings or structures as shown on Drawings in which equipment is located.
4. Name of equipment as set forth in Contract Documents.
5. Specification section number for equipment as set forth in Contract Documents.
6. Contractor's name, address, and telephone number.
7. Subcontractor's name, address, and telephone number if equipment provided by Subcontractor.
8. Purchase order number, manufacturer's shop order number or other such number required for parts and service.
9. Manufacturer's name, address, and telephone number.
10. Name, address, and telephone number for local source of parts and service.

C. Product List: Immediately after title sheet. List of each product and major components, indexed to content of submittal, and identified by product name and model number as set forth by manufacturer and Specification section and article number.

D. Table of Contents: Immediately following product list. Arrange in logical, systematic order and shall be at minimum a tabbed section index. Provide each tabbed section with table of contents for section.

E. Product Data Sheets: Provide specification and catalog sheets showing configuration, manufacturer's specifications, models, options, and styles of equipment and major components being provided. Product data sheets shall show project specific information with inapplicable information deleted by removal. Insert in tabbed sections.

F. Drawings:

1. Supplement text with drawings to clearly illustrate following:

a. Product and components.
b. Relations of component parts of equipment and systems.
c. Control and flow diagrams.

2. Drawings to be actual drawings of equipment from manufacturer. "Typical" drawings are not acceptable unless they accurately illustrate actual equipment.

G. Special Information:

1. Provide explanation of interrelationships of equipment and components, and effects one component has on another or system.

2. Provide overall instructions and procedures for equipment tying in instructions and procedures for separate components into unified instructional package.
3. Provide glossary of special terms used by manufacturer.
4. Organize in consistent format under separate headings for different procedures.
5. Provide logical sequence on instructions for each procedure.

H. Warranty, Bond, or Service Contract.

1. Provide copy of each issued.
2. Provide information sheets to explain proper procedures in event of failure or malfunction to prevent voiding warranty or bond, and instances affecting validity of warranty or bond.

3.03 SPECIFIC CONTENT OF DATA

A. Specific content, for each unit of equipment and system, shall include following:

1. Description of Unit and Component Parts:

a. Function, normal operating characteristics, and limiting conditions.
b. Performance curves, engineering data, and tests as applicable.
c. Complete nomenclature and commercial number of replacement parts.
d. Complete nameplate data.
e. P&ID numbers for equipment as set forth in Contract Documents.

2. Operating Procedures:

a. Startup, break-in, and normal operating instructions.
b. Regulation, control, stopping, shutdown, and emergency instructions.
c. Summer and winter operating instructions.
d. Special operating instructions.

3. Maintenance Procedures:

a. Routine maintenance operations.
b. Guide to troubleshooting.
c. Disassembly, repair, and reassembly instructions.
d. Alignment, adjusting, and checking instructions.

4. Servicing and Lubrication Schedule:

a. List of lubricants required and quantity to be applied.
b. Schedule of lubrication.
c. Schedule for other routine maintenance.

5. Manufacturer’s printed instructions regarding safety precautions for both protection of personnel and prevention of damage to equipment.
6. Description of sequence of operation of controls.
7. Manufacturer’s parts list, illustrations, assembly drawings, and diagrams required for maintenance.
8. Recommended spare parts to be stocked, and quantity.
9. Predicted life of parts.
10. Control diagrams (ladder diagrams, instrumentation loop diagrams, and electrical schematics as appropriate).
11. Bill of material.
12. Completed EQUIPMENT DATA FORM typewritten on copy of Form 2 to Section 01 78 23. (Example of completed form is Form 3 to Section 01 78 23.)
13. Other data as required under pertinent section of Specifications.

B. Specific content for each electric and electronic system, as applicable to equipment.

1. Description of System and Component Parts:

    a. Function, normal operating characteristics, and limiting conditions.
    b. Performance curves, engineering data, rating tables, and tests as applicable.
    c. Complete nomenclature and commercial number of replaceable parts.
    d. Complete nameplate data.
    e. P&ID numbers for equipment as set forth in Contract Documents.

2. Circuit Directories of Panelboards:

    a. Electrical service.
    b. Controls.
    c. Communications.

3. Complete instrumentation loop diagrams with tabulated listing of components in each control circuit or loop.
4. Operating Procedures:

    a. Routine and normal operating instructions.
    b. Sequences required.
    c. Special operating instructions.

5. Maintenance Procedures:

    a. Routine maintenance operations.
    b. Guide to troubleshooting.
    c. Disassembly, repair, and reassembly instructions.
    d. Adjustment and checking instructions.

6. Manufacturer's printed instructions regarding safety precautions for both protection of personnel and prevention of damage to equipment.
7. Recommended spare parts to be stocked, and quantity.
8. Other data as required under pertinent sections of Specifications.

C. Prepare and include additional data when need for such data becomes apparent during instruction of Owner's personnel.

FORM 1 TO SECTION 01 78 23
CONTRACTOR SUBMITTAL FORM

TO: (Engineer) (Address) (Attn:)		DATE	
		SPECIFICATION SECTION TITLE	
		SECTION NO.	
FROM: (Contractor) (Address)		MANUFACTUER/ VENDOR	
		NO. OF COPIES	

TO ALL:

We have checked the O&M data submittal dated _____ and have found it to be in accordance with Specification Section 01 78 23 and as noted below.

_____
Signature of Contractor

	Provided	Not Applicable	Page No.
3.04 FORMAT			
Size: 8-1/2 x 11 or 11 x 17			
Paper: 20-lb min, white			
Text: Printed data / typewritten			
Drawings:			
Standard size bound in text			
Text-size labeled envelopes			
Tabbed Section Dividers			
Cover:			
Title			
Project title			
Building / structure name			
Equipment name			
Specification section no.			
Binders: Plastic cover			
Pages: Numbered			

	Provided	Not Applicable	Page No.
3.05 GENERAL CONTENT			
One Specification Section			
Title Sheet:			
Title			
Project title			
Building / structure name			
Equipment name			
Specification section no.			
Contractor ID			
Subcontractor ID			
Purchase order data			
Manufacturer ID			
Service / parts supplier ID			
Product List			
Table of Contents			
Product Data Sheets: Tabbed sections			
Drawings:			
Illustrate product and components			
Control and flow diagrams			
Special Information:			
Interrelationships of equipment and components			
Unified instruction package			
Glossary			
Instructions organized in consistent format			
Instructions in logical order			
Warranty, Bond, Service Contract			

	Provided	Not Applicable	Page No.
SPECIFIC CONTENT (EQUIPMENT / SYSTEM)			
Description of Unit and Components:			
Equipment function			
Normal operating characteristics			
Limiting conditions			
Performance curves			
Engineering data			
Test data			
Replaceable parts list			
Nameplate data			
P&ID numbers			
Operating Procedures:			
Startup			
Normal operation			
Regulation and control			
Stopping and shutdown			
Emergency			
Seasonal operation			
Special instructions			
Maintenance Procedures			
Routine			
Troubleshooting			
Disassembly / repair / reassembly			
Adjustment and checking			
Service and Lubrication:			
List of lubricants			
Lubrication schedule			
Maintenance schedule			
Safety Precautions / Features			
Sequence of Operation of controls			
Assembly Drawings			
(Continued)			

	Provided	Not Applicable	Page No.
Parts List and Illustrations:			
Spare parts list			
Predicted life			
Control Diagrams / Schematics			
Bill of Material			
Completed EQUIPMENT DATA FORM			
Other Data as Required			

	Provided	Not Applicable	Page No.
SPECIFIC CONTENT (ELECTRIC / ELECTRONIC)			
Description:			
Equipment Function			
Normal operating characteristics			
Performance curves			
Engineering data			
Test data			
Replaceable parts list			
Nameplate data			
P&ID numbers			
Panelboard Directories			
Electrical			
Controls			
Communications			
Instrumentation Loops:			
Diagrams			
Components each circuit / loop			
Operating Procedures			
Normal operation			
Sequences			
Special instructions			
Maintenance Procedures:			
Routine			
Troubleshooting			
Disassembly / repair / reassembly			
Adjusting and checking			
Safety Precautions / Features			
Spare Parts List			
Additional Data			

FORM 2 TO SECTION 01 78 23 **Page 1 of 4**
EQUIPMENT DATA FORM

PROJECT NAME			
CONTRACT NO.			
CONTRACTOR			
EQUIPMENT NO.		ASSET NO.*	
DESCRIPTION		MAINT. NO.*	
LOCATION			
MANUFACTURER			
PURCHASED FROM			
VENDOR ORDER NO.			
DATE OF PURCHASE		PURCHASE PRICE	$
LOCAL SUPPLIER			
ADDRESS			
PHONE NO.			
MODEL NO.			
NO. OF UNITS			
SERIAL NUMBERS			

*By Owner

PART 4 – EQUIPMENT NO.	**PART 5 –**	PART 6 – ASSET NO.*	**PART 7 –**
PART 8 – DESCRIPTION	**PART 9 –**	PART 10 – MAINT. NO.*	**PART 11 –**

PART 12 – NAMEPLATE DATA

PART 13 – ELECTRIC MOTOR		**PART 14 – PUMP / HVAC UNIT**	
MANUFACTURER		MANUFACTURER	
TYPE	[ ]AC [ ]DC	TYPE	
HORSEPOWER		SIZE	
RPM		CAPACITY	
VOLTAGE		PRESSURE	
AMPERAGE		ROTATION	
PHASE		IMPELLER SIZE	
FRAME		IMPELLER MATL.	
PART 15 – DRIVE / REDUCER		**OTHER (I&C)**	
MANUFACTURER		MANUFACTURER	
TYPE	[ ]GEAR [ ]V-BELT [ ]CHAIN [ ]VARIDRIVE	TYPE	
		SIZE	
SERVICE FACTOR		CAPACITY	
RATIO		RANGE	

*By Owner

PART 16 – MAINTENANCE SUMMARY

PART 17 – EQUIPMENT NO.	**PART 18 –**	PART 19 – ASSET NO.*	**PART 20 –**
DESCRIPTION		MAINT. NO.*	

PART 21 – MAINTENANCE OPERATION	**PART 22 – FREQUENCY**
List briefly each maintenance operation and refer to specific information in Manufacturer's Manual, if applicable. Refer by symbol to "Lubrication List" for lubrication operation.	List required frequency of each maintenance operation.

*By Owner

PART 23 – LUBRICATION / RECOMMENDED SPARE PARTS LIST

PART 24 – EQUIPMENT NO.	PART 25 –	PART 26 – ASSET NO.*	**PART 27 –**
DESCRIPTION		MAINT. NO.*	

PART 28 – LUBRICANT LIST

REFERENCE SYMBOL	LUBRICANT TYPE (MILITARY STANDARD)	RECOMMENDED LUBRICANT AND MANUFACTURER
List of symbols in "Maintenance Operation"	List general lubrication type.	List specific lubrication name, viscosity, and manufacturer.

PART 29 – RECOMMENDED SPARE PARTS LIST

PART NO.**	DESCRIPTION	UNIT	QUANTITY	UNIT COST

PART 30 – ADDITIONAL DATA AND REMARKS

*By Owner
**Identify parts provided by this contract with two asterisks.
Note: Attach additional sheets if necessary.

"EXAMPLE"

FORM 3 TO SECTION 01 78 23

EQUIPMENT DATA FORM

PROJECT NAME	Anytown WWTP		
CONTRACT NO.	10023		
CONTRACTOR	Built-to-Last		
EQUIPMENT NO.	P-8-6-5, P-8-6-6	ASSET NO.*	
DESCRIPTION	Feed Pumps	MAINT. NO.*	
LOCATION	Chemical Building		
MANUFACTURER	Pumptech		
PURCHASED FROM	Suppliers Inc.		
VENDOR ORDER NO.	SI-1324-aa		
DATE OF PURCHASE	May 7, 1997	PURCHASE PRICE	$1,200
LOCAL SUPPLIER	Helpful Tech.		
ADDRESS	464553 N. Balyor, Outthere, Ohio 45362		
PHONE NO.	354-576-9876		
MODEL NO.	CC-2-5674		
NO. OF UNITS	2		
SERIAL NUMBERS	P674A123456-A / P674A123456-B		

*By Owner

"EXAMPLE"

FORM 3 TO SECTION 01 78 23

EQUIPMENT DATA FORM

PART 31 – EQUIPMENT NO.	PART 32 – P-8-6-5, P-8-6-6	PART 33 – ASSET NO.*	PART 34 –
PART 35 – DESCRIPTION	PART 36 – FEED PUMPS	PART 37 – MAINT. NO.*	PART 38 –
PART 39 – NAMEPLATE DATA			
PART 40 – ELECTRIC MOTOR		**PART 41 – PUMP / HVAC UNIT**	
MANUFACTURER	Westinghouse	MANUFACTURER	Pumptech
TYPE	[X]AC [ ]DC	TYPE	Centrifugal
HORSEPOWER	25	SIZE	2 inch
RPM	2000	CAPACITY	9 gpm
VOLTAGE	460	PRESSURE	14 psig
AMPERAGE	1.4 FL	ROTATION	CW
PHASE	3	IMPELLER SIZE	NA
FRAME	28a	IMPELLER MATL.	NA
PART 42 – DRIVE / REDUCER		**OTHER (I&C)**	
MANUFACTURER	Westinghouse	MANUFACTURER	
TYPE	[X]GEAR [ ]V-BELT [ ]CHAIN [ ]VARIDRIVE	TYPE	
		SIZE	
SERVICE FACTOR		CAPACITY	
RATIO	1:1	RANGE	

*By Owner

PART 43 – MAINTENANCE SUMMARY

PART 44 – EQUIPMENT NO.	PART 45 – P-8-6-5, P-8-6-6	PART 46 – ASSET NO.*	**PART 47 –**
DESCRIPTION	Feed Pumps	MAINT. NO.*	

PART 48 – MAINTENANCE OPERATION	**PART 49 – FREQUENCY**
List briefly each maintenance operation and refer to specific information in Manufacturer's Manual, if applicable. Refer by symbol to "Lubrication List" for lubrication operation.	List required frequency of each maintenance operation.
1) Lubricate	Reassembly
2) Clean pump	As needed
3) Adjust and check clearance	As needed

*By Owner

PART 50 – LUBRICATION / RECOMMENDED SPARE PARTS LIST

PART 51 – EQUIPMENT NO.	PART 52 – P-8-6-5, P-8-6-6	PART 53 – ASSET NO.*	**PART 54 –**
DESCRIPTION	Feed Pumps	MAINT. NO.*	

PART 55 – LUBRICANT LIST

REFERENCE SYMBOL	LUBRICANT TYPE (MILITARY STANDARD)	RECOMMENDED LUBRICANT AND MANUFACTURER
List of symbols in "Maintenance Operation"	List general lubrication type.	List specific lubrication name, viscosity, and manufacturer.
1	Lithium base grease	Texaco TH268

PART 56 – RECOMMENDED SPARE PARTS LIST

PART NO.**	DESCRIPTION	UNIT	QUANTITY	UNIT COST
**2-567-098	Mechanical seal	1	1	
3-987-456567	O-Ring	1	2	$6.75

PART 57 – ADDITIONAL DATA AND REMARKS

*By Owner
**Identify parts provided by this contract with two asterisks.
Note: Attach additional sheets if necessary.

END OF SECTION

SECTION 01 78 39
PROJECT RECORD DOCUMENTS

PART 1 – GENERAL

1.01 SUMMARY

A. Throughout progress of the Work, maintain an accurate record of changes in the Contract Documents.

B. Maintain at Site one record copy of:

1. Drawings.
2. Project Manual.
3. Addenda.
4. Change Orders and other modifications to Contract.
5. Engineer Field Orders, written instructions, or clarifications.
6. Approved Shop Drawings and other Work-related submittals.
7. Field modifications made to equipment by Contractor, Subcontractors and Suppliers.
8. Field test records.
9. Construction photographs.
10. Associated permits.
11. Certificates of inspection and approvals.

1.02 PAYMENTS

A. Progress payments will not be made until the Contractor has demonstrated to the Engineer that a marked up set of Drawings is being satisfactorily maintained on the site and is available for Engineer's review as specified herein.

1.03 SUBMITTALS

A. Prior to Substantial Completion, submit revised operation and maintenance data for field modifications made by Contractor, Subcontractors, and Suppliers. Revised operation and maintenance data shall include electronic files and paper copies.

B. Prior to Substantial Completion, submit revised copies of approved Shop Drawings and other Work-related submittals for equipment modified in field by Contractor, Subcontractors, and Suppliers.

C. Prior to submitting request for Substantial Completion, deliver one complete coordinated marked up set of Drawings to Engineer for use in preparation of record drawings.

D. Prior to submitting request for final payment, submit the remaining Project Record Documents to Engineer for Owner.

E. Accompany submittals with transmittal letter containing following:

1. Date.
2. Project title and number.
3. Contractor's name and address.
4. Title of record document.
5. Signature of Contractor or authorized representative.

F. Included with each Pay Application, submit up to date Record Drawings in PDF format for

review by Engineer.

PART 2 – PRODUCTS

(NOT USED)

PART 3 – EXECUTION

3.01 MAINTENANCE OF DOCUMENTS AND SAMPLES

A. Store documents and Samples in Contractor's field office apart from documents used for construction.

1. Provide files and racks for storage of documents.
2. Provide secure storage space for storage of Samples.
3. Provide dedicated location for storage of flash drive that contains electronic documentation, including the most up to date Record Drawings. Flash drive shall be made available for Engineer's use to view files at all times.

B. Maintain documents in clean, dry, legible condition and in good order.

C. Do not use record documents for construction purposes.

D. Record documents shall only contain marks pertaining to recorded changes and should not contain notes, calculations, or other stray information.

E. Label each document "PROJECT RECORD" in neat, large letters.

F. Make documents and samples available for inspection by Engineer and Owner.

G. Failure to properly maintain record documents may be reason to delay a portion of progress payments until records comply with Contract Documents.

3.02 RECORD DRAWINGS

A. Maintain one record set of Drawings, in electronic PDF format (one PDF file for each drawing volume), legibly annotated to show all changes made during construction and the final location of all underground piping and utilities.

1. The marked up set of Drawings shall be a compilation of all of the changes made by all of the trades involved. Individual sets from the various subcontractors will not be accepted.
2. The marked up set of Drawings shall graphically show the changes. Reference to RFI's, Change Orders, Field Orders, etc. will not be accepted.
3. The marked up set of Drawings shall incorporate changes made to the primary drawings and shall include the corresponding changes made to the ancillary drawings.
4. Changes made to the process drawings, electrical drawings, and I&C drawings shall be depicted on the P&ID's.

B. All annotations on Record Drawings shall be done electronically in PDF format.

1. The base drawing used for Record Drawing edits shall be in an original PDF file.
2. Using the following color scheme:

a. RED: For drawing additions or elements to be added to the drawing.
b. GREEN: For items to be removed or deleted from the drawing.

c. BLUE: For descriptive notes, dimensions, arrows, or other labels to provide direction to drafters but that are not specifically intended to be added to the drawings.

3. Coloring scheme, labels, dimensions, and line work shall be consistent throughout the entire Record Drawing set.
4. Use a straight-line drawing tool where appropriate.
5. Use text boxes with appropriately sized text for all text work.
6. Drawing changes shall be to scale.
7. All drawing comments shall be “flattened” prior to submitting any Record Drawings to prevent the inadvertent shifting or changing of any comment or mark-up and to provide final documentation of all mark-ups.

C. Record information concurrently with construction progress.

D. Drawings:

1. Graphically depict changes by modifying or adding to plans, details, sections, elevations, or schedules.
2. Note the following:

a. Depths of various elements of foundation in relation to finished first floor elevation.
b. Horizontal and vertical locations of underground cable, conduit, duct runs, underground utilities and appurtenances, and underground piping referenced to visible and accessible features. These features shall be located where they leave or enter any structure and at changes in horizontal or vertical direction. The invert elevation of piping and the top of conduit or duct banks shall be noted. GPS coordinates may be used.
c. Field changes.
d. Details not on original Drawings.
e. Location and identification of exposed interior piping, including those shown schematically on Drawings.
f. Location and size of equipment including connections.
g. Departures from original Drawings.

END OF SECTION

SECTION 01 79 10
SYSTEMS DEMONSTRATIONS

PART 1 – GENERAL

1.01 DESCRIPTION

A. Before Substantial Completion is considered, Contractor shall demonstrate satisfactory operation of specific equipment systems and associated facilities. Prior to conducting system demonstrations, the Contractor shall prepare a start-up plan unique to each system. Conduct demonstrations on systems listed below. Each system shall include facilities listed and associated structures, channels, conduits, piping, valves, gates, electrical, instrumentation, water, and other utilities necessary for system operation.

1. System 1 – Chemical Feed Systems

a. Sodium Hypochlorite facilities as shown on Drawing No. 009-N-1.
b. Aqua Ammonia facilities as shown on Drawing No. 009-N-2.
c. Sodium Hydroxide facilities as shown on Drawing No. 009-N-3.
d. Hydrofluorosilicic Acid piping and valves as shown on Drawing No. 009-N-4. If Alternate 1 is accepted, Hydrofluorosilicic Acid piping and valves in the Fluoride Room.

2. System 2 – Backwash System

a. Backwash Pump No. 2 and associated valves and piping as shown on Drawing No. 009-N-5.
b. Backwash Tank isolation and control valves as shown on Drawing No. 009-N-5.

B. Preliminary:

1. Before Contractor begins Systems Demonstrations, the following Work shall be complete:

a. Installation services specified in Section 01 61 00.
b. Operation and maintenance (O&M) data in accordance with Section 01 78 23 has been submitted to and approved by Engineer.
c. Process control system testing as specified in Section 40 61 21.
d. Application software programming.
e. Instructional Services specified in Section 01 79 30.

2. Contractor shall provide services of qualified, certified representatives of Suppliers to be present at Project Site as necessary to successfully complete Systems Demonstrations.
3. Contractor shall submit evidence of the representative's certification and qualifications to the Engineer for review and approval 30 days prior to the start of Systems Demonstrations.

C. Coordination:

1. Designate representative of Contractor to be responsible for Systems Demonstrations.
2. Contractor shall submit schedule of Systems Demonstrations for review by Engineer and Owner 30 days prior to Systems Demonstrations.
3. Notify Engineer at least 7 days before Systems Demonstrations are to begin.
4. Reschedule cancelled Systems Demonstrations 7 days in advance.

1.02 SUBMITTALS

A. Start-up Plans

1. For each System identified in Paragraph 1.01.A above, Contractor shall prepare a system specific start-up plan. Submit each start-up plan no later than 4 weeks prior to the start date of each System's demonstration test.
2. Each system's start-up plan shall include a detailed step-by-step procedure addressing the requirements of this Section. Each plan shall identify the required activities that need to be completed, who will be responsible for completing each activity, the order in which the activities need to be completed, and a schedule giving the dates for each activity. Each start-up plan shall describe the documentation that needs to be prepared to confirm that the activities have been successfully completed.
3. Each start-up plan shall identify the Contractor's representative that will be leading the Systems Demonstration during the testing period.

B. Reports:

1. Prepare report for each system on results and activities encompassing system demonstration. Submit report within two working days of completion of System Demonstration.
2. Report shall describe operational conditions; daily results of systems operation; dates and names of people involved and observing operation; and statement regarding system ability to meet operational criteria.

C. Submit in accordance with Section 01 33 00.

PART 2 – PRODUCTS

(Not Used)

PART 3 – EXECUTION

3.01 SYSTEMS DEMONSTRATIONS

A. Demonstrate operation and performance of each system for:

1. System 1: Chemical Feed Systems – 30 consecutive days.
2. System 2: Backwash System – 7 consecutive days.

B. System Demonstrations requirements include:

1. Demonstrate to show equipment operates in accordance with acceptable industry standards for application of equipment.
2. System Demonstration shall show equipment operates within manufacturer's tolerances for noise and vibration, equipment is responsive to manual and automatic controls, control and protective devices are properly set, and equipment operates on controlled or intermittent basis when such operation is intended.
3. Demonstrate proper function and process control for each control point, alarm, and safety lockout system.

C. Temporary facilities and services are Contractor's responsibility. Contractor shall provide temporary facilities and services as required to complete testing and systems demonstrations. Contractor shall also provide required equipment maintenance during the time between the systems demonstration testing and the issuance of a Certificate of Substantial Completion.

D. For each system, Engineer will consider system demonstration successful and complete when system operates properly for the consecutive days stated in Paragraph 3.01 – A. without significant interruption.

E. If, in Engineer's opinion, system is not operating properly at any time during System Demonstration, Contractor shall stop demonstration and adjust, calibrate, or replace material and equipment as required to correct problem. After corrections have been made, restart System Demonstration and operate system for the consecutive days stated in Paragraph 3.01 – A. without significant interruption.

F. If the system is not operating properly, and the Contractor opts to continue operating the system until the corrections to the system have been completed and the system can proceed to restarting the Systems Demonstration, the Contractor shall continue to be responsible for providing ongoing required equipment maintenance, temporary facilities and services.

3.02 SUBSTANTIAL COMPLETION

A. Engineer will not consider Work substantially complete until Systems Demonstrations have been successfully completed.

END OF SECTION

SECTION 01 79 30
INSTRUCTIONAL SERVICES

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes:

1. Training manuals.
2. Classroom instruction.
3. Field training.
4. Other activities to provide comprehensive training program.

1.02 SUBMITTALS

A. Training Program:

1. Submit copies of proposed training program to electronic document management system, including student training manual and instructor guide, for review by Engineer.
2. After training program is approved by Engineer provide 3 student training manuals and one instructor guide.

B. Resumes:

1. Submit resumes, including three outside references, for each instructor proposed for training program.
2. Engineer will review resumes. Based upon review of resumes, and contacts with references, Engineer will approve, request additional information, or reject proposed instructors for training program.
3. If proposed instructor is rejected, Contractor shall submit resume and references on an alternate instructor for acceptance.

C. Submit in accordance with Section 01 33 00.

D. Provide “Certificate of Instructional Services” cosigned by Owner and instructor, verifying training accomplished to satisfaction of all parties. Use the form in Appendix and furnish electronic copies to Owner and Engineer.

PART 2 – PRODUCTS

2.01 TRAINING PROGRAM

A. Training shall include both classroom instruction and hands-on field training:

1. Classroom instruction shall be a minimum of one hour and be completed before the field training. Classroom training shall provide an overview of the theory of equipment operation, mechanical operation and maintenance, and various modes and functions available.
2. Field training shall include hands-on instruction of the installed equipment where personnel can observe equipment operation and features, controls, and maintenance points can be directly pointed out. If field training is to be performed in a location that requires hearing protection, provide voice amplification so all students can adequately hear the training.

B. Instruct and train Owner’s personnel in maintenance and operation of equipment and

systems supplied and installed under this Contract.

C. Incorporate operation and maintenance information from shop drawings and equipment manuals into training program.

D. Prepare instruction materials and objectives, student notes and guides, and tests required for complete classroom and field training.

E. Classroom instruction shall be conducted with a maximum of 15 students for each instructor.

F. Field training shall be conducted with a maximum of 15 students for each instructor, perform multiple field training sessions as required so all students attending the classroom instruction receive field training.

2.02 INSTRUCTORS

A. Preparation of training materials and conduct of training shall be performed by personnel:

1. Trained and experienced in maintenance and operation of equipment and systems installed under this Contract.
2. Familiar with training requirements of Owner's personnel, that is, understand Owner's personnel training needs.

2.03 FORM OF TRAINING MATERIALS

A. Prepare training materials in form of an instruction manual for use by Owner's personnel.

B. Instruction manual format:

1. Size: 8-1/2 inch by 11 inch.
2. Paper: 20-pound minimum, white, for typed pages.
3. Text: Manufacturer's printed data, or neatly typewritten, including:

    a. Table of Contents.
    b. Learning Objectives.
    c. General Operation, Theory, Specific Equipment Information.
    d. Test.

4. Drawings:

    a. Provide reinforced, punched binder tabs, bind in with text.
    b. Reduce larger Drawings and fold to size of text pages, not larger than 11 inch by 17 inch.

5. Cover: Identify each volume with typed or printed title "Training Manual; NAME OF EQUIPMENT."

    a. Title of Project.
    b. Identify separate structure or system as applicable.
    c. Identify general subject matter in Manual.

6. Binders:

    a. Commercial quality binder with durable and cleanable plastic covers. Binders shall include title pockets for holding notes. Binders shall not be filled more than 75 percent capacity.

b. When multiple binders are used, correlate information into related consistent groupings.

PART 3 – EXECUTION

3.01 TRAINING LOCATIONS

A. Use Owner's designated training facilities for classroom instruction.

B. Field training shall be conducted at the equipment installation location.

C. Coordinate use of Owner's facilities with Owner and Engineer, including any computer or display requirements for presenting material from the training manuals.

3.02 SCHEDULE

A. Coordinate training periods with Engineer and Supplier's representatives.

1. Notify Engineer at least 14 days before training sessions are to begin so Engineer can make arrangements with Owner's operating personnel.
2. Reschedule canceled training sessions 14 days in advance.
3. Failure of instructors to appear for scheduled training, failure to notify Engineer 48 hours in advance of need to cancel training session, or failure to arrive within 30 minutes of start of scheduled training session shall result in reimbursement to Owner for time lost by Owner's personnel in waiting for arrival of instructor.

B. Provide training after completion of application software programming and before the start of Systems Demonstrations specified in Section 01 79 10. See section 01 11 00 for sequencing and constraints.

C. Owner's personnel will require training both for operating and maintenance functions. These individuals shall be trained during two sessions during the Monday through Friday workweek.

3.03 MAINTENANCE OF PROCESS EQUIPMENT

A. Training Requirements:

1. Describe functions of process equipment.
2. Component preventative and corrective maintenance activities required to keep unit equipment in good operating conditions.
3. Instruct trainees in locating probable source of equipment malfunctions, determining symptoms of trouble, establishing probable cause, and effecting solution.

B. Course Materials:

1. Pertinent portions of operation and maintenance manuals as well as alignment tolerances, lubrication schedules, vibration analysis instructions and parameters, and special calibration test and procedures.
2. Detailed course outlines and troubleshooting guides for each piece of equipment. Troubleshooting guides shall include symptoms, probable causes, and solutions for trouble described during training program.
3. Course outlines shall include objectives that indicate information to be learned. The objectives shall state the answers to the test questions. Example of objective: "Students shall identify the points and frequency of grease lubrication on the machine."
4. Provide a 15 to 20 question test of the objectives being taught.
5. The objectives shall be equally divided between operation and maintenance and cover

the subjects listed in 3.04 and 3.05.

C. Method of training maintenance personnel shall include Contractor using Owner's equipment to demonstrate troubleshooting, preventative and corrective maintenance procedures.

3.04 OPERATION OF PROCESS EQUIPMENT

A. Training Requirements:

1. Describe functions of equipment including how components of system are controlled together and what effects of control methods are on system and on other upstream and downstream processes.
2. Being able to implement start-up and shutdown procedures for each piece of equipment individually, as well as start-up and shutdown of systems comprising equipment. This instruction shall include normal operation, alternative operations, and emergency operations.
3. Understand functions of instrumentation, describing individual components and how each component is used in monitoring and/or controlling equipment and/or processes.
4. Understand operating modes possible as result of modifications and installations.
5. Locating probable source of system inefficiency, determining symptoms, establishing probable cause, and restabilizing system efficiency for systems.
6. Understand necessary precautions for safe operation of equipment, instrumentation, and control system installed under this Contract.
7. Emergency procedures for equipment and systems during pump malfunction, chemical spills, and other extreme conditions.

B. Course Materials:

1. Pertinent portions of operation and maintenance manuals, including start-up and shutdown procedure; descriptions of equipment and instrumentation functions and modes of operations, control, and monitoring; troubleshooting instructions and process control instructions.
2. Detailed course outlines and troubleshooting guides for equipment and processes for field use. Operations guides shall include general operating procedures, start-up and shutdown procedures, optimization procedures, and emergency operating procedures.
3. Course outlines shall include objectives that indicate information to be learned. The objectives shall state the answers to the test questions. Example of objective: "Students shall identify the points and frequency of grease lubrication on the machine."
4. Provide a 10 to 20 question test of the objectives being taught.
5. The objectives shall be equally divided between operation and maintenance and cover the subjects listed in 3.04 and 3.05.

3.05 FIELD QUALITY CONTROL

A. Training Effectiveness:

1. Effectiveness of training personnel shall be assessed through written and in-the-field skill evaluation of trainees. Evaluations shall be designed to determine trainees' ability to control processes, as well as their ability to operate and maintain equipment.
2. Unsatisfactory evaluations shall include recommendations for corrective action or additional training sessions.

END OF SECTION

DIVISION 03

CONCRETE

SECTION 03 20 00
CONCRETE REINFORCING

PART 1 – GENERAL

1.01 SUMMARY

A. Provide concrete reinforcement where shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

1.02 REFERENCES

A. ACI: American Concrete Institute

B. ASTM: American Society for Testing and Materials

C. CRSI: Concrete Reinforcing Steel Institute

1.03 SUBMITTALS

A. Shop Drawings:

1. Conform to ACI SP-66 showing bending diagrams, assembly diagrams, location diagrams, splicing and laps of bars, shapes, dimensions, and details for reinforcing, and stirrup spacing, accessories, and additional reinforcing at openings.

B. Product Data:

1. Dowel Adhesive manufacturer's product data.

C. Submit in accordance with Section 01 33 00.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver reinforcement to site bundled and tagged.

B. Use necessary precautions to maintain identification after bundles are broken.

C. Store in a manner to prevent excessive rusting and fouling with dirt, grease, and other bond-breaking coatings.

PART 2 – PRODUCTS

2.01 REINFORCEMENT MATERIALS AND ACCESSORIES

A. Deformed Steel Bars: ASTM A615, Grade 60.

B. Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcement in place:

1. Comply with CRSI recommendations.
2. Exterior exposed surfaces, surfaces in contact with earth or liquid, and interior exposed surfaces in humid areas shall have all plastic or stainless steel supports.
3. Interior exposed surfaces in dry areas shall have all plastic, stainless steel, or plastic tipped steel supports.

4. When supports bear directly on the ground and it is not practical to use steel or plastic supports, solid precast concrete blocks may be used to support only the bottom mat of reinforcement. Precast blocks must be of equal or greater strength than the concrete being placed.

C. Dowel Adhesive:

1. Epoxy or acrylic adhesive.
2. Manufacturers:

a. HIT-RE 500 V3 or HIT-HY 200-R V3 System by Hilti Corp.
b. Pure 110+, AC200+ Gold by Dewalt.

2.02 FABRICATION

A. Fabricate reinforcing bars to conform to the required shapes and dimensions and in accordance with ACI 318 and CRSI Manual.

B. In case of fabricating errors, do not straighten or rebend reinforcement in a manner that will weaken or injure the material.

C. Reinforcement with any of the following defects will not be acceptable.

1. Bar lengths, depths, and/or bends exceeding the specified fabrication tolerances.
2. Bends or kinks not shown on the Drawings.
3. Bars with reduced cross-section due to excessive rusting or other causes.

PART 3 – EXECUTION

3.01 SURFACE CONDITIONS

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.02 INSTALLATION

A. Clean reinforcement to remove loose rust and mill scale, earth, and other materials which reduce or destroy bond with concrete.

B. Position, support, and secure reinforcement against displacement by formwork, construction, and concrete placing operations. Unless otherwise noted, provide clear cover as follows:

1. Cast against:

Earth: 3 inches
Mud Slab: 2 inches

2. Exposed to earth, weather, or water:

a. Slabs, Footings and Walls: 2 inches

3. Not exposed to earth, weather, or water:

a. Slabs and Walls: 1 inch

C. Correct displacement of reinforcement prior to and during concrete placement. Maintain clear cover as noted on Drawings. Tolerances shall be in accordance with ACI 117 and ACI 318, unless noted otherwise.

D. Support reinforcing steel in accordance with CRSI “Placing Reinforcing Bars” with maximum spacing of 4 feet.

E. Tie reinforcing steel at intersections in accordance with CRSI “Placing Reinforcing Bars”.

1. Spacing for Footings and Walls: Every third intersection, 3 feet maximum.
2. Spacing for Slabs and Other Work: Every fourth intersection, 3 feet maximum.
3. Tie each dowel in-place.

F. Reinforcement shall be continuous through construction joints.

G. Reinforcement may be spliced at construction joints provided that the entire lap is placed within only 1 pour.

H. Do not field bend bars, including bars partially embedded in concrete unless indicated.

I. Tack welding of, or to, reinforcement prohibited.

J. Placement of reinforcement shall be approved by Engineer before placing concrete.

K. Anchor dowels into drilled holes with epoxy dowel adhesive where noted. Conform to details shown.

3.03 SPLICES

A. Lap reinforcing at splices. Tie securely to prevent displacement of splices during placement of concrete.

B. Welding of reinforcing bars is prohibited.

END OF SECTION

SECTION 03 30 00
CAST-IN-PLACE CONCRETE

PART 1 – GENERAL

1.01 SUMMARY

A. Provide cast-in-place concrete where shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

1.02 REFERENCES

A. ASTM: ASTM International

B. NRMCA: National Ready Mixed Concrete Association

C. ACI: American Concrete Institute

D. AASHTO: American Association of State Highway and Transportation Officials

1.03 SUBMITTALS

A. Shop Drawings:

1. Verification of Mix Design:

a. Proposed mix design for each class of concrete to be used as specified using designations indicated. Provide dry weight of cement, saturated dry weight of coarse and fine aggregate, brand name and quantities of admixtures when applicable, fly ash and other supplementary cementitious materials when applicable, gallons of water required for 1 cubic yard of concrete, and chloride ion content.
b. Source and material certificates of cement and fine and coarse aggregate, including sieve analysis that will be used in each class of concrete.
c. Admixture product data.
d. Source and test reports of fly ash and other pozzolans.
e. Source of slag cement and documented ability of supplier to consistently furnish these materials in accordance with applicable ASTM and AASHTO requirements.
f. Test data supporting proportions of design mixes based on laboratory trial batches or past field experience in accordance with ACI specification 301.
g. NRMCA certification, DOT certification, or letter stating plant and equipment complies with industry standard requirements.
h. Mix design shall be approved by Engineer before concrete delivered to site.

B. Product Data:

1. Evaporation Retardant and Curing and Sealing Compound: Proposed rate of coverage and manufacturer's literature.
2. Finishing Grout manufacturer's literature.
3. Bonding Agent manufacturer's literature.
4. Patching Mortar manufacturer's literature.

C. Test Results:

1. Concrete test results.
2. Concrete delivery tickets: With each load of concrete delivered, provide duplicate tickets,

one for Contractor, one for Engineer, with following information.

a. Serial number of ticket.
b. Date and truck number.
c. Name of supplier.
d. Class of concrete.
e. Type of cement and cement content in bags/cubic yard.
f. Admixture brand names.
g. Aggregate size.
h. Time loaded.
i. Amount of concrete in load.
j. Gallons of water added at site and slump of concrete after addition of water.
k. Temperature of concrete at delivery.
l. Time unloaded.

D. Submit in accordance with Section 01 33 00.

1.04 QUALITY ASSURANCE

A. Plant Certification: Plant or concrete supplier shall comply with requirements of NRMCA certification plan as regards material storage and handling, batching equipment, central mixer, truck mixers with counters, agitators, nonagitating units, and ticketing system.

B. Do not commence placement of concrete until mix designs have been reviewed and approved by Engineer.

C. Concrete Testing: Testing shall be provided by Contractor in accordance with

D. Section 01 45 29 and this Section.

1. Conduct tests on sample material in accordance with methods listed below:

a. Slump: ASTM C143.
b. Air Content: ASTM C231.
c. Compressive Strength: ASTM C31 and ASTM C39.

1.05 PROJECT / SITE CONDITIONS

A. Hot Weather:

1. Comply with ACI 305.1.
2. Concrete temperature shall not exceed 95°F.
3. At air temperatures of 80°F or above, keep concrete as cool as possible during placement and curing.
4. When concrete temperature exceeds 80°F, water reducing, set-retarding admixtures shall be used.

B. Cold Weather:

1. Comply with ACI 306.1.
2. Cold weather is considered when air temperatures have fallen to, or are expected to fall below, 40°F.
3. Temperature of reinforcement, forms, fillers, and other material in contact with concrete at time of placement shall not be less than 35°F. Preheat if temperature below 35°F.
4. Maintain air and forms in contact with concrete sections having minimum dimension less

than 12 inches at temperature above 50°F for at least 3 days and at temperature above 32°F for remainder of specified curing period.

5. Maintain air and forms in contact with concrete in more massive sections at temperature above 40°F for at least 3 days and at temperature above 32°F for remainder of specified curing period.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Cementitious Materials:

1. Portland cement conforming to ASTM C150.

   a. Type I or II except tricalcium aluminate (C_3A) content of Type I shall not exceed 8%. If this type of Type I not available, Type I with C_3A content less than 12% shall be used in combination with fly ash.
   b. Type II shall be used for mass concrete applications and where heat hydration is a concern.
   c. Type III may be substituted for Type I when approved by Engineer and additional requirements for Type I are met.
   d. When aggregates determined to be deleteriously reactive, as defined by ASTM C33, alkali content of cement defined by ASTM C150 shall not exceed 0.60%.

2. Blended hydraulic cement conforming to ASTM C595.

   a. Type IL, IP, or IS may be used in replacement of ASTM C150 Type I.
   b. Type IL (MS), IP (MS), or Type IS (MS) may be used in replacement of ASTM C150 Type II where moderate sulfate expose is anticipated.
   c. Type IL (MH), IP (MH), or Type IS (MH) may be used in replacement of ASTM C150 Type II where heat of hydration is a concern.
   d. Blended hydraulic cements may not be used in replacement of ASTM C150 Type III or V cements.

3. Fly Ash:

   a. ASTM C618, Class C or F including requirements of Table 1A.
   b. Supplemental Requirements:

      1) Loss on Ignition (maximum): 3%.
      2) Water Requirement (maximum): 100% (as percent of control).
      3) Fineness (maximum retained on No. 325 sieve): 25%.

4. Slag Cement:

   a. Slag cement shall conform to the requirements of ASTM C989 Grade 100 or 120.
   b. Slag cement from different sources or of different grades shall not be mixed in the same construction.

5. Silica fume conforming to ASTM C1240, amorphous silica.

B. Aggregates:

1. ASTM C33, modified as follows:

a. Fine aggregate: Natural sand.
b. Coarse aggregate: Crushed gravel, crushed stone or gravel, Size 467 (1-1/2 inch maximum), size 67 (3/4 inch maximum), Size 8 (3/8 inch maximum).

2. Potential reactivity of aggregates shall be determined in accordance with ASTM C33.

C. Admixtures:

1. Shall be non-corrosive and shall not contain intentionally added chlorides.
2. Air-Entraining: ASTM C260.
3. Chemical Admixtures:

a. Water-Reducing: ASTM C494, Type A.
b. Mid-Range Water-Reducing: ASTM C494, Type A.
c. Retarding: ASTM C494, Type B or D.
d. Accelerating: ASTM C494, Type C or E.
e. High-Range Water-Reducing: ASTM C494, Type F.
f. Workability-Retaining: ASTM C494, Type S.
g. Corrosion-Inhibiting: A nominal 30 percent solution of calcium nitrite or an amine/ester-based organic corrosion-inhibiting admixture.

D. Water: Potable.

E. Curing and Sealing Compound:

1. Manufacturers:

a. MasterKure CC 300SB by Master Builders Solutions.
b. Dress and Seal 30 by L&M Construction Materials, Inc.
c. Cure & Seal 1315 J22WB by Dayton Superior.
d. Or Equal

2. ASTM C309.
3. ASTM C1315, Type I, Class A.
4. Approved and compatible with scheduled finishes and coatings.

F. Finishing Grout

1. Manufacturers:

a. MasterSeal 581 by Master Builders Solutions.
b. Concrete Finisher with AKKRO-7T by Tamms Industries Co.
c. SikaTop Seal 107 by Sika Corp.

G. Cement Grout: Mixture of cement and fine sand in proportions used in concrete being finished.

H. Epoxy Bonding Agent:

1. Manufacturers:

a. MasterEmaco ADH Series by Master Builders Solutions.
b. Sikadur 32 Hi-Mod by Sika Corp.
c. Epoxtite 2362 by A.C. Horn.
d. Sure Bond J-58 by Dayton Superior.
e. Epobond by L&M Construction Materials, Inc.

f. Five Star Bonding Adhesive by Five Star Products, Inc.

2. Use when joining new to existing concrete.
3. Conforming to ASTM C881.

I. Non-Epoxy Bonding Agent:

1. Manufacturers:

a. Weld-Crete by Larsen Products Corp.
b. MasterEmaco A660 by Master Builders Solutions.
c. Everbond by L&M Construction Materials, Inc.

2. Use when joining new to existing concrete when bonding agent cannot be placed immediately prior to placement of new concrete.
3. Conforming to ASTM C1059 Type II.

J. Evaporation Retardant:

1. Manufacturers:

a. Econ by L&M Construction Materials, Inc.
b. MasterKure ER 50 by Master Builders Solutions.
c. Sikafilm by Sika Corp.

K. Patching Mortar.

1. Manufacturers:

a. SikaTop-122 Plus by Sika Corp.
b. Concrete-Top Supremem by Euclid Chemical.
c. MasterEmaco T 310CI by Master Builders Solutions.

2. Polymer modified cementitious fast setting mortar for repair of concrete surfaces. Consisting of polymer and selected Portland cements, aggregates, accelerator, admixtures for controlling set, water reducers for workability, and corrosion inhibitor. Shall contain no chlorides, nitrates, gypsum, or lime. Shall not produce vapor barrier. Shall be thermally compatible with concrete and shall be freeze-thaw resistant.

a. Concrete gray.
b. 5000 pounds per square inch minimum compressive strength.
c. 400 pounds per square inch minimum bond strength.

2.02 CONCRETE MIX DESIGN

A. Concrete Mix: Measure and combine cement, aggregate, water, and admixtures in accordance with ASTM C94 and ACI PRC-211.1.

1. Cement: When used in exposed concrete shall be one brand from one source. Do not mix different cements in same element of Work.
2. Water-Cementitious Materials Ratio (if fly ash or slag cement is used, water-cement plus fly ash and slag cement ratio): 0.42 maximum for Class A concrete, 0.50 maximum for Class B concrete.
3. Air-Entrainment: Air-entrain concrete exposed to exterior or exposed to liquids.
4. Chemical Admixtures: Use is optional to aid concrete properties and allow for efficient

placement. Manner of use and amount shall be in accordance with manufacturer's written recommendations and as approved by Engineer. Do not use admixtures that increase early shrinkage or negatively affect finishing.

5. Fly Ash: Use is optional unless otherwise noted. Combine fly ash with cement at rate of 1 pound fly ash for each pound reduction of cement. Amount of fly ash shall not be less than 15% or more than 25% of weight of cementitious material.
6. Slag Cement: Use is optional unless otherwise noted. Combine slag cement with cement at a rate of 1 pound slag cement for each pound reduction of cement. Amount of slag cement shall not be greater than 50% of weight of cementitious material.
7. Fly Ash and Slag Cement Combination: Use is optional unless otherwise noted. Combine fly ash and slag cement with cement at a rate of 1 pound fly ash or slag cement for each pound reduction of cement. Amount of fly ash and slag cement combination shall not be greater than 50% of weight of cementitious material. Amount of fly ash shall not be greater than 25% of weight of cementitious material
8. Use no admixtures other than specified, unless approved by Engineer.

B. Class of Concrete:

1. Furnish in accordance with table. Cement contents listed are minimum values and shall be increased as required to attain other specified characteristics.
2. Slumps listed are maximum, except when the mix contains an approved admixture. Maximum slump when admixtures are used shall be 10 inches.
3. Chloride ion content shall not exceed values listed in ACI 318.
4. Mid-range water reducer required for Class A1 and A2 concrete.

Class	28-Day Compressive Strength (psi)	Coarse Aggregate (size no.)	Minimum Cementitious Material (lbs/cu yd)	Air Content (%)	Slump (in.)
A1	4500	467	517	5.5±1.5	3±1
A2	4500	67	564	6±1.5	3±1
B1	3000	67	446	6±1.5	3±1
B2	3000	8	470	7.5±1.5	4 max
C	2000	67	212	---	---

psi = pounds per square inch
cu yd = cubic yard
in. = inch
max = maximum

C. Concrete Usage:

1. Class A: All locations, except where Class B and C specified.
2. Class B: Interior equipment bases.
3. Class A1: Exterior unreinforced concrete pavement.
4. Class A2: Concrete curb and gutter and concrete sidewalk.
5. Class C: Mud slabs and backfill below and around structures where necessary.
6. Do not use coarse aggregate Size 467 in sections less than 12 inches thick, where clear cover of reinforcement is less than 1-1/2 inches or where clear spacing between reinforcement bars is less than 3 inches.

2.03 MIXING AND DELIVERY

A. Use ready mixed concrete conforming to ASTM C94.

B. Deliver and complete discharge within 1-1/2 hours of commencing of mixing. Limitations may

be waived by Engineer if concrete slump, after 1-1/2 hours, is sufficient so that concrete can be placed without addition of water. In hot weather, time criteria may be reduced by Engineer.

C. Do not add water on-site unless slump and water-cement ratio, after addition of water, is below maximum allowed.

D. Deliver concrete to site having temperature not less than 50°F or greater than 90°F.

PART 3 – EXECUTION

3.01 SURFACE CONDITIONS

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.02 FORMS

A. Formwork design, detailing, and installation shall be Contractor's responsibility.

B. Type of forms used is Contractor's option, except as otherwise indicated or shown. Plywood and other wood surfaces shall have smooth, level surfaces treated with form oil or sealer to produce clean release of concrete from forms.

1. Where walls remain exposed use plywood, prefabricated metal or wood forms; do not use boards.
2. Form ties shall be plastic cone snap ties. Cone shall be min 3/4 inch diameter by 1 inch deep. Taper tie through-bolt form ties may be used as an alternate to plastic cone snap ties; conform to details shown. Do not use wire ties on exposed concrete.
3. Removal of ties shall leave holes clean cut and without appreciable spalling at face of concrete.
4. Provide 3/4 inch chamfer on external corners of exposed concrete walls and equipment bases and exposed edges of construction joints. Do not chamfer edges flush with masonry walls.

C. Coat plywood and wood forms with non-staining form release agent. Apply release agent before reinforcement is placed.

D. Clean, patch, and repair form material before reuse.

E. Formwork shall prevent leakage of mortar, shall not deflect under weight of concrete and workmen, and shall withstand fluid pressure of concrete.

F. Conform to tolerances as specified in ACI specification 117.

3.03 SUBGRADE PREPARATION

A. Subgrade and bedding shall be compacted and free of frost. If placement occurs at temperatures below freezing, provide temporary heat and protection to remove frost. Do not place concrete on frozen material.

B. Provide mud slabs where necessary, and when required by Engineer to obtain dry and stable working platform for placement of concrete. Unless otherwise approved by Engineer, 2 inch thick mud slabs shall be provided between free-draining fill and concrete as detailed.

C. Remove standing water, ice, mud, and foreign matter before placing concrete.

3.04 PLACING CONCRETE

A. Notify Engineer 24 hours in advance of placing operations.

B. Place concrete, except as modified herein, in accordance with ACI specification 301.

C. Concrete will not be allowed to drop freely where reinforcing will cause segregation of mix.

1. Concrete containing high-range water reducer: 10 feet maximum drop.
2. Other Concrete: 5 feet maximum drop.

D. If pumping used, do not use aluminum piping for delivery system.

E. When placing concrete temporarily halted or delayed, provide construction joints as shown and as specified.

F. Place in lifts not exceeding 24 inches and compact with internal mechanical vibrator equipment.

G. Provide bonding agent between new and hardened or existing concrete where shown. Existing concrete shall be sandblast cleaned to remove all foreign materials, to expose the coarse aggregate, and result in a roughened surface with minimum amplitude of 1/8 inch.

H. When hot and/or wind conditions will result in evaporation of 0.2 pounds per square foot per hour or more, evaporation retardant shall be used in accordance with manufacturer's written recommendations to minimize plastic shrinkage cracking.

3.05 JOINTS

A. Unless otherwise noted, construction joints shown are optional. Joints not shown on Drawings shall be approved by Engineer. Locate to miss splices in reinforcement.

B. Before concrete placed, construction joints shall be cleaned, laitance removed, and surface wetted. Remove standing water.

C. Construction joints shall have roughened surfaces and have an amplitude of 1/4 inch minimum.

3.06 EMBEDDED ITEMS

A. Cast pipe and other embedded items into concrete as placement progresses. Do not provide blockouts.

B. Do not place ducts, conduit, and pipes in slabs on grade. Place minimum 4 inches below slab.

C. Set items such as bolts, anchors, piping, and frames in concrete as shown.

D. Place items constructed of dissimilar metals to avoid physical contact with reinforcing. Secure item and reinforcing to ensure they will not shift and come into contact during concrete placement. Contact between reinforcing steel and other metal, other than bare, coated, or plated carbon steel not permitted.

3.07 REPAIR OF SURFACE DEFECTS

A. General:

1. Prior to starting repair work, obtain Engineer's approval of proposed repair techniques and materials.
2. Method of repair shall not adversely affect the appearance of the finished structure.
3. Develop repair techniques on portion of as-cast surface selected by Engineer. Surface of repair remaining exposed to view shall match color and texture of adjacent surfaces.
4. Prepare surfaces, apply and install materials, and cure as recommended by material manufacturers.

B. Tie Holes: Fill plastic cone snap tie holes with Patching Mortar. Fill taper tie through-bolt form tie holes with Non-Shrink Grout.

C. Defective Areas:

1. Remove honeycombing, stone pockets, spalls, and other defective concrete down to sound concrete. If chipping required, make edges perpendicular to surface. Do not feather edges.
2. Fill defective area with Patching Mortar.

3.08 FINISHING SLABS AND FLATWORK

A. Slab Finishes:

Description	Concrete Finish
Equipment Pads	Float
Buried Slabs	Float
Exterior Walks	Float and Broom Finish

B. After placement, screed concrete with straightedges, power strike-offs or vibrating screeds.

C. After screeding, bull float or darby surfaces to eliminate ridges and to fill in voids left by screeding.

D. Float:

1. Use magnesium or aluminum hand floats or power floats with slip on float shoes.
2. Float finish shall result in uniform smooth granular texture.

E. Broom Finish: Use fine, soft-bristled broom and broom at right angles to direction of traffic to give nonskid finish approved by Engineer.

F. Tolerances:

1. Concrete slabs shall be within 3/16 inch of 10 foot straightedge in all directions. Deviations from elevation indicated shall not exceed 3/4 inch.

3.09 FINISHING FORMED CONCRETE

A. As-Formed Finish: Finish resulting directly from formwork for surfaces which will be hidden from view by earth, submergence in water, or subsequent construction.

1. Repair surface defects as specified herein.
2. Where joint marks or fins on submerged surfaces exceed 1/4 inch, grind smooth.

B. Smooth Finish: Interior concrete surfaces permanently exposed to view.

1. Repair surface defects as specified herein.
2. Grind joint marks and fins smooth with adjacent surface. Remove stains and rinse.
3. Dampen concrete and paint entire surface with Cement Grout. Work grout into surface with suitable float. When grout has set to where it will not be pulled out of holes or depressions, brush off surface with burlap or carpet.

C. Rubbed Finish: Exterior concrete surfaces permanently exposed to view extending to 6 inch below finished grade or liquid level.

1. Repair surface defects as specified herein.
2. Grind joint marks and fins smooth with adjacent surface. Remove stains and rinse.
3. Apply heavy coat of Finishing Grout. After first coat has set, apply second coat. When second coat has set, float to uniform texture.
4. Follow manufacturer's written recommendations.
5. Finish color shall be gray.

3.10 PROTECTION AND CURING

A. Protect concrete from frost and keep moist for min curing period of 7 days after placement in accordance with ACI specification 308.1.

B. Formed Surfaces:

1. Wet cure by spraying surfaces as frequently as drying conditions may require to keep concrete surfaces moist.
2. Surfaces may be cured by leaving forms in-place. For vertical surfaces, apply water to run down inside of forms, if necessary, to keep concrete moist.
3. After forms are removed, wet cure for remainder of curing period or apply curing compound.
4. Do not use curing compound where mortar, grout, concrete or adhesives will be applied.

C. Flatwork:

1. Cure using curing compound or wet cure.
2. Do not use curing compound where mortar, grout, concrete, or adhesives will be applied.

D. Curing Compound:

1. Apply curing compound at uniform rate sufficient to comply with requirements for water retention as specified and as measured in accordance with ASTM C156.
2. Cover areas subjected to direct sunlight with ambient temperature expected to exceed 80°F with white pigmented compound, other surfaces may be covered with fugitive dye compound.

E. Protect from damaging mechanical disturbances, load stresses, heavy shock, and excessive vibration.

F. Protect finished concrete surfaces from damage caused by construction equipment, materials, and methods, and from rain or running water.

G. Do not load self-supporting structures to overstress concrete.

3.11 REMOVAL OF FORMING AND SHORING

A. Do not remove forming or shoring until member supported has acquired sufficient strength to

safely support own weight and any imposed loads. Forming shall remain in place for at least min time recommended by ACI PRC-347. In addition, forming for horizontal members shall remain in place minimum 7 days. In no case shall forming for horizontal members be removed before concrete has reached 70% of specified design strength.

B. Reshore areas as required to carry additional imposed loads.

3.12 FIELD QUALITY CONTROL

A. Obtain samples of concrete in accordance with ASTM C172. Place cylinders on-site where they can be stored under conditions similar to concrete they represent without being disturbed for first 24 hours.

B. Make slump tests daily and when requested by Engineer, in accordance with ASTM C143. Make slump tests from same load from which strength tests are made.

C. Make air content tests daily and when requested by Engineer, in accordance with ASTM C231. Make air content tests from same load from which strength tests are made.

D. Make temperature tests daily and when requested by Engineer, in accordance with ASTM C1064. Make temperature tests from same load from which strength tests are made.

E. If measured slump, air content, or temperature falls outside specified limits, make check test immediately on another portion of same sample. In event of second failure, concrete shall be considered to have failed to meet requirements of Specifications and will be rejected.

F. Make strength test specimens for each of the following conditions for each class of concrete:

1. Each day's pour.
2. Each change of source.
3. Each 100 cubic yards poured.

G. Strength test for each class of concrete consists of (5)-cured 4 x 8 in. standard cylinders or (4)-cured 6 x 12 in. standard cylinders made from composite samples secured from same load of concrete in accordance with ASTM C172. Make compressive strength tests on 1 cylinder at 7 days and (3)-standard 4 x 8 in. cylinders or (2)-standard 6 x 12 in. cylinders at 28 days. Test remaining cylinder if needed.

H. Strength of concrete considered satisfactory if following requirements met.

1. Every average of 3 consecutive strength tests equals or exceeds specified 28-day compressive strength (*fc′*).
2. No individual strength test falls below specified 28-day compressive strength by more than 500 psi if *fc′* is 5000 psi or less, or by more than 0.10*fc′* if *fc′* is greater than 5000 psi.

I. If analysis of strength tests indicate above requirements are not being met, make immediate adjustments to mix design and make additional tests as required by Engineer to determine strength of concrete in-place in portion of structure represented by deficient cylinders. If tests verify Work in-place is not in conformance with Specifications, Engineer will determine if Work in-place is adequate for intended use. If Work in-place is determined to be inadequate, Contractor shall follow such remedial or replacement measures which Engineer may require. Contractor shall bear costs associated with testing, engineering analysis, remedial work, and replacement required under terms of this paragraph.

END OF SECTION

SECTION 03 62 00
NON-SHRINK GROUTING

PART 1 – GENERAL

1.01 SUMMARY

A. Cement based grout for setting equipment, column base plates, and locations noted on the drawings.

1.02 REFERENCES

A. ASTM: American Society for Testing and Materials

1.03 SUBMITTALS

A. Product Data:

1. Manufacturer's literature.

B. Submit in accordance with Section 01 33 00.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Manufacturers:

1. Five Star Grout by Five Star Products, Inc.
2. SET Grout by BASF.
3. Duragrout by L&M Construction Chemicals, Inc.
4. SikaGrout 212 by Sika Corp.

B. Grout:

1. Preblended, cement based, nonmetallic, nongas forming, nonshrink and shall not bleed.
2. Comply with ASTM C1107 and CRD C621, Grade B.
3. Moderate fluidity.
4. 5000 pounds per square inch minimum compressive strength.

C. Water: Potable.

PART 3 – EXECUTION

3.01 PREPARATION

A. Clean grout contact surfaces of oil, grease, scale, and other foreign matter.

B. Chip away unsound concrete leaving surface rough but level.

C. Clean base plates, rails, anchors, bolts, etc. in contact with grout of oil, grease, dirt, and coatings.

3.02 MIXING AND PLACING

A. Mix and place in accordance with manufacturer's written instructions.

B. Provide forming materials where necessary to retain grout until hardened.

C. Work grout from one side. Avoid trapping air under base plate.

D. Do not load grout until it has reached a minimum of 3000 pounds per square inch compressive strength.

3.03 CURING

A. Cure as recommended by grout manufacturer.

END OF SECTION

DIVISION 04

MASONRY

SECTION 04 22 00
CONCRETE UNIT MASONRY

PART 1 – GENERAL

1.01 SUMMARY

A. Provide concrete unit masonry where shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

1.02 REFERENCES

A. ASTM: American Society for Testing and Materials

B. ACI: American Concrete Institute

1.03 SUBMITTALS

A. Shop Drawings:

1. Source, material certificates, and proportions by weight of cement, fine and coarse aggregates, and admixtures for mortar and masonry grout.
2. Bar reinforcement shop drawings.

B. Miscellaneous Submittals:

1. Material certification for masonry units. Test data shall not be more than 5 years old.
2. Certification of masonry compressive strength.

C. Submit in accordance with Section 01 33 00.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units above ground on level platforms which allow air circulation under the stacked units.

B. Cover and protect against wetting prior to use.

1.05 PROJECT / SITE CONDITIONS

A. Cold Weather Protection:

1. Temperature of masonry units shall not be less than 32°F when laid.
2. When air temperature falls below 40°F or when temperature of masonry units is below 40°F:

a. Remove visible ice on masonry units before unit is laid.
b. Heat mortar sand or mixing water to produce mortar temperature between 40°F and 120°F.
c. When air temperature is between 25°F and 40°F, completely cover masonry by covering with weather resistant membrane for 24 hours after construction.
d. When air temperature is between 20°F and 25°F, use heat sources, install wind breaks when wind velocity exceeds 15 miles per hour, and completely cover masonry with insulating blankets for 24 hours after construction.
e. When air temperature is below 20°F, provide enclosure and use heat source to

maintain temperature within enclosure above 32°F for 24 hours after construction.

B. Hot Weather Protection:

1. When air temperature exceeds 100°F, or 90°F with wind velocity greater than 8 miles per hour:

a. Do not spread mortar more than 4 feet ahead of masonry.
b. Set units within 1 minute of spreading mortar.

PART 2 – PRODUCTS

2.01 MORTAR AND GROUT

A. Materials:

1. Portland Cement: ASTM C150, Type I.
2. Blended Cement: ASTM C595, Type IL, IS, or IP.
3. Masonry Cement: ASTM C91, Type S.
4. Lime: Hydrated lime, ASTM C207, Type S.
5. Aggregates:

a. Mortar: ASTM C144, acceptable in color, 10% passing No. 100 sieve.
b. Masonry Grout: ASTM C404.

6. Water Repellant Admixture:

a. Dry-Block by W.R. Grace & Co.

7. Water: Potable.
8. Coloring Pigments: Commercial iron oxide, manganese dioxide, or chromium oxide of color selected by Engineer.
9. Do not use antifreeze compounds.

B. Proportions:

1. Masonry Assembly Net Compressive Strength: f'm = 2,500 pounds per square inch (minimum).
2. Concrete Masonry Unit Compressive Strength: f'cmu = 3,250 pounds per square inch (minimum).
3. Mortar: ASTM C270, property specification Type S, 1,800 pounds per square inch (minimum).
4. Masonry Grout: ASTM C476, 2,500 pounds per square inch (minimum).
5. Use water repellant admixture in mortar for units exposed to earth or weather in accordance with manufacturer's written recommendations.

2.02 CONCRETE MASONRY UNITS

A. Hollow Normal Weight Concrete Block: ASTM C90.

B. Provide fire rated units where noted.

C. Provide special block for corners, jambs, lintels, etc.

D. Provide bull nose edges where shown and at all interior exposed vertical corners, including

door openings.

2.03 REINFORCEMENT AND ANCHORS

A. Reinforcing Bars: Conform to requirements of Section 03 20 00.

PART 3 – EXECUTION

3.01 SURFACE CONDITIONS

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.02 CONCRETE MASONRY UNITS

A. General:

1. Use normal weight block for interior partitions or backing for exterior walls.
2. Use normal weight block with water repellant admixture where exposed to earth or weather.
3. Lay only dry masonry units.
4. Use masonry saws to cut and fit masonry units.
5. Set units plumb, true to line, and with level courses accurately spaced.
6. Clean the top surface of foundation free from dirt and debris prior to start of installing first course.
7. Accurately fit the units to plumbing, ducts, openings, and other interfaces, neatly patching all holes.
8. Keep the walls continually clean, preventing grout and mortar stains. If grout does run over, clean immediately.

B. Unless otherwise shown on the Drawings, provide running bond with vertical joints located at center of masonry units in the alternate course below.

C. Do not use chipped or broken units. If such units are discovered in the finished wall, Engineer may require their removal and replacement with new units at no additional cost to the Owner.

D. Laying up:

1. Place units in mortar with full bed and head joints where cells are to be filled with mortar or masonry grout. Other masonry shall have face-shell bedding.
2. Align vertical cells of hollow units to maintain a clear and unobstructed system of flues.

E. Bar Reinforcement:

1. Provide reinforcement as shown on the Drawings.
2. Provide required metal accessories to ensure adequate alignment of steel during grout filling operations.

F. Tooling:

1. Tool joints to a dense, smooth surface.
2. Unless otherwise shown on the Drawings, provide joints of "concave" pattern throughout.
3. Brush with soft brush to remove projecting mortar.
4. Cut mortar flush with surface on concealed surfaces.

G. Lintels:

1. Provide reinforced masonry lintels over openings where noted.
2. Form lintels by using lintel units to match wall texture.
3. Lintels shall bear on masonry minimum 8 inches beyond each side of opening.

3.03 GROUTING

A. Perform grouting in strict accordance with the provisions of ACI 530.1.

1. Spaces to be grouted shall be free of mortar droppings, debris, and loose aggregate.
2. Solidly fill vertical cells containing reinforcement with masonry grout.
3. Fill cores under lintels with masonry grout.
4. Consolidate grout at time of pour by puddling with a mechanical vibrator, filling all cells of the masonry, and then reconsolidating later by puddling before the plasticity is lost.

3.04 PROTECTION

A. Protect masonry from damage.

B. Cover freshly laid masonry and walls not being worked on to prevent rapid drying and to exclude rain and snow.

C. Do not apply superimposed loads until completed masonry reaches design strength.

3.05 CLEANING

A. Clean as units are set, daily, and upon completion. Acid shall not be used.

B. Remove surplus mortar and leave surface clean and finished.

END OF SECTION

DIVISION 05

METALS

SECTION 05 50 00
METAL FABRICATIONS

PART 1 – GENERAL

1.01 SUMMARY

A. Provide miscellaneous metal work shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

B. Section Includes:

1. Concrete anchors.
2. Surface mounted floodtight hatch.
3. Metal frames.
4. Miscellaneous items.

1.02 DEFINITIONS

A. Submerged: At or below level 1 foot 6 inches above maximum water level in water holding structures.

1.03 REFERENCES

A. AISC: American Institute of Steel Construction

B. AA: Aluminum Association

C. AWS: American Welding Society

D. ASTM: American Society for Testing and Materials

E. AISI: American Iron and Steel Institute

1.04 SUBMITTALS

A. Shop Drawings:

1. Indicate materials, sizes, connections, anchors, and finishes.

B. Product Data:

1. Manufacturer’s catalog sheets on premanufactured items.

C. Miscellaneous Submittals:

1. Floodtight hatch warranty.

D. Submit in accordance with Section 01 33 00.

1.05 QUALITY ASSURANCE

A. Perform shop and/or field welding required in connection with the work of this Section by certified welders in strict accordance with pertinent recommendations of AWS.

B. Conform to AISC and AA standards.

PART 2 – PRODUCTS

2.01 MATERIALS

A. In fabricating items which will be exposed to view, limit materials to those which are free from surface blemishes, pitting, and roughness.

B. Comply with following standards, as pertinent.

1. Structural Steel Shapes:

a.	W Shapes:	ASTM A992, 50 ksi.
b.	M Shapes:	ASTM A36.
c.	S, C and MC Shapes:	ASTM A36.
d.	L Shapes:	ASTM A36.
e.	HP Shapes:	ASTM A572 Grade 50.
f.	HSS Square and Rectangular Shapes:	ASTM A500, Grade B, 46 ksi.
g.	HSS Round Shapes:	ASTM A500, Grade B, 42 ksi
h.	Pipe Shapes:	ASTM A53, Grade B, 35 ksi.
i.	Plates and Bars:	ASTM A36.

2. Stainless Steel:

a. Exterior and submerged uses: AISI, Type 316.
b. Interior uses: AISI, Type 304 or Type 316.

3. Aluminum shapes and plates: Alloy 6061-T6 or 6063-T6.
4. Connection Bolts:

a. For steel members: ASTM F3125 Grade A325, galvanized.
b. For aluminum and galvanized steel members: Stainless steel.

5. Cast-in-place Anchor Rods:

a. 1/2 inch minimum diameter.
b. Nonsubmerged: ASTM F1554, Grade 36, galvanized.
c. Submerged: Stainless steel.

6. Nuts and washers:

a. For carbon steel bolts and rods: ASTM A563 DH nuts and ASTM F436 washers.
b. For stainless steel bolts and rods: ASTM F593 nuts and washers shall match bolt/rod and nut material.

2.02 CONCRETE ANCHORS

A. Wedge Anchors:

1. Manufacturers:

a. Power-Stud+ SD1, SD2, SD4 or SD6 by Dewalt.
b. Kwik Bolt TZ or Kwik Bolt 1 by Hilti Corp.
c. Strong-Bolt 2 by Simpson Strong-Tie Co., Inc.

2. Usage: In concrete.

    a. 316 stainless steel unless noted otherwise.
    b. Do not use when submerged or subjected to dynamic loads.

B. Expansion Anchors:

1. Manufacturers:

    a. Power-Bolt+ by Dewalt.
    b. HSL-3 by Hilti Corp.

2. Usage: In concrete.

    a. 316 stainless steel unless noted otherwise.
    b. Do not use when submerged, in overhead applications, or subjected to dynamic loads.

C. Adhesive Anchors (Concrete):

1. Manufacturers:

    a. HIT-RE 500 V3 or HIT-HY 200-R V3 System by Hilti Corp.
    b. Pure 110+, AC200+ Gold by Dewalt.

2. Adhesive with 316 stainless steel stud assembly.
3. Usage:

    a. In concrete, submerged.
    b. Do not use in overhead applications.

D. Adhesive Anchors (Masonry):

1. Manufacturers:

    a. HIT-HY 270 Adhesive Anchor by Hilti Corp.
    b. AC100+ Gold by Dewalt.
    c. SET-3G Adhesive System by Simpson Strong-Tie Co., Inc.
    d. A7+ or C6+ by Red Head.

2. Adhesive with 316 stainless steel stud assembly.
3. Usage:

    a. In masonry.
    b. Grout masonry cores at anchor locations unless noted otherwise or approved by Engineer.
    c. Provide screen tube inserts for hollow masonry units or multi-wythe masonry.
    d. Do not locate anchors in vertical mortar joints.

E. Hollow Core Plank Anchors:

1. Manufacturers:

    a. Hollow-Set Dropin or Mini Dropin by Dewalt.
    b. Hollo Set Drop-In Anchor by Wej-it Fastening Systems.
    c. Hollow Drop-In Anchor by Simpson Strong-Tie Co., Inc.

d. Multi-Set II RX by Red Head.
e. HDI-P by Hilti Corp.

2. Usage: In precast concrete hollow core plank.

a. Zinc plated carbon steel or stainless steel.
b. Overhead applications in interior locations for attachment of light duty pipe and equipment supports.
c. Do not use in corrosive or humid areas, tanks, when submerged, or subjected to dynamic loads.
d. For heavy duty pipe and equipment supports or when subject to dynamic loads, use anchors that completely penetrate the plank.

F. Rod Hanger Anchors:

1. Manufacturers:

a. Hangermate+ or Snake+ by Dewalt.
b. KH-EZ I by Hilti Corp.
c. Titen HD by Simpson Strong-Tie Co., Inc.

2. Usage: In concrete.

a. Zinc plated carbon steel or stainless steel unless noted otherwise.
b. Overhead applications in interior locations for attachment of light duty pipe and equipment supports.
c. Do not use in corrosive or humid areas, tanks, when submerged, or subjected to dynamic loads.

2.03 FINISHES

A. Primer: Conform to requirements of Section 09 96 00.

B. Galvanizing Repair Paint: High zinc-dust content paint complying with MIL-P-21035.

C. All carbon steel shapes, plates, and fabrications shall be galvanized, other than locations indicated below or where specifically noted on drawings.

2.04 FABRICATION

A. Except as otherwise shown on the Drawings or the approved Shop Drawings, use materials of size, thickness, and type required to produce reasonable strength and durability in the work of this Section.

B. Provide clips, lugs, brackets, straps, plates, bolts, nuts, washers, and similar items, as required for fabrication and erection.

C. Fabricate with accurate angles and surfaces which are true to the required lines and levels, with projecting corners clipped, grinding exposed welds smooth and flush, forming exposed connections with hairline joints, and using concealed fasteners wherever possible.

D. Weld shop connections and bolt or weld field connections.

E. Use AISC standard 2-angle web connections or single plate framing connections capable of supporting min of 50% of total uniform load capacity of member.

F. Connections shall consist of minimum two 3/4 inch diameter bolts or welds developing minimum of 10,000 pounds capacity.

G. Prior to shop painting or priming, properly clean metal surfaces as required for the applied finish and for the proposed use of the item. Conform to Section 09 96 00.

1. Do not coat ferrous metal surfaces embedded in concrete.
2. On surfaces inaccessible after assembly or erection, apply two coats of the specified primer. Change color of second coat to distinguish it from the first.
3. Coat aluminum surfaces in contact with concrete in accordance with AA and Section 09 96 00. Under no circumstances shall aluminum contact dissimilar metal.

H. Galvanizing:

1. Galvanize after fabrication.
2. Galvanize by hot-dip process conforming to ASTM A123 and AHDGA specifications.

2.05 SURFACE MOUNTED FLOODTIGHT HATCH

1. Manufacturers:

a. Halliday Series F1R.
b. Or equal.

2. Provide type 316 stainless steel access hatches and frames of type and size as shown on Drawings.
3. Door leaves shall be 1/4 inch minimum diamond pattern plate with reinforcing on underside to withstand 625 psf load rating.
4. Frames shall be 1/4 inch minimum thick with a continuous flange around perimeter to be bolted down. Equip hatches with stainless steel hinges.
5. Equip hatches with hold-open arm with positive locking device with conveniently positioned release handle for easy and controlled closing.
6. Provide exterior 316 stainless steel pad lock lug and cam locks.
7. Provide neoprene compression gasket at underside of cover.
8. Hardware shall be stainless steel.
9. Manufacturer shall warranty in writing against defects in material and workmanship for 5 years.

2.06 METAL FRAMES

A. Provide door, hatch, grille, louver, and other frames fabricated from structural shapes or plates.

B. Select sections for trueness of web and flange. Straighten members so finished frames are uniform, square, and true throughout length and depth of assembled units.

C. Miter or cope and join members with continuous welds.

D. Provide temporary spreader bars to prevent springing frames out of shape prior to and during erection.

2.07 MISCELLANEOUS ITEMS

A. Fabricate miscellaneous framing, supports, and items of structural shapes, plates, bars, and tubing of sizes and arrangements indicated and as required.

PART 3 – EXECUTION

3.01 SURFACE CONDITIONS

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.02 INSTALLATION

A. General:

1. Set work accurately into position, plumb, level, true, and free from rack.
2. Tolerance: 1/8 inch in 10 feet.
3. Anchor firmly into position.
4. Where field welding is required, comply with AWS recommended procedures for appearance and quality of weld and for methods to be used in correcting welding work.
5. Grind exposed welds smooth, and touchup shop prime coats.
6. Do not cut, weld, or abrade surfaces which have been hot-dip galvanized after fabrication and which are intended for bolted or screwed field connections.
7. Perform cutting, drilling, and fitting as required for proper installation. Drill field holes for bolts, do not burn holes.
8. Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint the exposed areas with same material used for shop priming.

B. Concrete Anchors:

1. Do not install until concrete or masonry has reached its design strength.
2. Do not install closer than 6 bolt dia to edge of concrete or masonry, or closer than 12 bolt diameter to another anchor unless otherwise shown.
3. Minimum embedment shall be 8 bolt diameter.
4. Install in accordance with manufacturer's recommendations.

C. Floodtight Hatches:

1. Install floodtight hatches per manufacturer's recommendations.
2. Contractor shall provide neoprene gasket between hatch and concrete surfaces.
3. Contractor shall provide sealant around the perimeter of the hatch frame.
4. Contractor is responsible for providing a watertight seal between the hatch and the concrete surface.

3.03 ADJUSTING AND CLEANING

A. Clean exposed surfaces, removing dirt, dust, and other foreign matter.

B. Prepare surfaces for finished painting as specified is Section 09 96 00.

C. Field Repair of Damaged Galvanized Coatings:

1. Repair surfaces damaged during shipping, erection, or construction operations.
2. Use zinc rich paint.
3. Prepare surfaces and apply in accordance with ASTM A780, Annex A2.

END OF SECTION

DIVISION 07

THERMAL AND MOISTURE PROTECTION

SECTION 07 92 00
JOINT SEALANTS

PART 1 – GENERAL

1.01 SUMMARY

A. Preparation of joint substrates and installation of joint sealants, joint backer materials and accessories needed to ensure a complete and durable weathertight seal at locations indicated.

1.02 REFERENCES

A. ASTM: American Society for Testing and Materials

B. NSF: National Sanitation Foundation

1.03 SUBMITTALS

A. Product Data:

1. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.
2. Manufacturer's recommended installation procedures.
3. Catalog illustrations in sufficient detail to show installation and interface of the Work of this Section with the Work of adjacent trades.
4. Standard color card showing full range of colors available for each product exposed to view.

B. Miscellaneous:

1. Written documentation of applicator's qualifications, including reference projects of similar scope and complexity, with current phone contacts of engineers and owners for verification.
2. Certification from sealant manufacturers that their products are suitable for the use indicated and comply with specification requirements.

C. Submit in accordance with Section 01 33 00.

1.04 QUALITY ASSURANCE

A. Applicator shall be approved by sealant manufacturer and shall have at least three years experience in installing materials of types specified and shall have successfully completed at least three projects of similar scope and complexity.

B. Obtain joint sealants from single manufacturer for each different product required to ensure compatibility.

1. Provide joint sealants, joint fillers and accessory joint materials that are compatible with one another and with joint substrates under Project conditions.
2. Provide joint sealants, joint fillers and related joint materials that are nonstaining to visible joint surfaces and surrounding substrate surfaces.
3. Manufacturer shall instruct applicator in procedures for intersecting sealants.

C. Perform Work in accordance with ASTM C1193 guidelines except where more stringent requirements are indicated or specified.

D. Schedule applications of waterproofing, water repellents, and preservative finishes after sealant installation unless sealant manufacturer approves otherwise in writing. Ensure that installed sealant is allowed to cure sufficiently prior to subsequent applications.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver the materials to Site in the manufacturer's unopened containers with all labels intact and legible at time of use.

B. Maintain the products in a dry condition during delivery, storage, handling, installation, and concealment.

1.06 SUBSTRATE CONDITIONS

A. Surfaces shall be broom clean, dry, sound, and free of voids, bugholes, rockpockets, honeycombs, protrusions, excessive roughness, foreign matter, frost, ice, and other contaminants which may inhibit application or performance of the sealant system.

B. Provide joints properly dimensioned to receive the approved sealant system.

1.07 WARRANTY

A. Furnish written warranties against adhesive and cohesive failure of the sealant and against infiltration of water and air through the sealed joint for a period of 3 years from date of substantial completion.

1. Manufacturer's standard warranty covering materials.
2. Installing Subcontractor's standard warranty covering workmanship.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Tremco.

B. Euclid Chemical Company.

2.02 SEALANTS

A. The sealant products listed are set as a standard of quality. Sealants of other manufacturers shall meet or exceed the characteristics of the products listed.

B. Provide colors selected by Engineer from manufacturer's standard color range.

C. Sealant Type A:

1. For interior and exterior joints in vertical surfaces and non-traffic horizontal surfaces; such as:

a. Control and expansion joints in concrete unit or brick masonry.
b. Metal panel joints.
c. Joints around frames of doors, windows, louvers, and other similar openings.
d. Under metal thresholds.
e. Joints in sheet metal flashings.
f. Trim or finish joints.

2. Single-component or multi-component, non-sag polyurethane or hybrid sealant having 25% joint movement capability that is suitable for continuous immersion in water; comply with ASTM C920, Type S or M, Grade NS, Class 25.
3. Acceptable Sealants:

    a. Tremco – Vulkem 116.
    b. Tremco – Dymonic FC

D. Sealant Type B:

1. For interior and exterior joints in horizontal and sloped traffic surfaces; such as control, expansion, and isolation joints in concrete pavement and sidewalks.
2. Single-component or multi-component polyurethane sealant having a Shore A hardness of not less than 25 or more than 50 and 25% joint movement capability that is suitable for continuous immersion in water; comply with ASTM C920, Type S or M, Grade P or NS, Class 25.
3. Acceptable Sealants:

    a. Tremco – Vulkem 45SSL/445SSL.

E. Sealant Type C:

1. In interior vertical and non-traffic horizontal surfaces requiring up to a 3-hour fire and temperature rating.
2. Gun grade silicone sealant and fire blocking designed for use in firestop applications and rated by UL for up to 3-hour fire and hose stream test.
3. Provide fire rated joint assemblies meeting fire rating indicated, in accordance with manufacturer's recommendations.
4. Acceptable Sealant:

    a. Tremco – Tremstop Fyre-Sil.

5. Acceptable Fire Blocking.

    a. FBX Safing Insulation by Fibrex Insulations, Inc.

F. Sealant Type D:

1. In exterior and interior joints in vertical and horizontal surfaces of potable water storage areas.
2. Two-part polysulfide sealant certified by NSF as conforming to the requirements of NSF Standard 61-Drinking Water System Components-Health Effects.

    a. Comply with ASTM C920, Type M, Grade NS, Class 25.
    b. Select color from the NSF listing.

3. Acceptable Sealants:

    a. Euclid Chemical Co. – Tammsflex NS.

2.03 ACCESSORIES

A. Joint Cleaner: As recommended by sealant manufacturer for substrates indicated.

B. Joint Primer: As recommended by sealant manufacturer for substrates, conditions and

exposures indicated.

C. Bond Breaker: Polyethylene tape or other adhesive faced tape as recommended by sealant manufacturer to prevent sealant contact where it would be detrimental to sealant performance.

D. Joint Backer: Polyethylene foam rod or other compatible non-waxing, non-extruding, non-staining resilient material in dimension 25% to 50% wider than joint width as recommended by sealant manufacturer for substrates, conditions and exposures indicated.

E. Masking Tape: Non-staining, non-absorbent tape product compatible with joint sealants and adjacent joint surfaces that is suitable for masking.

2.04 OTHER MATERIALS

A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor and approved by the sealant manufacturer as compatible, subject to the approval of the Engineer.

PART 3 – EXECUTION

3.01 SURFACE CONDITIONS

A. Examine the areas and conditions under which Work of this Section will be performed.

1. Verify conformance with manufacturer's requirements.
2. Report unsatisfactory conditions in writing to Engineer.
3. Correct conditions detrimental to timely and proper completion of the Work.
4. Do not proceed until unsatisfactory conditions are corrected.

3.02 PREPARATION

A. Prepare surfaces to receive sealants in accordance with sealant manufacturer's instructions and recommendations except where more stringent requirements are indicated.

B. Thoroughly clean joint surfaces using cleaners approved by sealant manufacturer whether primers are required or not.

1. Remove all traces of previous sealant and joint backer by mechanical methods, such as by cutting, grinding and wire brushing, in manner not damaging to surrounding surfaces.
2. Remove paints from joint surfaces except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer.
3. Remove wax, oil, grease, dirt, film residues, temporary protective coatings and other residues by wiping with cleaner recommended for that purpose. Use clean, white, lint-free cloths and change cloths frequently.
4. Remove dust by blowing clean with oil-free, compressed air.

C. Provide joint backer material to depth required by sealant manufacturer for proper joint design.

1. Fit securely by compressing backer material 25% to 50% so no displacement occurs during tooling.
2. Avoid stretching or twisting joint backer.

D. Provide bond-breaker where indicated or recommended by sealant manufacturer, adhering strictly to the manufacturer's installation requirements.

E. Prime joint substrates where required.

1. Use and apply primer according to sealant manufacturer's recommendations.
2. Confine primers to sealant bond surfaces; do not allow spillage or migration onto adjoining surfaces.

F. Taping:

1. Use masking tape where required to prevent sealant or primer contact with adjoining surfaces that would be permanently stained or otherwise damaged by such contact or the cleaning methods required for removal.
2. Apply tape so as not to shift readily and remove tape immediately after tooling without disturbing joint seal.

3.03 INSTALLATION

A. Coordinate as required with other trades to assure proper and adequate provision in the work of those trades for interface with the Work of this Section.

B. Provide the approved sealant system where shown on the Drawings, and in strict accordance with the manufacturer's recommendations as approved by Engineer.

C. Install sealants immediately after joint preparation.

D. Mix and apply multi-component sealants in accordance with manufacturer's printed instructions.

E. Install sealants to fill joints completely from the back, without voids or entrapped air, using proven techniques, proper nozzles and sufficient force that result in sealants directly contacting and fully wetting joint surfaces.

F. Install sealants to uniform cross-sectional shapes with depths relative to joint widths that allow optimum sealant movement capability as recommended by sealant manufacturer.

G. Tool sealants in manner that forces sealant against back of joint, ensures firm, full contact at joint interfaces and leaves a finish that is smooth, uniform and free of ridges, wrinkles, sags, air pockets and embedded impurities.

1. Dry tooling is preferred; tooling liquids that are non-staining, non-damaging to adjacent surfaces and approved by sealant manufacturer may be used if necessary when care is taken to ensure that the liquid does not contact joint surfaces before the sealant.
2. Provide concave tooled joints unless otherwise indicated to provide flush tooling or recessed tooling.
3. Provide recessed tooled joints where the outer face of substrate is irregular.

H. Remove sealant from adjacent surfaces in accordance with sealant and substrate manufacturer’s recommendations as work progresses.

I. Protect joint sealants from contact with contaminating substances and from damages. Cut out, remove and replace contaminated or damaged sealants, immediately, so that they are without contamination or damage at time of Substantial Completion.

END OF SECTION

DIVISION 08

OPENINGS

SECTION 08 16 13
FIBERGLASS DOORS AND FRAMES

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Fire-rated Fiberglass reinforced plastic (FRP) doors.
2. Fire-rated FRP door frames.

1.02 RFERENCES

A. ASTM: American Society for Testing and Materials.

B. ANSI: American National Standards Institute.

C. NFPA: National Fire Protection Association

1.03 SUBMITTALS

A. Product Data: Manufacturer's printed product data indicating characteristics of products specified, fire resistance ratings, and installation instructions.

B. Shop Drawings:

1. Dimensioned elevation of each type door assembly in project; indicate sizes and locations of door hardware.
2. Installation details of each type installation condition in project.
3. Schedule: Indicate each door assembly in project; cross-reference to plans, elevations, and details. Use same designation indicated on Drawings.

C. Samples: Manufacturer's standard color chips.

D. Manufacturer's standard warranty documents, executed by manufacturer's representative, countersigned by Contractor.

E. Submit in accordance with Section 01 33 00.

1.04 QUALITY ASSURANCE

A. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 252.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Packing, Shipping, Handling, and Unloading: Package door assemblies in manufacturer's standard containers.

B. Store door assemblies in manufacturer's standard containers, on end, to prevent damage to face corners and edges.

1.06 WARRANTY

A. Manufacturer's Lifetime warranty against failure due to corrosion from specified environment.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. FIB-R-DOR.

B. CORRIM.

C. Chem-Pruf.

2.02 MATERIALS

A. Fiberglass Mat: Minimum 1.5 ounces per square foot.

B. Resins: Manufacturer's formulation for fabricating units to meet specified requirements.

C. Anchors: Manufacturer's standard stainless steel expansion anchors for existing openings, and stainless steel masonry tee anchors for new construction.

D. Fasteners: Stainless steel.

2.03 DOOR AND FRAME COMPONENTS

A. Fiberglass Reinforced Plastic (FRP) Doors:

1. Thickness: 1-3/4 inches.
2. Thermal Insulating Value: R-value of 11.
3. Minimum glass fiber to resin ratio: 30%.
4. Core: Urethane core with solid fiberglass reinforcement at all structural joints. Core at hinges, locksets, and other hardware mounting locations shall be solid fiberglass reinforced as noted and required.
5. Door Plates: Molded in one continuous piece, resin reinforced with hand-laid glass fiber mat, nominal 1/8 inch thick, minimum 15 mil gel-coated surface.
6. Door Edges: Minimum three (3) layers resin-reinforced glass fiber mat, nominal 3/8 to 1 1/2 inch thick, machine tooled.
7. Mortise for lockset, and recess for strike plate in lock stile.
8. Embed steel reinforcement for hinges in fiberglass matrix; provide for hinge leaf recesses in hinge stile.
9. Doors shall be fire rated and conform to UL Design No. UL-10B.
10. Sizes: Indicated on drawings.
11. Finish: Smooth gloss or Satin surface, minimum value 88 in accordance with ASTM D523.
12. Color: as per Owner.

B. Fiberglass Frames: One-piece solid molded fiberglass reinforced plastic, minimum 1/4 inch wall thickness.

1. Jamb-to-head joints mitered and reinforced with FRP clips and stainless steel fasteners; conforming to ANSI A250.8 requirements for performance equivalent to 16 gauge steel frames.
2. Frame profile: 5-3/4 inches deep, 2 inches wide face; double rabbeted with 5/8 inch high stop.
3. Mortise for lock strike, and recess for strike plate in lock jamb.

4. Reinforce for hinges and other indicated hardware.
5. Frames shall be fire rated and conform to UL Design No. UL-10B.
6. Sizes: Indicated on drawings.
7. Finish: Smooth Gloss or Satin surface, with true and consistent color.
8. Color: to match door.

C. Frame Anchors: Types recommended by manufacturer for project conditions.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Verify that openings are correctly prepared to receive doors and frames and are correct size and depth in accordance with shop drawings.

B. Examine conditions under which construction activities of this section are to be performed and submit written report if conditions are unacceptable.

3.02 INSTALLATION

A. Install door opening assemblies in accordance with shop drawings, ANSI A250.8, and manufacturer's printed installation instructions, using installation methods and materials specified in installation instructions.

B. Install fire-rated doors and frames according to NFPA 80.

C. Install of door hardware as specified in Section 08 71 00.

D. Install door hardware in accordance with manufacturer's printed instructions, using through-bolts to secure surface applied hardware.

E. Installation Tolerances: Maintain plumb and level tolerances specified in manufacturer's printed installation instructions.

3.03 ADJUSTING

A. Adjust doors in accordance with door manufacturer's maintenance instructions to swing open and shut without binding, and to remain in place at any angle without being moved by gravitational influence.

B. Adjust door hardware to operate correctly in accordance with hardware manufacturer's maintenance instructions.

3.04 CLEANING

A. Clean surfaces of door assemblies and exposed door hardware in accordance with manufacturer's maintenance instructions.

3.05 PROTECTION

A. Protect door assemblies and door hardware from damage by subsequent construction activities until final inspection.

END OF SECTION

SECTION 08 71 00
DOOR HARDWARE

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes:

1. Hardware for fiberglass doors.

1.02 REFERENCES

A. BHMA: Builders Hardware Manufacture’s Association

B. ANSI: American National Standards Institute

C. UL: Underwriter Laboratories

1.03 QUALITY ASSURANCE

A. Manufacturers: Companies specializing in manufacturing door hardware with a minimum of three years of experience.

B. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and of an Architectural Hardware Consultant who is available during the work to consult the Contractor, Project Engineer/Manager, Architect, and Owner about door hardware and keying.

C. Keying Conference: conduct conference at project site.

1. Incorporate conference decisions into keying schedule after reviewing door hardware keying system including, but not limited to, the following:

a. Flow of traffic and degree of security required.
b. Preliminary key system schematic diagram.
c. Requirements for key control system.
d. Requirements for access control.
e. Address for delivery of keys.

1.04 SUBMITTALS

A. Shop Drawings. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Product Data. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

C. Door Hardware Schedule: Prepared by or under the supervision of Installer's Architectural Hardware Consultant. Coordinate door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Submittal Sequence: Submit door hardware schedule concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate the fabrication of other

work that is critical in Project construction schedule.

2. Format: Use same scheduling sequence and format and use same door numbers as in door hardware schedule in the Contract Documents.
3. Content: Include the following information:

    a. Identification number, location, hand, fire rating, size, and material of each door and frame.
    b. Locations of each door hardware set, STC rating, cross-referenced to drawings on floor plans and to door and frame schedule.
    c. Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
    d. Description of electrified door hardware sequences of operation and interfaces with other building control systems.
    e. Fastenings and other installation information.
    f. Explanation of abbreviations, symbols, and designations contained in door hardware schedule.
    g. Mounting locations for door hardware.
    h. List of related door devices specified in other Sections for each door and frame.

4. Keying Schedule: Prepared by or under the supervision of Installer's Architectural Hardware Consultant, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations that are coordinated with the Contract Documents.

D. Submit in accordance with Section 01 33 00.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Package hardware items individually; label and identify package with door opening code to match hardware schedule.

B. Protect hardware from theft by cataloging and storing in secure area.

C. Include installation instructions, templates, and necessary fasteners with each item or package.

PART 2 – PRODUCTS

A. Exit Devices: Vertical rod type x stainless steel x US 32D. Provide compatible passage type exit device trim for interior doors. ANSI A115.2, BHMA A156.3. Include dogging function. Basis of design - Precision Apex 2000 Series.

1. Double doors:

    a. ED5400 Corbin Russwin
    b. Apex 2000 Precision

B. Hinges x 4-1/2 x 4-1/2 x US 32D.

1. FBB 191 Stanley
2. BB 4101 Lawrence

C. Closers x delayed action x AL - size as recommended by manufacturer. Install closers on room side, using parallel arms where necessary. Basis of design: Best HD8016 series.

1. HD8016 Series — Best
2. 4010 / 4110 Series — LCN
3. 8900 Series — dormakaba

D. Kick Plates – 10 inch x 2 inch LDW x US 32D x 16GA.

1. Brookline
2. Ives
3. Hiawatha
4. Rockwood

E. Flush Bolts with Dustproof Strike long enough to pass through threshold.

1. FB458 x 26D — Ives
2. 0600 x 26D — Baldwin
3. 555 x 26D — Rockwood

F. Overhead Stop – Hold Open.

1. 70H x 26D — Glynn Johnson

G. Astragals x Full Height Door - Clear Anodized Aluminum with thermoplastic rubber.

1. Doors with one active leaf:

a. 158NA — National Guard
b. 355CS — Pemko

2.02 KEYING

A. Owner to specify restricted, patented, or standard keyway. Basis of design: Best COREMAX

B. Provide temporary construction cores and keys during construction period.

C. Temporary construction, control, and operating keys and cores are not part of permanent keying system or furnished on same keyway as permanent keying system.

D. Permanent Keys and Cores: Prepare permanent IC cores and keys in accordance with keying schedule. Stamp with applicable key mark for identification. Key quantities to be determined by owner.

E. When possible, key to existing system.

2.03 FINISHES

A. Manufacturer responsible for surface preparation and priming. Finish coating of doors either in plant or field. System shall comply with Section 09 96 00, refer to Schedule. Coordinate finish color with Engineer.

B. Finishes are US 32 satin stainless steel unless otherwise noted. Closer finishes may be paint.

PART 3 – EXECUTION

3.01 INSPECTION

A. Verify that doors and frames are ready to receive work and dimensions are as indicated on shop drawings.

B. Beginning of installation means acceptance of existing conditions.

3.02 INSTALLATION

A. Install hardware in accordance with manufacturer's instructions.

B. Use the templates provided by hardware item manufacturer.

3.03 HARDWARE SCHEDULE

A. Set No. 1.

1. 3 PR Butts x NRP
2. 1 Exit Device with Dummy Trim (On Corridor Side of Active Leaf)
3. 1 Closer x 110 degrees x HO
4. 1 Overhead Stop
5. 2 Flushbolts (top & bottom)
6. 2 Kickplates
7. 1 Astragal

END OF SECTION

DIVISION 09

FINISHES

SECTION 09 96 00
HIGH-PERFORMANCE COATINGS

PART 1 – GENERAL

1.01 SUMMARY

A. Coating of surfaces as noted on the Drawings and as specified herein, including:

1. New and existing surfaces notes on Drawings.
2. Interior masonry wall surfaces.
3. Exposed interior and exterior ferrous metal, ductile iron, or cast iron piping, regardless of factory-applied finish.
4. Exterior and interior equipment, pumps, valves, motors, etc. and all appurtenances.
5. Copper piping and galvanized steel piping and conduit mounted to coated surfaces.
6. Existing surfaces remodeled or damaged during construction which presently have a finish. Refinish surrounding areas as required so touch-up not visible from 6 feet away.
7. Existing surfaces exposed by removals where adjacent surface has a finish. Finish areas as required so touch-up not visible from 6 ft away.
8. If Owner accepts Alternate 3, perform all work associated with cleaning and coating of the Backwash Tank.
9. If Owner accepts Alternate 3, coating inspections for the Backwash Tank will be performed by a third-party independent testing laboratory that will be hired by the Owner.

B. Labeling and directional arrows on piping, equipment, valves, and ducts whether coated or not coated is specified in Section 10 14 10.

C. Do not coat the following unless specifically noted otherwise:

1. Factory-finished electrical motor control center (MCC), main instrument panels (MIP), flow indicators, and related equipment.
2. Moving parts of operating units, electrical parts, linkages, sensing devices, and motor shafts.
3. Buried equipment and piping.
4. Surfaces above ceilings.
5. Factory-finished trim.
6. Stainless steel, chrome plate, copper, bronze, galvanized surfaces, and similar finished materials.
7. Aluminum ductwork or aluminum faced insulation.
8. Aluminum louvers and trim.
9. Plastic and FRP piping, equipment, and ductwork.

D. Do not coat over any code-required labels such as UL and Factory Mutual, or any equipment identification, performance rating, name, or nomenclature plates.

E. Equipment manufacturers are responsible for surface preparation and coating of equipment, motors, and appurtenances. Equipment to be coated and coating system is identified in the equipment specification sections.

1.02 DEFINITIONS

A. Definitions as used in Coating Schedule included herein.

1. Coatings: Paint or heavy duty finishes for use on surfaces subject to interior and exterior exposure, submergence, high moisture, splash, or chemical environment, including

primers, sealers, fillers, and intermediate and finished coats.
2. Submerged P: Surfaces submerged in potable water plus 1 foot-6 inches above high water level.
3. Submerged NP: Surfaces submerged in non-potable liquid plus 1 foot-6 inches above high liquid level.
4. First Coat: Field primer, factory primer, or shop primer. When only one coat is required, first coat is the finished coat.
5. Second, Third, or Intermediate Coats: Successive finished coats applied over first coat.
6. DFT: Dry film thickness (mils/coat).
7. sfpg: Square feet per gallon (per coat).

1.03 SUBMITTALS

A. Product Data:

1. Manufacturer's literature including application recommendations and generic makeup for each coating scheduled.
2. Factory or shop-applied primer manufacturer's literature including application recommendations and generic makeup shall be submitted with all material and equipment submittals. All primers shall conform to the requirements of this Section.

B. Samples:

1. Actual color samples available for each coating scheduled.

C. Miscellaneous:

1. Schedules:

a. Schedule of proposed coating systems.
b. Schedule of proposed coating systems shall contain all information as indicated in Coating Schedule included herein.

D. Submit in accordance with Section 01 33 00.

1.04 QUALITY ASSURANCE

A. Regulatory Requirements:

1. All coatings shall conform to OSHA requirements for allowable exposure to lead and other hazardous substances.
2. All coatings in contact with potable water or within potable water reservoirs shall be NSF 61/600 approved.

B. Applicator Qualifications:

1. Engage an experienced applicator who has successfully completed coating system applications similar in material and extent to those indicated.

C. Single-Source Responsibility:

1. Provide coating material produced by same manufacturer for each system.

D. Independent Testing Laboratory (ITL):

1. If the Owner accepts Alternate 3, the Owner will retain an independent testing laboratory to oversee coatings of the Backwash Tank. Contractor shall coordinate Work with the Owner, Engineer, and ITL. Contractor shall notify the Owner as to the progress of the Work completed and the Work shall be made available for inspection by the ITL when requested. Specific tests performed shall be determined by the ITL, but may include:

    a. Inspect all containers for coating type, temperature limitations, date of manufacture, and shelf life for acceptance.
    b. Inspect and approve the surface preparation before application of prime coat.
    c. Inspect and approve prime coat.
    d. Inspect and approve finish coats.
    e. Performing cumulative DFT testing for final inspection.
    f. Complete holiday testing of all coated surfaces.
    g. Complete adhesion tape testing.
    h. For coatings applied over concrete, confirm substrate pH is within acceptable limits.
    i. Perform any additional testing deemed necessary to ensure a complete and proper installation.

2. For each of the inspection visits listed above, the ITL shall submit a letter to the Owner citing the acceptance or non-acceptance of the work inspected. If there are non-acceptance issues the letter shall state the reasons for non-acceptance. Owner shall share submitted letters with the Contractor.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Materials shall be delivered to site in original containers with labels intact and seals unbroken.

B. Protect and heat or cool material storage location to maintain temperature ranges recommended by coating manufacturers, but not less than 55°F.

C. Avoid danger of fire. Oily rags and waste must be removed from buildings each night or kept in appropriate metal containers. Provide fire extinguishers of type recommended by coating manufacturers in areas of storage and where finishing is occurring. Allow no smoking or open containers of solvent.

D. Empty containers shall have labels canceled and clearly marked as to use.

1.06 PROJECT / SITE CONDITIONS

A. Environmental Requirements:

1. Dry-heat and ventilate areas to obtain conditions recommended by coating manufacturer.
2. Relative humidity conditions as specified by coating manufacturer shall be adhered to.
3. No unprotected, unheated exterior coating shall be undertaken when cold, damp, foggy, or rainy weather appears probable, nor when the temperature of the substrate is below 55°F, unless approved in writing by coating manufacturer.
4. Maintain manufacturer's environmental requirements until coating is fully cured.
5. Apply no coating in areas where dust is being generated.
6. Testing and disposal of any waste and coating shall be the responsibility of the Contractor.

B. Protection:

1. Drop cloths shall be provided in all areas where coating is done to fully protect other surfaces.
2. Remove hardware, accessories, plates, lighting fixtures, and similar items or provide

protection by masking. Upon completion, replace items or remove protection and clean.

C. It is the intent of this Section that all ferrous metal items scheduled for coating be shop-primed. If items are not shop-primed, surfaces shall be prepared and coated in the field as specified.

D. Upon Substantial Completion, remaining unused material will become property of Owner. Seal material as required for storage, mark contents with color, type, location, and shelf life, and store on Site where required by Owner. Provide minimum of two gallons of each system component and color used.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Tnemec

B. Carboline

2.02 MATERIALS

A. Coatings shall meet surface burning characteristics as required by code and established by ASTM E84.

B. Coating products listed in the Coating Schedule, are set as a standard of quality. Coatings of substitute manufacturers shall meet or exceed the characteristics of the products listed as established by the flowing ASTM standards; B117, C307, C413, C579, C580, C868, D870, D1014, D1653, D2047, D2240, D2370, D2794, D3363, D4060, D4141, D4541, D4585, D4587, and G85.

C. If the Contractor wishes to offer a substitute to the products specified, the request for a substitute shall conform to the requirements of Section 01 61 00.

D. The Contractor and top coat coating manufacturer shall verify the compatibility of their products with the various primers used on shop primed materials and equipment.

2.03 COLORS

A. Color shall be formed of pigments free of lead, lead compounds, or other materials which might be affected by presence of hydrogen sulfide or other gases likely to be present at Site.

B. Colors shall be as selected by Owner. System color-coding shall be as specified in Section 40 05 05.

C. Coat access doors of electrical distribution panels and grilles to match color of adjacent wall or ceiling surfaces.

D. In areas scheduled for finishing, coat exposed piping, conduit, and ducts to match color of adjacent or near surfaces, except for color-coding.

E. In areas where existing surfaces are finished, coat new exposed piping, conduit, and ducts to match color of adjacent or near surfaces, except for color-coding.

F. Equipment Colors:

1. Equipment includes pumps, blowers, valves, flow meters, etc, and associated motors,

structural supports, hangers, and attached portions of electrical conduit, and other associated components.
2. Color of non-submerged equipment, including equipment with a manufacturer-applied finish coat, shall be same color as piping equipment serves; see Section 40 05 05.
3. Color of submerged equipment can be manufacturer's standard color.

2.04 THINNING, MIXING, AND TINTING

A. Where thinning is necessary, only the products of the manufacturer furnishing the coating will be allowed. All such thinning shall be done in strict accordance with coating manufacturer's recommendations.

B. Mix in accordance with manufacturer's recommendations.

C. Each coat shall be slightly darker than preceding coat, unless otherwise noted. Tint undercoats similar to finish coat.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine the areas and conditions under which Work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work.

B. Materials removed and replaced to correct defects due to Work placed on unsuitable surfaces shall be at Contractor's expense.

3.02 SURFACE PREPARATION

A. General:

1. All surfaces to be coated shall be prepared as specified herein and in accordance with coating manufacturer's recommendations. The object shall be to obtain a uniform, clean, and dry surface.
2. Quality of surface preparation described herein is considered a minimum. If coating manufacturer requires a higher degree of preparation, comply with coating manufacturer's recommendations.
3. Where surface dryness is questioned, test with dampness indicating instrument. Do not apply coatings over surfaces where moisture content exceeds that permitted by coating manufacturer.
4. Shop primed surfaces shall be scarified before applying top coats. Conform to top coat manufacturers recommendations.
5. If recoat time between application of primer and second coat or between top coats is exceeded, scarify surface before applying coatings. Conform to top coat manufacturers recommendations.
6. Workmanship for surface preparation shall conform to the following SSPC specifications:

a. Solvent Clean: SP-1.
b. Hand Tool Cleaning: SP-2.
c. Power Tool Cleaning: SP-3.
d. White Metal Blast Cleaning: SP-5.
e. Commercial Blast Cleaning: SP-6.
f. Brush-Off Blast Cleaning: SP-7.
g. Pickling: SP-8.
h. Near-White Blast Cleaning: SP-10.

i. Power Tool Cleaning to Bare Metal: SP-11.
j. Surface Preparation by Water Jetting: SP-12.
k. Surface Preparation of Concrete: SP-13.

B. Ferrous Metal:

1. Ferrous metal primed in the shop shall have all rust, dust, scale, and other foreign substances removed by abrasive cleaning conforming to SSPC SP-10. Cleaned metal shall be primed or pretreated immediately after cleaning to prevent new rusting.
2. Ferrous metal not primed in the shop shall be abrasive blast cleaned in the field prior to application of primer, pretreatment, or coating. Blast cleaning shall conform to SSPC SP-10 for submerged service. Blast cleaning shall conform to SSPC SP-6 for non-submerged service.
3. Prior to finish coating, primed areas that are damaged shall be cleaned and spot primed.

C. Galvanized Metal:

1. Where galvanized metal items are not submerged or buried, they shall be abrasive sweep blast cleaned and then solvent cleaned in accordance with SSPC SP-1.

D. Masonry:

1. Remove loose grit and mortar.
2. Remove grease, oil, dirt, salts, or other chemicals, or other foreign substances by solvent, detergent, or other suitable cleaning methods.

E. Existing Surfaces:

1. Remove and replace or mask attachments if attachments are not to be coated.
2. Remove surface contamination such as oil, grease, loose or defective coatings, mill scale, dirt, rust, mold, mildew, mortar, efflorescence, and sealers to assure sound bonding to tightly adhered old coatings. Glossy surfaces of old coatings shall be cleaned and dulled before overcoating.
3. Sand surfaces and feather edges where chips have occurred.
4. Cut out and fill cracks or other defects to match adjacent surface.
5. Exact nature of existing coatings is not known. Check compatibility of new coating by application to small area prior to starting coating. If lifting or other problems occur, notify Engineer for direction.
6. Comply with new coating manufacturer's recommendations for preparation of previously coated surfaces.
7. Prepare surfaces subject to submerged service as specified for new surfaces.

3.03 APPLICATION

A. Surfaces shall be dry at time of application.

B. The minimum surface temperature shall be 55°F and rising.

C. Apply in strict accordance with manufacturer's recommendations by brush, roller, spray, or other application method. The number of coats and thickness required is the same regardless of application method.

D. Each coat shall be allowed to dry in accordance with manufacturer's requirements. Drying time shall be construed to mean "under normal conditions". Where conditions other than normal exist, because of weather or because of confined space, longer times will be necessary. Units

shall not be put in service until coatings are thoroughly dry and cured.

E. Surfaces to be coated that will be inaccessible in the completed work shall receive the final coat before enclosure.

F. Coatings shall be applied to provide an opaque, smooth surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, or other surface imperfections will not be acceptable. Areas cut-in by brush prior to rolling shall have uniform appearance in comparison with adjoining surfaces.

G. Make edges of coating adjoining other materials or colors sharp and clean without overlapping.

H. Concrete block walls shall be back-rolled in conjunction with application of sprayed prime coat.

I. Crevices and other hard-to-apply areas shall be back-rolled/back-brushed in conjunction with application of field applied prime coat or intermediate coat. This includes, but is not limited to: between pipe flanges, pipe flange/barrel joints, equipment fittings, and other narrow openings.

J. Finish edges of doors as specified for faces. Apply first finish coat on edges before fitting. After doors fitted and hung apply second finish coat.

K. Manufacturer-Applied Coatings:

1. Repair abraded areas on factory-finished items in accordance with equipment manufacturer’s recommendations.
2. Blend repaired areas into original finish.

3.04 FIELD QUALITY CONTROL

A. If the Owner accepts Alternate 3, the Owner will pay for the services of an Independent Testing Laboratory to visit the Site throughout surface preparation and painting of the Backwash Tank for product application quality assurance, and to determine compliance with manufacturer's instructions and these Specifications, and as may be necessary to resolve field problems attributable to, or associated with, the manufacturer's products furnished under this Contract.

B. Examination of Work on Site by coating manufacturer’s representative shall be performed when requested by Engineer.

C. Sampling of Materials:

1. Engineer reserves the right to select unopened containers of materials furnished for the Project and have the materials tested at an independent laboratory. Owner will pay for first tests.
2. Retests of rejected materials and tests of replacement materials shall be paid for by Contractor.
3. Remainder of contents of containers not required for testing will be returned to Contractor.

D. Coverage:

1. Before beginning Work, finish one complete room, space, surface, and item of each color scheme required, showing selected colors, finished texture, material, and workmanship. After approval, sample room, space, surface, and item shall serve as standard for similar Work.
2. If coverage is not acceptable to Engineer, Engineer reserves the right to require additional application of coating at no extra cost to Owner.

E. Work at Site, where coat of material is to be applied, shall be observed by Engineer after surface has been prepared and before application of specified prime coat and each succeeding coat, otherwise no credit for applied coat will be given and Contractor automatically assumes responsibility to recoat Work in question. Surfaces coated without such observation shall be abrasive blast cleaned, reprepared, and recoated at no addition cost to Owner. Notify Engineer when surface preparation complete, coat applied, and when ready for inspection to comply with above.

3.05 FINAL TOUCH-UP AND CLEANING

A. Prior to Substantial completion, examine coated surfaces and retouch or refinish surfaces to leave in condition acceptable to Engineer.

B. Remove masking, coatings, and other material from floors, glass, and other surfaces not scheduled to be coated.

3.06 COATING SCHEDULE

A. Scheduled thickness or coverage rate is minimum as recommended by manufacturer. Manufacturer's recommendations shall be followed, but in no case shall the thickness or coverage rate be less than scheduled.

B. Coatings shall conform to the following schedule and coating manufacturer's recommendations. Examples of surfaces to be coated may not be all inclusive.

COATINGS SCHEDULE

System No.	Generic Type	Application	Tnemec	Carboline
1	Polyamidoamine Epoxy	Interior Concrete Block Walls / Satin	First Coat – Series N69 Hi Build Epoxoline II @ 105 sfpg, sprayed and backrolled Second Coat – Series N69 Hi Build Epoxoline II @ 150 sfpg Third Coat – Series N69 Hi Build Epoxoline II @ 165 sfpg	First Coat – Carboguard 890 VOC @ 100 sfpg, sprayed and backrolled Second Coat – Carboguard 890 VOC @150sfpg Third Coat – Carboguard 890 VOC @ 150 sfpg Or Sanitile 500/755 Block Filler
8	Modified Aromatic Polyurethane - Polyamidoamine Epoxy	Ferrous Metal, Cast Iron, Ductile Iron / Interior Non-Submerged / Satin	First Coat – Series N69 Hi Build Epoxoline II @ 3 mils DFT, touch-up primer prior to second coat Second Coat – Series N69 Hi-Build Epoxoline II@ 5 mils DFT Third Coat – Series N69 Hi-Build Epoxoline II @ 5 mils DFT	First Coat – Carbomastic 15 @ 3 mils DFT, touch-up primer prior to second coat Second Coat – Carboguard 890 VOC @ 5 mils DFT Third Coat – Carboguard 890 VOC @ 5 DFT

System No.	Generic Type	Application	Tnemec	Carboline
9	Modified Aromatic Polyurethane - Polyamidoamine Epoxy – Aliphatic Acrylic Polyurethane	Ferrous Metal, Cast Iron, Ductile Iron / Exterior Non-Submerged / Gloss	First Coat – Series N69 Hi Build Epoxoline II @ 3 mils DFT, touch-up primer prior to second coat Second Coat – Series N69 @ 4-6 mils DFT Third Coat – Series 1094 @ 2-3 mils DFT	First Coat – Carbomastic 15 @ 3 mils DFT, touch-up primer prior to second coat Second Coat – Carboguard 890 VOC @ 5 mils DFT Third Coat – Carbothane 134 MC @ 3 mils DFT
10	Polyamide Epoxy – Polyamidoamine Epoxy	Frames, Motors and other Equipment with Non-Epoxy Primer / Interior / Satin	Lightly Hand Sand Solvent Clean SP-1 First Coat – Series 27-1255 FC Typoxy Beige @ 3 mils DFT Second Coat – Series N69 Hi-Build Epoxoline II @ 5 mils DFT	Lightly hand sand Solvent Clean SP-1 First Coat – Carboguard 890 VOC @ 3 mils DFT Second Coat – Carboguard 890 VOC @ 5 mils DFT
11	Polyamide Epoxy – Aliphatic Acrylic Polyurethane	Frames, Motors and other Equipment with Non-Epoxy Primer / Exterior / Gloss	Lightly Hand Sand Solvent Clean SP-1 First Coat – Series 27-1255 FC Typoxy Beige @ 3 mils DFT Second Coat – Series 1094 Endura-Shield @ 3 mils DFT	Lightly Hand Sand Solvent Clean SP-1 First Coat – Carboguard 890 VOC @ 3 mils DFT Second Coat – Carbothane 134 MC @ 3 mils DFT
12	Polyamidoamine Epoxy	Galvanized Metal, Copper, PVC / Non-Submerged / Interior / Satin	First Coat – Series N69-1255 Hi-Build Epoxoline II Beige @ 2 mils DFT, touch-up primer prior to second coat Second Coat – Series N69 Hi-Build Epoxoline II @ 3 mils DFT Third Coat – Series N69 Hi-Build Epoxoline II @ 3 mils DFT	First Coat – Carboguard 890 VOC tan @ 2 mils DFT, touch-up primer prior to second coat Second Coat – Carboguard 890 VOC @ 3 mils DFT Third Coat – Carboguard 890 VOC @ 3 mils DFT
13	Polyamidoamine Epoxy – Aliphatic Acrylic Polyurethane	Galvanized Metal, Copper, PVC / Non-Submerged / Exterior / Gloss	First Coat – Series N69-1255 Hi-Build Epoxoline II Beige @ 2 mils DFT, touch-up primer prior to second coat Second Coat – Series N69 Hi-Build Epoxoline II @ 3 mils DFT Third Coat – Series 1094 Endura-Shield @ 3 mils DFT	First Coat – Carboguard 890 VOC tan @2 mils DFT, touch-up primer prior to second coat Second Coat – Carboguard 890 VOC @ 3 mils DFT Third Coat – Carbothane 134 MC @ 3 mils DFT

System No.	Generic Type	Application	Tnemec	Carboline
20	Polyamide Epoxy Coal Tar	Dissimilar Metal Protection / Semi-Gloss	Scarify the Surface, SP-1 First Coat – Series 46H-413 Hi-Build Tneme-Tar @ 20 mils DFT	Scarify the Surface, SP-1 First Coat – Bitumastic 300M @ 20 mils DFT
21	Polyamine Epoxy – Polyamine Novolac Epoxy	Chemical Containment / Concrete / Interior / Gloss	Filler – Series 218 MortarClad as needed to fill voids and bugholes First Coat – Series 201 Epoxoprime @ 200 sfpg Second Coat – Series 282 Tneme-Glaze @ 200 sfpg, hand broadcast anti-skid aggregate onto floor while still wet Third Coat – Series 282 Tneme-Glaze @ 200 sfpg	Filler – Carboguard 510 as needed to fill voids and bugholes First Coat – Semstone 110 @ 200 sfpg Second Coat – Semstone 140 @ 200 sfpg; hand broadcast anti-skid aggregate onto floor while still wet Third Coat – Semstone 140 @ 200 sfpg
27	Phenalkamine or Polyamide Epoxy	Ferrous Metal, Cast Iron, Ductile Iron / Interior Non-Submerged / Submerged P / Satin	First Coat – Series 91-H20 @ 2.5-3.5 mils DFT, touch-up primer prior to second coat Second Coat – Series N140 @ 2-4 mils DFT (stripe coat) Third Coat – Series 22 @ 25-30 mils DFT	First Coat – Hydroplate 1086 @ 6 mils DFT, touch up primer prior to second coat Second Coat – Hydroplate 1086 @ 6 mils DFT Third Coat – Hydroplate 1086 @ 6 mils DFT

Foot Notes:

1. Tnemec:

    a. Series 49 may be substituted for Series N69 in lower VOC and high solids options.

2. Carboline:

    a. In states who have not adopted Ozone Transport Commission guidelines, Carboguard 890 can be used in place of Carboguard 890 VOC.
    b. In states who have not adopted Ozone Transport Commission guidelines, Carbothane 134 HG can be used in place of Carbothane 134 MC.

END OF SECTION

DIVISION 10

SPECIALTIES

SECTION 10 14 10
SYSTEMS IDENTIFICATION

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes:

1. Identification requirements for various systems:

a. Pipe Markers.
b. Valve Tags.
c. Equipment Tags.
d. Electrical System Marking.
e. Signs.

B. Any required safety or hazard signage shall be provided by Owner.

1.02 SUBMITTALS

A. General:

1. Submit Product Data in sufficient detail to confirm compliance with requirements of this Section.
2. Submit in accordance with Section 01 33 00.

B. Product Data:

1. Catalog cuts and product specifications for each product type specified.
2. Storage and handling requirements and recommendations.
3. Installation methods and/or instructions.

C. Schedules:

1. Submit schedules indicating proposed lettering, symbols, letter size, and color coding for equipment, piping, valve, duct, and electrical identification.
2. Submit the following identification schedules. Schedules may be submitted separately as listed below but each schedule shall be complete:

a. Piping System Schedule: Indicating service, label content, specific location, and products to be used. Submittal shall include color chart for reference. Schedule shall include all piping systems from Division 40.
b. Sign Schedule: Indicating sign content, specific location, sizes, colors, fastening method, and products to be used. Submittal shall include color chart for reference.
c. Equipment and Devices Label Schedule: Provide a schedule of all equipment to be labeled with proposed content for each label similar to the following table.
d. For devices that are named or tagged in the Contract Documents, use the nomenclature in the Contract Documents.
e. For devices that are not named or tagged in the Contract Documents but are shown on Process and Instrumentation Diagrams of the Drawings, use the nomenclature below:

1) XXX-YYY-ZZZ where XXX = Process Line, YYY = Component Type, ZZZ = Tag Number (e.g, FLTR-V-001 represents a filtrate valve 001).

2) Component Types, YYY shall be defined as follows: V = valve, FLT = filter, STR = strainer.

Structure[3]	Room[4]	Description[5]	Tag Line 1	Tag Line 2	Tag Line 3
300	010 Pump Room	Backwash Butterfly Valve[1]		BW-V-001	Unique QR Code
300	030 North Filter Basement	Backwash Tank Isolation Valve[2]	30" BACKWASH TANK ISOLATION VALVE	FILTR-V-321	Unique QR Code
800	110 NAOH Room	Hypo Storage Tank Isolation Valve[2]		NAOC-V-1	Unique QR Code

[1] – example shows device that is not named in Contract Documents,
[2] – example shows device that is named and tagged in Contract Documents.
[3] – Structure column is for location purposes only and is not labeled on each tag.
[4] – Room column is for location purposes only and is not labeled on each tag.
[5] – Description column is for informational purposes only and is not labeled on each tag.

3. Valve Tag Schedule: Schedule including valve tag number, piping system, system abbreviation, and room or space location of valve.
4. Duct Label Schedule: Provide a schedule of each duct system indicating service, label content, specific location, and products to be used. Submittal shall include color chart for reference.
5. Electrical Identification Schedule including proposed nomenclature and tag numbers. Submittal shall include color chart for reference.
6. Schedules shall be submitted in Microsoft Excel and PDF format.

D. Record Submittal:

1. Provide updated tag schedules as part of the record drawing process to record as built conditions.

1.03 QUALITY ASSURANCE

A. Systems identification products shall comply with the following standards:

1. ASME A13.1 for color scheme, lettering size, length of color field, and viewing angles of identification devices.
2. NFPA 70 National Electrical Code.
3. NFPA 70E Standards for Electrical Safety in the Workplace.
4. NFPA 79 Electrical Standards for Industrial Machinery.
5. NFPA 99 Health Care Facilities Code.
6. 29 CFR 1910.144 Safety color code for marking physical hazards.
7. 29 CFR 1910.145 Specifications for accident prevention signs and tags.
8. ANSI Z535.4 for safety signs and labels.
9. NFPA 704 Standard System for the Identification of the Hazards of Materials for

Emergency Response
10. OSHA 29 CFR 1910.1200 Hazard Communication Standard

B. For consistency, obtain all systems identification labeling/tagging from single manufacturer with responsibility for entire system.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to their final locations in protective wrappings, containers, and other protection that will exclude dirt and moisture and prevent damage from construction operations. Remove protection only after equipment is made safe from such hazards.

B. Store materials in a clean, dry location.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Marking Services, Inc.

2.02 COMMON REQUIREMENTS

A. Provide manufacturer's recommended products as specified for each application. Where more than one type is listed for specified application, selection is Contractor's option, but provide a single type for each application category.

B. Materials shall support safe operations and emergency response through effective and durable labeling. Materials used shall withstand harsh and hazardous environments.

C. Bands, markers, tags, and other identification materials used in mechanical rooms and process locations shall be rated for exterior applications and suitable for withstanding occasional wash down.

D. Tags shall be oversized, or text shall be arranged to leave adequate space to install a Quick Response (QR) label after installation.

E. Lettering and Graphics:

1. For each identification type, provide products with consistent text, style, color, shape, and other identification features.

    a. Each tag/nameplate shall include the equipment name and tag number for all equipment, pumps, fans, control panels, and other such equipment.
    b. Pipe identification labels shall include direction-of-flow arrows and fluid service.
    c. All valves shall be tagged with a number.
    d. Duct identification labels shall include direction-of-flow arrows and service.
    e. Electrical system identification labels shall have service indicated.

2. Multiple Units: Where multiple units of same generic name are shown or specified, provide identification indicating individual system number (e.g. Air Supply Unit 10-ASU-1 and Air Supply Unit 10-ASU-2).

2.03 COMMON PRODUCTS

A. Cable/Zip Ties:

1. Fungus-inert, self-extinguishing, one piece, self-locking, Type 6/6 nylon cable ties with UV protection as described below:

    a. Minimum Width: 3/16 inch (5 millimeter).
    b. Tensile Strength: 50-pound (22.3 kilograms) minimum.
    c. UL 94V-2 Rated.
    d. Service Temperature Range: -40°F (-40°C) to 185°F (85°C).
    e. Color: Black.

B. Stainless Steel Strapping:

1. Thermoplastic coated, 1/4" inch wide, 316 stainless steel strapping.
2. Provide locking clips for fastening ends together.

C. Stainless Steel Braided Wire:

1. 7 x 7 Configuration, 14 gauge 316 stainless steel wire.
2. Outside minimum diameter 0.063” (1.6mm).
3. Provide 316 stainless steel swag sleeves for fastening ends together by crimping.

D. Custom Adhesive Labels / Tapes:

1. Printed thermoplastic with UV resistant ink and chemical/UV resistant overlaminate.
2. Manufacturer will provide certification that the printed labels or tapes do not contain any chlorides.

E. Signs:

1. Signs shall consist of printed graphics sealed between layers of chemical resistant plastic. The top layer will be an outdoor durable thermoplastic that provides resistance to process chemicals and protection from high impact.
2. Suitable for a service temperature range of -40 to 200 F.
3. The substrate shall be 0.1-inches thick and rigid for signs mounted on flat surfaces and 0.03-inches and flexible for signs mounted on curved surfaces.
4. Fastening: Provide grommeted hole(s) or adhesive backing for fastening depending on installed location.
5. Unless shown or specified elsewhere:

    a. Warning Signs:

        1) Size: 7” x 12”
        2) Background Color: Red.
        3) Letter Color: White.
        4) Text Height: 1/2" minimum, provide larger text size where possible to fit within sign boundary.

    b. Piping To/From Signs:

        1) Size: 4” x 8”
        2) Background Color: Shall match associated piping system color for piping. White for item tags not associated with a color-coded piping system.
        3) Letter Color: Either white or black for best contrast to background color. Black for item tags not associated with a color coded piping system.

4) Text Height: 1" or largest font size that allows all words to fit on sign of indicated size.
5) Signs shall indicate piping source or destination. E.g. “TO FILTER BUILDING” “FROM DIGESTER COMPLEX.”

c. Tank Signs:

1) Size: 12” x 20”
2) Background Color: White.
3) Letter Color: Black.
4) Text Height: Size to fit within sign boundary.
5) Signs shall indicate tank tag as shown on the drawings (e.g. 100-T-1301), contents (e.g. 15% Sodium Hypochlorite), and nominal capacity (e.g. 15,000 Gallons).

F. Engraved Plastic Labels:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick.
2. Letter Color: Black.
3. Background Color: White
4. Minimum Label Size: Length and width vary for required label content, but not less than 1 by 3 inches.
5. Minimum Letter Size: 1/4 inch.

2.04 PIPE MARKING PRODUCTS

A. General Requirements:

1. Pipe markers shall comply with ANSI A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.
2. Service Temperature: -40 to 200 F
3. Storage Durability: 2-year minimum
4. Marker labels shall be constructed of a layer of polyester film and a layer of UV and chemical resistant protective film, laminated to form a single construction. Printed graphics will be between the two layers of film to protect them from the effects of the environment.
5. As installed, material will be self-extinguishing when exposed to open flames per UL-94HB test method.

B. Pipe Marker Lettering and Arrows:

1. Lettering: Comply with piping system nomenclature as specified, scheduled, or shown and abbreviate only as necessary for each application length, and only with approval of Engineer. Lettering height shall be as follows:

Outside Pipe Diameter (inches)	Minimum Letter Height (inches)	Minimum Length of Marker (inches)
¾ to 1-1/4	½	8
1-1/2 to 2	¾	8
2-1/2 to 6	1-1/4	12
8 to 10	2-1/2	24
Over 10	3-1/2	32

2. Arrows: Print each pipe marker with arrows indicating direction of flow, either integrally with piping system service lettering (to accommodate both directions), or as separate unit of

plastic. Arrows for flow direction on carriers shall be identified by application of a separate arrow label of same construction placed on reserved space on carrier.

3. Label and band colors in accordance with ANSI A13.1-2007, Process-Mechanical Piping Schedule Section 40 05 05 and following:

    a. Lettering and arrows:

        1) Flammable or oxidizing fluids - Black text on yellow background.
        2) Potable, cooling, boiler feed, and other waters – White text on green background.
        3) Compressed air - White text on blue background.
        4) Fire quenching fluids – White text on red background.
        5) Toxic and corrosive fluids, including biogas – Black text on orange background.
        6) Combustible fluids – White text on brown background.
        7) Wastewater and other liquid process services - Black text on white background.
        8) Sludge services – White text on gray background.
        9) Others - White text on black background.

    b. Banding: Colors and band spacing as scheduled or as shown on Drawings.

C. Pipe Marker Types:

1. Snap-On MS975 – A pretensioned, semi-rigid premium-grade thermoplastic coiled pipe marker formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive in contact with the pipe surface.
2. Strap-On MS995 – A printed 5 mil (0.005 inch) polyester label, top laminated with a clear ultraviolet and chemical resistant plastic film that is pre-applied to an acrylic-faced, co-extruded ABS plastic carrier. Carrier shall have pre-formed legs running its entire length to ensure marker remains straight and aligned with pipe. Flow direction shall be identified by application of a separate arrow label of same construction. Carriers shall be affixed to piping by means of two stainless steel straps that wrap entirely around the circumference of the pipe.
3. Adhesive – A preprinted, permanent adhesive, color coded, pressure sensitive vinyl pipe marker.

2.05 EQUIPMENT, VALVE, INSTRUMENT, AND DEVICE TAG PRODUCTS

A. Requirements:

1. Tags shall consist of printed graphics sealed between layers of chemical resistant plastic. The top layer will be an outdoor durable thermoplastic that provides resistance to process chemicals and protection from high impact. The substrate shall be rigid or flexible depending on application.
2. Fastening: Provide grommeted hole(s) or adhesive backing for fastening depending on installed location.
3. Background Color: Shall match associated piping system color for piping. White for item tags not associated with a color-coded piping system.
4. Letter Color: Either white or black for best contrast to background color. Black for item tags not associated with a color coded piping system.
5. Sizing:

    a. 2 x 6-inch minimum size for equipment tags.
    b. 2 x 2-inch minimum size for valve and instrument tags.
    c. 3/8-inch high letters for tag number.
    d. 1/4-inch high letters for descriptive name and asset ID number.
    e. 1 x 1-inch space for QR code.

2.06 DUCTING SYSTEM PRODUCTS

A. Duct Labels:

1. Pre-printed, color-coded, with lettering indicating associated equipment, service, and showing flow direction.
2. Contents: Include identification of duct service using same system designation as used on Drawings and an arrow indicating flow direction. On each label, prefix the system designation with the associated equipment number (example: 100-AHU-1 SUPPLY AIR).
3. Material: vinyl with pressure sensitive acrylic adhesive backing for non-plenum spaces. For plenum spaces provide 1.6 mil aluminum with pressure sensitive adhesive backing meeting NFPA 101 Life Safety Code for Class A materials having a Flame Spread Index of 25 or less and a Smoke Developed Index of 450 or less.
4. Marker Size: 2-1/4 inch high, with length to suit required label content.
5. Lettering Size: Minimum 1-1/2 inches high.
6. Direction-of-Flow Arrows: Flow direction shall be identified by application of a separate arrow label of same label construction.
7. Arrow Marker Size: 2-1/4 inch by 6-1/2 inches.
8. Duct Label Color Schedule:

    a. Supply Air: White text on green background.
    b. Exhaust Air: Black text on yellow background.
    c. Return Air: White text on blue background.
    d. Relief Air: White text on blue background.
    e. Outside Air: White text on blue background.

2.07 ELECTRICAL SYSTEMS PRODUCTS

A. General requirements:

1. Provide electrical system identification labels with service indicated. All labels shall have background colors matched with specific service designation.
2. Coordinate names, abbreviations and other designations used in electrical identification work with corresponding designations shown, specified, or scheduled.
3. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturer or as required for proper identification and operation/maintenance of electrical system and equipment.
4. Comply with ANSI A13.1 for minimum sizes for letters and numbers.
5. Comply with NFPA 70 for labeling content and spacing requirements.

B. Raceway and Conduit Markers:

1. Colors:

    a. Normal Power: White text on green background.
    b. Critical Branch: Black text on yellow background.
    c. Life Safety: White text on purple background.
    d. Fire Alarm: White text on red background.
    e. Communications: White text on blue background.
    f. Low Voltage: White text on black background.

2. Coiled Conduit Markers: Flexible, preprinted, color coded, acrylic or latex bands sized to suit diameter of line it identifies and arranged to stay in place by pre-tensioned gripping action when placed in position.
3. Colored Adhesive Tape: Self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inch

wide (0.08 millimeter thick by 25 to 51 millimeter wide).

K. Conduit Tags:

1. Printed graphics protected by a chemical and UV resistant 7 mil thick matte velvet textured laminate.
2. Color: Black text on white background.
3. Size: 1-1/2-inch square.

L. Cable Markers:

1. Stainless Steel: Laser engraved 316 stainless steel with permanently engraved black text. Markers shall fasten with stainless steel straps.
2. Coiled Markers: Semi rigid plastic formed to cover full circumference of cable and to attach without fasteners or adhesive in contact with the cable surface.

M. Conductor Markers:

1. Pre-Printed Heat Shrinkable Wire Markers: 2:1 polyolefin and printed with abrasion resistant text.
2. Sizes: 8 AWG to 24 AWG.

N. Detectable Underground Line Warning Tape:

1. Permanent, bright colored, continuous printed polyethylene with a sandwiched aluminum core tape with the following features:

   a. Size: Not less than 6 inch wide by .005 inch thick (152 millimeter wide by 0.127 millimeter thick).
   b. Resistant to acids, alkalis and other destructive agents found in soil.
   c. Compounded for permanent direct burial service – 5+ Years buried.
   d. Storage Durability – 5+ Years
   e. Embedded continuous metallic strip or core.

2. Provide black text over colored background based on service in accordance with APWA Uniform Color Code and as shown below:

Color Code	Swatch
Electric Power Lines, Cables, Conduit, and Lighting Cables	Red
Gas, Oil, Steam, Petroleum or Gaseous Materials	Yellow
Communication, Alarm or Signal Lines, Cable or Conduit	Orange
Potable Water	Blue
Sewers and Drain Lines	Green
Reclaimed Water, Irrigation and Slurry Lines	Purple
Temporary Survey Marking	Pink
Proposed Excavation	White

PART 3 – EXECUTION

3.01 COMMON REQUIREMENTS

A. Installation:

1. Coordinate locations with Owner during walk-through prior to installation following these guidelines:

    a. Labels shall be visible from point of normal approach and at every entry point in the floor or wall.
    b. Provide multiple points of labeling in areas of complex flow or significant congestion to allow identification of systems from multiple points of view.

2. Install identification in accordance with manufacturer's written instructions.
3. Clean surfaces of dust, loose material, and oily films before applying adhesive mounted products.

B. Tag Fastening:

1. Where suitable flat space is available, tags shall be mounted directly to equipment per the following:

    a. In Dry Exposures, as indicated on the drawings, fasten to equipment with stainless steel screws or suitable adhesive where required to maintain NEMA rating.
    b. In Exterior or Wet Exposures, as indicated on the drawings, fasten to equipment with suitable adhesive.
    c. In Chemical Exposures, as indicated on the drawings, fasten to equipment with suitable adhesive.

2. Where suitable flat space is not available mount tags per one of the following methods after approval of the Owner:

    a. Mount tag on adjacent surface using stainless steel screws or suitable adhesive.
    b. Attached to equipment with stainless steel braided wire. Tag wire shall be terminated in a loop using a 316 stainless steel swage sleeve to produce a clean, neat loop. Knotted or loosely twisted ends are not acceptable. Beaded chain/wire is not acceptable.
    c. In Chemical Exposures where the chemicals being stored are incompatible with stainless steel use plastic cable-ties to fasten tags.

3.02 PIPE MARKING

A. Installation:

1. Where identification products are to be applied to surfaces requiring insulation, painting, covering, or finish install identification after completion of covering and finishing. Install identification prior to installation of acoustical ceilings and similar removable concealment.
2. Pipe Marker Usage:

    a. Small Pipes: For external diameters less than 8-inch (including insulation, if any), provide full band circumference of pipe markers, extending 360 degrees around pipe at each location. Arrows shall be integrated into to the marker and not a separate arrow tape.

        1) Snap-on type pipe markers.
        2) Adhesive type pipe markers, taped to pipe (or insulation) with color coded plastic adhesive tape not less than 4 inch wide, full circle at both ends of pipe marker, and tape lapped 1-1/2 inch. For plastic chemical tubing use only snap-on type.

b. Large Pipes: For external diameter 8-inch and larger (including insulation, if any).

1) Strap-on type pipe marker strapped to pipe (or insulation).
2) Adhesive type pipe marker taped to pipe (or insulation), not less than 4-inch wide, full circle at both ends of pipe marker, tape lapped 3 inch.

3. Locate pipe markers with arrows and color bands as follows wherever piping exposed to view in occupied spaces, machine rooms, accessible maintenance spaces (shafts, tunnels, plenums), and exterior non-concealed locations.

a. Near each valve and control device.
b. Near locations where pipes pass through walls or floors, ceilings or enter non-accessible enclosures.
c. At access doors, manholes, and similar access points permitting view of concealed piping.
d. Near major equipment items and other points of origination and termination.
e. Spaced intermediately at maximum spacing of 30 feet along each piping run, except reduce spacing to 20 feet in congested area of piping and equipment.
f. On piping above removable acoustical ceilings
g. Maximum spacing for chemical piping shall not exceed 10 feet or as required by local codes.
h. At all changes in direction (on both sides of turn).

4. Locate identification color bands at each marker and at intermediate spacing not to exceed 10 feet between bands, and at lesser spacing as indicated or as required by local codes.
5. Locate directional arrows at each marker. Provide three arrows at each tee or branch fitting.
6. Where piping is normally visible from more than one side, provide two or three labels and arrows spaced at 120-degree intervals around pipe in accordance with ANSI A13.1.
7. Painting or Coating:

a. Surface painting of piping, ductwork, and equipment is the work of Section 09 96 00. Coordinate painting of identification systems with products supplied in Section 09 96 00.
b. Piping color coding shall be as specified in Section 40 05 05.
c. For piping scheduled to be color coded, but not specified for complete painting (such as plastic piping, stainless steel piping, or those with aluminum jacketed insulation) provide additional banding to represent background color. At each banding location provide following sequence:

1) 8-inch-wide tape of scheduled pipe color.
2) 4-inch-wide tape of scheduled band color.
3) 8-inch-wide tape of scheduled pipe color.

B. Adjustment and Cleaning:

1. Adjusting: Relocate any identification device visually blocked.
2. Cleaning: Clean face of identification devices after installation.

3.03 VALVES AND FLOW CONTROL DEVICES

A. Provide tags for all:

1. Flow control and/or measurement devices installed in piping 2-inches in diameter or larger.

2. Flow control devices that control flow to or in basins or channels.

B. Valve and Instrument Tag Placements:

1. Tags shall be installed relative to the valve as per the following:

Type of Valve	Valve Orientation	Placement of Tag
Rising Stem	Horizontal or Vertical	Around Stem Yoke or Packing Gland
Non-Rising Stem, Screwed or Welded Valve	Horizontal	Around Pipe to Local Valve
	Vertical	On Pipe Above Valve Body
Non-Rising Stem, Flanged	Horizontal	Around Body
	Vertical	Around Body, Above Lower Flange

3.04 EQUIPMENT

A. Equipment Tag Placement:

1. Tags shall be centered on the side of the equipment and shall be placed such that each tag is clearly visible, and equipment easily identified from all working areas.
2. Tags shall be placed depending on the orientation of equipment:

a. Horizontal Equipment – On the base or supports of the equipment.
b. Vertical Equipment – Affixed to equipment, bottom edge of the tag shall be 5 feet above the finished floor.

3.05 SIGNS

A. Sign placement height and location may vary; signs shall be placed to be clearly readable from normal working areas. If locations are in question, signs shall be placed as directed by the Owner.

B. Provide warning signs at locations indicated on the drawings.

C. Provide piping to/from signs at each location where new piping penetrates a wall and is not visible on the opposite side of that wall. Sign shall be mounted on the wall adjacent to pipe, at a location visible from normal travel areas, and in a fashion to clearly indicate which pipe the sign is referring to.

D. Provide a tank sign for each tank. Signs for tanks shall be placed on the tank to be clearly visible above the containment wall from working areas near the tank at the operating floor level.

3.06 ELECTRICAL SYSTEMS

A. Provide tags for:

1. All equipment named or tagged on Drawings.
2. Electrical cabinets and enclosures.
3. Push button stations.
4. Contactors.
5. Dimmers.

6. Receptacles.

B. Installation:

1. Install labels / tags at locations for best convenience of viewing without interference with operation and maintenance of equipment.
2. Lettering, Colors, and Graphics: Coordinate names, abbreviations, colors, and / or designations used for electrical identification with corresponding designations used in Contract Documents or required by codes and standards. Use consistent designations throughout Project.
3. Identify feeders over 600 volt with "DANGER-HIGH VOLTAGE" in black letters 2-inches high, stenciled with paint at 10 feet intervals over continuous, painted orange background. Identify following:

    a. Entire floor area directly above conduits running beneath. Within 12-inches of basement or ground floor that is in contact with earth or is framed above unexcavated space.
    b. Wall surfaces directly external to conduits concealed within wall.
    c. All accessible surfaces of concrete envelope around conduits in vertical shafts, exposed in building, or concealed above suspended ceilings.
    d. Entire surface of exposed conduits.

4. Identify raceways containing power, control and instrumentation conductors with coiled conduit markers identifying voltage and raceway contents. Locate labels at penetrations of walls, floors, and junction boxes, at 50 feet maximum intervals in straight runs, and at 25 feet in congested areas. Locate labels at all three sides of tees and similar fittings.
5. Identify raceways and exposed cables of certain systems with colored bands of coiled conduit markers. Band exposed and accessible raceways of systems listed below for identification.

    a. Provide 2-inch wide bands, completely encircling conduit, and place adjacent bands of two color markings in contact, side by side.
    b. Locate bands at changes in direction, at penetrations of walls and floors, at 50 feet maximum intervals in straight runs, and at 25 feet in congested areas.
    c. Colors:

        1) Fire Alarm System: Red.
        2) Fire Suppression Supervisory and Control System: Red and yellow.
        3) Combined Fire Alarm and Security System: Red and blue.
        4) Security System: Blue and yellow.
        5) Mechanical and Electrical Supervisory System: Green and blue.
        6) Telecommunications System: Green and yellow.

6. Install Caution Signs for Enclosures Over 600 volts: Use pressure sensitive, self-adhesive label indicating system voltage in black, preprinted on orange field. Install on exterior of door or cover.
7. Install Circuit Identification Labels on Boxes: Label externally as follows:

    a. Exposed Boxes: Pressure sensitive, self-adhesive plastic label on cover.
    b. Concealed Boxes: Plasticized card stock tags.
    c. Labeling Legend: Permanent, waterproof listing of panel and circuit number or equivalent.

8. Color Code Conductors: Secondary service, feeder, and branch circuit conductors throughout secondary electrical system.

a. Field applied; color coding methods may be used in lieu of factory coded wire for sizes larger than No. 10 AWG.

    1) Colored, pressure sensitive plastic tape in half lapped turns for distance of 6-inches from terminal points and in boxes where splices or taps are made. Apply last 2 turns of tape with no tension to prevent possible unwinding. Use 1-inch wide tape in colors as specified. Adjust tape bands to avoid obscuring cable identification markings.
    2) Colored cable ties applied in groups of 3 ties of specified color to each wire at each terminal or splice point starting 3-inches from terminal and spaced 3-inches apart. Apply with special tool or pliers, tighten to snug fit, and cut off excess length.

b. 208/120 Volt System:

    1) Phase A: Black.
    2) Phase B: Red.
    3) Phase C: Blue.
    4) Neutral: White.
    5) Ground: Green.

c. 480/277 Volt System:

    1) Phase A: Brown.
    2) Phase B: Orange.
    3) Phase C: Yellow.
    4) Neutral: White with non-green stripe.
    5) Ground: Green.

9. Power Circuit Identification: Use metal tags for cables, feeders, and power circuits in vaults, pull boxes, junction boxes, manholes, and switchboard rooms.

    a. Legend: 1/4-inch steel letter and number stamping or laser etching with legend corresponding to indicated circuit designations.
    b. Fasten tags with nylon cable ties; fasten bands using integral ears.

10. Apply identification to conductors as follows:

    a. Conductors to Be Extended in Future: Indicate source and circuit numbers.
    b. Multiple Power or Lighting Circuits in Same Enclosure: Identify each conductor with source, voltage, circuit number, and phase. Use color coding for voltage and phase indication of secondary circuit.
    c. Multiple Control and Communications Circuits in Same Enclosure: Identify each conductor by its system and circuit designation. Use consistent system of tags, color coding, or cable marking tape.

11. Apply warning, caution, and instruction signs and stencils as follows:

    a. Install warning, caution, and instruction signs where indicated or required to ensure safe operation and maintenance of electrical systems and of items to which they connect.
    b. Install engraved, plastic laminated instruction signs with approved legend where instructions or explanations are needed for system or equipment operation. Install UV protected signs with metal backing for outdoor items.
    c. Emergency Operating Signs: Install engraved laminate signs with white legend on red background with minimum 3/8 inch high lettering for emergency instructions on power

transfer, load shedding, and or emergency operations.

12. Install identification as follows:

    a. Apply equipment identification labels on each major unit of equipment, including central or master unit of each system. This includes communication, signal, and alarm systems, unless units are specified with their own self-explanatory identification.
    b. Apply designation labels of engraved plastic laminate for disconnect switches, breakers, push buttons, pilot lights, motor control centers, and similar items for power distribution and control components above, except panelboards and alarm/signal components where labeling is specified elsewhere. For panelboards, provide framed, typed circuit schedules with explicit description and identification of items controlled by each individual breaker.
    c. Receptacles shall be fitted with a label indicating the panel and circuit powering the receptacle, e.g., 100LP1-21.

13. Buried Lines:

    a. During trench backfilling, for exterior underground power, control, signal, and communications lines, install continuous underground line warning tape located directly above lines at 6 to 8 inches below finished grade.
    b. Where multiple lines installed in a common trench or ductbank provide multiple underground line warning tapes, one for each 16 inches of width.

3.07 CONTROLS SYSTEMS

A. Instrument and Device Identification:

1. Provide systems identification tag for each instrument and transmitter, if applicable. Place tags for instruments near point of installation for elements not readily accessible.

B. Control Panel and Stations Labels and Nameplates:

1. Panel designation:

    a. Provide equipment identification tag as specified previously.

2. Front of panel mounted devices:

    a. Provide engraved plastic label for each front of panel device with descriptive phrase using nomenclature used on Drawings and in Specifications.
    b. Labels shall black characters on white background except emergency stop switches. Emergency stops shall have black text on yellow background.
    c. Fastened with stainless steel screws or suitable adhesive where required to maintain panel NEMA rating.

3. Rear of panel mounted devices:

    a. Provide nametag for each rear of panel device with labels used on as-built panel drawings.
    b. Custom adhesive labels.
    c. Self-adhesive backing.
    d. Clean areas prior to affixing labels.

3.08 QUALITY CONTROL

A. Final Survey and Repairs:

1. Prior to final completion of the project, Engineer, Contractor, and Owner shall perform walk-through survey of all identification systems.
2. Contractor shall remove and replace any bands, labels, tags, or markers that are found to be loose, discolored, damaged, or defective.

END OF SECTION

DIVISION 22

PLUMBING

SECTION 22 00 05
PLUMBING SYSTEMS

PART 1 – GENERAL

1.01 SUMMARY

A. This section includes plumbing equipment, fixtures, insulation and piping systems, including:

1. Domestic Water Piping System:

a. Domestic cold water piping (W1, W2, and W3).
b. Domestic hot water piping (HW, HWRE, TMW, TPW).
c. Exterior water piping.

2. Plumbing Fixtures and Equipment.

1.02 DEFINITIONS, ABBREVIATIONS AND ACRONYMS

A. Acronyms:

1. ABS: Acrylonitrile Butadiene Styrene
2. CPVC: Chlorinated Polyvinyl Chloride
3. CWP: Cold Working Pressure
4. DR: Dimension Ratio
5. DWV: Drain Waste Vent
6. EPDM: Ethylene Propylene Diene Monomer
7. HDPE: High Density Polyethylene
8. IDR: Inside Dimension Ratio
9. IPS: Iron Pipe Size
10. NPT: National Pipe Thread
11. OS&Y: Outside Stem and Yoke
12. PE: Polyethylene
13. PEX: Crosslinked Polyethylene
14. PLC: Programmable Logic Controller, refer to Division 40 for interface requirements
15. PTFE: Polytetrafluoroethylene (Teflon®)
16. PVC: Polyvinyl Chloride
17. TEFC: Totally Enclosed Fan Cooled
18. TFE: Tetrafluoroethylene

B. Unit Abbreviations:

1. °F: Degrees Fahrenheit
2. Btu/Hr: British Thermal Units per Hour
3. CFM: Cubic Feet per Minute
4. GPH: Gallons per Hour
5. GPM: Gallons per Minute
6. HP: Horsepower
7. kW: Kilowatts
8. PSI: Pounds per Square Inch
9. RPM: Revolutions per Minute

1.03 REFERENCES

A. Code References:

1. ADA: Americans with Disabilities Act

B. Standard References:

1. ANSI: American National Standards Institute
2. ASME: American Society of Mechanical Engineers
3. ASSE: American Society of Sanitary Engineering
4. ASTM: American Society for Testing and Materials
5. AWWA: American Water Works Association
6. CISPI: Cast Iron Soil Pipe Institute
7. CDA: Copper Development Association Incorporated
8. CSA: Canadian Standards Association
9. MSS: Manufacturers Standardization Society
10. PDI: Plumbing and Drainage Institute
11. UL: Underwriters Laboratories Incorporated

1.04 SUBMITTALS

A. General:

1. Submit Product Data in sufficient detail to confirm compliance with requirements of this Section. Submit Product Data and Shop Drawings in one complete submittal package. Partial submittals are unacceptable.

B. Product Data: Submit manufacturer's technical data for all fixtures, drain, valves and equipment. Include in submittal, specifications, capacity ratings, pump curves showing scheduled operating point clearly identified, dimensions, weights, materials, accessories furnished, and installation instructions.

C. Shop Drawings: Submit assembly-type shop drawings showing unit dimensions, construction details, rough-in elevations, methods of assembly of components, and field connection details.

D. Wiring Diagrams: Submit manufacturer's electrical requirements for power supply wiring to equipment. Submit manufacturer's ladder-type wiring diagrams for interlock and control wiring. Clearly differentiate between portions of wiring that are factory-installed and portions to be field-installed.

E. Maintenance Data: Submit maintenance data and parts list for piece of scheduled equipment, accessory, and control. Include this data and product data in maintenance manual in accordance with requirements of Division 01.

F. Submit all pipe testing reports.

G. Submit in accordance with Section 01 33 00.

H. Operation and Maintenance (O&M) Data:

1. Operating instructions and maintenance data for materials and products for inclusion in O&M Manual.
2. Manufacturer's written instructions for periodic tests of equipment in service.
3. Submit in accordance with Section 01 78 23.

1.05 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Provide plumbing equipment, fixtures, insulation and piping from firms regularly engaged in manufacture of same types and sizes of equipment required, whose products have been in satisfactory use in similar service for not less then 3 years.

B. Plumbing Code Compliance: Comply with all applicable portions of building codes pertaining to plumbing materials, construction and installation of products.

1. Indiana Plumbing Code: 675 IAC 16-1.3.

C. PDI Compliance: Comply with applicable PDI standards pertaining to products and installation of soil waste piping systems.

D. Manufacturer Qualifications: Firms experienced in manufacturing equipment of types and capacities indicated that have record of successful in-service performance.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver equipment and system components to their final locations in protective wrappings, containers, and other protection that will exclude dirt and moisture and prevent damage from construction operations. Remove protection only after equipment is made safe from such hazards.

B. Store all equipment and fixtures in clean, dry location.

PART 2 – PRODUCTS

2.01 GENERAL

A. Where more than one type is indicated, selection is Contractor's option or compliance with governing regulations.

B. Size system drain piping as shown or, if not shown, as required to properly drain piping systems, including valves and equipment.

C. Manufacturer's equipment used as basis of design for project is name indicated in Specifications for particular type of equipment or application contained in these contract documents. If no manufacturer listed, basis of design is industry standard indicated.

2.02 ABOVE GROUND DOMESTIC WATER PIPING

A. Acceptable Materials:

1. Copper Tube:

a. ASTM B88, Type L.
b. ANSI/NSF 61 certified, bearing NSF-61 mark.
c. Fittings: ANSI/ASME B16.22 wrought copper solder joint.
d. All soldered joints shall be made in accordance with ASTM B828.
e. Utilize NSF approved flux.
f. ASTM B32, NSF/ANSI 61, Annex G lead free solder.

2. CPVC Pipe:

a. ASTM F441 CPVC pipe, Schedule 80.
b. Fittings: ASTM F439, socket weld joints.

c. All solvent weld joints shall be made in accordance with ASTM F493 with solvent cements complying with ASTM F493.
d. All plastic pipe and fittings serving potable water systems shall be third party certified to comply with NSF 61.
e. Primer and solvent cement shall conform to NSF 14.

3. Polyvinyl Chloride (PVC) Pipe:

a. ASTM D1785 PVC pipe, Schedule 80.
b. Fittings: ASTM D2467, socket weld joints.
c. All solvent weld joints shall be made in accordance with ASTM D2855.
d. Primer complying with ASTM F656.
e. Solvent cement complying with ASTM D2564.
f. When used on potable water systems, primer and solvent cement shall conform to NSF 14.

4. Stainless Steel Pipe:

a. ASME B36.19M, Schedule 40, seamless stainless steel, Type 304L pipe.
b. Fittings: Wrought stainless steel, ASTM A403, MSS SP-114, Class 150 threaded per ANSI B1.20.1 or socket welded fittings.

B. Material Selection:

1. Refer to Space Environment and Hazardous Ratings Schedule on Drawings for determination of the Exposure type of each space in which piping is to be installed. Refer to Material Schedule, Plumbing column, on Drawings for piping material to be utilized within each Exposure type.
2. Where Material Schedule identifies more than one acceptable material, selection of material is Contractor's option of scheduled acceptable materials.
3. Where Material Schedule identifies Plastic, CPVC shall be used for potable water systems. PVC or CPVC may be used for non-potable water systems.
4. Use of PEX tubing is restricted to concealed in wall installation locations within "Dry" Exposures.

2.03 PIPE SUPPORTS

A. Meeting requirements of local Plumbing Code and Section 40 05 07.

B. Refer to Space Environment and Hazardous Ratings Schedule on Drawings for determination of the Exposure type of each space in which pipe supports are to be installed. Refer to Material Schedule, Hangers and Supports column, on Drawings for support materials to be utilized within each Exposure type.

2.04 VALVES

A. General:

1. Valves installed in insulated piping systems shall be furnished with extended stem as required to allow operation of valve without damage to or interference with insulation system.
2. All valves used on potable water systems (TPW) shall be of lead-free construction suitable for potable water use, complying with NSF/ANSI 61.
3. Provide valves meeting the requirements of Section 40 05 53 and as indicated below:

a. Ball Valves for stainless steel piping systems: Type V336.

b. Ball Valves PVC piping systems: Type V355.

B. Emergency Wash Station Tempering Valve:

1. Manufacturers:

a. Lawler Manufacturing Co, Model 911.
b. Or equal.

2. Emergency shower mixing valve with two independent control mechanisms which split flow in half and blend split flow to desired temperature at discharge.
3. Adjustable setpoint range to 70-90°F, field set to 75°F.
4. Thermometer at two inlets and discharge.
5. Anti-scald protection to disrupt hot water if loss of cold water.
6. Designed to comply with ANSI Z358.1.
7. Rated for 125-psi inlet pressure and 180°F inlet temperature.
8. Bronze body construction.
9. Stainless steel recessed cabinet or painted steel cabinet.
10. Capacity: 60 gpm at 30 psig. Capable of maintaining setpoint temperature even if hot or cold water temperature changes 30°F, or a supply pressure reduction of 50%.

C. Emergency Eyewash Tempering Valve:

1. Manufacturers:

a. Lawler Manufacturing Co, Model 911E/F.
b. Or equal.

2. Emergency eyewash mixing valve with two independent control mechanisms which split flow in half and blend split flow to desired temperature at discharge.
3. Adjustable setpoint range to 70-90°F, field set to 75°F.
4. Anti-scald protection to disrupt hot water if loss of cold water.
5. Designed to comply with ANSI Z358.1.
6. Rated for 125 psi inlet pressure and 180°F inlet temperature.
7. Bronze body construction.
8. Capacity: 5 gpm at 20 psig. Capable of maintaining setpoint temperature even if hot or cold water temperature changes 30°F, or a supply pressure reduction of 50%.

2.05 FIXTURES

A. Emergency Eyewash and Showers: (EWS-1)

1. Manufacturers

a. Guardian, Model G1993.
b. Haws Drinking Faucet Co.
c. Or Equal.

2. Combination shower with eye/face wash.
3. Unit shall meet requirements of ANSI Z358.1.
4. Corrosion resistant, schedule 80 PVC construction. Shower assembly shall include vertical bracing of shower head supply connected to shower riser at a 45° angle. Bracing shall be of Type 316 stainless steel or non-metallic construction.
5. Yellow 10 inch diameter ABS plastic shower head with 20 gpm restrictor orifice.
6. 1 inch Type 316 stainless steel body stay open shower valve with stainless steel actuating

arm and pull rod.
7. 11.5 inch diameter yellow ABS plastic eye/face wash bowl.
8. ½ inch Type 316 stainless steel body stay open eyewash valve.
9. Eye/face wash assembly with flip-top dust cover, internal flow control, and water filter.
10. ANSI compliant identification sign.
11. Provide with flow switch with contact closure wired to Plant PLC to alarm on flow to shower or eyewash.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions under which piping and equipment is to be installed. Do not proceed with installation until unsatisfactory conditions are corrected.

B. Prior to completing any work associated with connecting to existing sanitary piping systems the existing systems shall be flow tested and camera inspected.

1. Flow test shall consist of applying a continuous flow of 10-gpm to the most upstream sanitary fixture for a minimum duration of 30 minutes.
2. Testing shall be witnessed by Owner or Owner's representative, provide a minimum 5 working days notice prior to testing.
3. All video documentation shall be furnished to Owner on a portable USB drive.

3.02 GENERAL

A. All work to conform to state and local plumbing and backflow prevention codes.

B. Install fixtures and equipment in accordance with manufacturer's installation instructions.

C. Install pipe hangers, supports and anchors in accordance with local plumbing code and Section 40 05 07.

D. Install pipe insulation in accordance with Section 40 42 13.

E. Provide pipe identification in accordance with Section 10 14 10.

F. Install wall pipes, sleeves and seals in accordance with Section 40 05 09.

G. Install valves in accordance with Section 40 05 53.

3.03 PIPING INSTALLATION

A. General:

1. Press fitting piping systems shall be installed in accordance with manufacturer's installation instructions including use of manufacturer's recommended crimping device.
2. Install pipe, tube and fittings in accordance with recognized industry practices, local plumbing code and ANSI B31.9 - Building Service Piping.
3. Piping installations shall achieve permanently leakproof piping systems capable of performing each indicated service without piping failure.
4. Install each pipe run with minimum joints and couplings.
5. Provide unions at each valve and equipment connection unless equipment connection includes a flanged or grooved joint connection.
6. Reduce sizes, where indicated, by use of reducing fittings.

7. Align piping accurately at connections, within 1/16 inch misalignment tolerance.
8. Where equipment connections differ from pipe sizes indicated on Drawings, route piping full size as indicated on drawings to unit including isolation valve and provide reducer as required at point of connection.

B. Pipe Locations:

1. Locate piping runs, except otherwise indicated, vertically and horizontally (pitched to drain), and avoid diagonal runs wherever possible.
2. Orient horizontal runs parallel with walls, building column lines and other piping.
3. Locate runs, as shown or described by diagrams, plans, details and notations or, if not otherwise indicated, run piping in shortest route which does not obstruct usable space or block access for servicing building and equipment.
4. Hold piping close to walls, overhead construction, columns and other structural and permanent enclosure elements of building; limit clearance to 1/2 inch where furring is shown for enclosure for concealment of piping, but allow for insulation thickness, if any.
5. Where possible, locate insulated piping for 1.0 inch clearance outside insulation.
6. Wherever possible in finished and occupied spaces, conceal piping from view by locating in column enclosures, hollow wall construction or above suspended ceilings; do not encase horizontal runs in solid partitions, except as indicated.
7. Do not run piping through transformer vaults and other electrical or electronic equipment spaces and enclosures unless unavoidable or indicated to do so.
8. Install drip pan under piping that must be run through electrical spaces.

C. Piping System Joints:

1. Thread pipe in accordance with ANSI B2.1; cut threads full and clean using sharp dies. Ream threaded ends to remove burrs and restore full inside diameter. Apply pipe joint compound, or pipe joint tape (Teflon) where recommended by pipe/fitting manufacturer, on male threads at each joint and tighten joint to leave not more than 3 threads exposed.
2. Solder copper tube-and-fitting joints where indicated, in accordance with recognized industry practice. Cut tube ends squarely, ream to full inside diameter, and clean outside of tube ends and inside of tube fittings. Apply solder flux to joint areas of both tubes and fittings. Insert tube full depth into fitting, and solder in manner which will draw solder full depth and circumference of joint. Wipe excess solder from joint before it hardens.
3. Weld pipe joints in accordance with ANSI B31.
4. Hubless Cast-Iron Joints - Comply with CISPI 310.
5. Plastic Pipe/Tube Joints - Comply with manufacturer's instructions and recommendations, and with applicable industry standards, ANSI/ASTM D 2235, and ANSI/ASTM F 402.

D. Expansion Compensation:

1. Install piping including mains, branches, and runouts with sufficient offsets to allow for free expansion and contraction, sufficient to prevent leaks and overstressing of piping system.

3.04 FIXTURES

A. General:

1. Install in accordance with manufacturer's written installation instructions and with local plumbing codes.
2. Install plumbing fixtures of types indicated where shown and at indicated heights, in accordance with fixture manufacturer's written instructions, roughing-in drawings, and recognized industry practices. Ensure plumbing fixtures comply with requirements and serve intended purposes. Comply with applicable requirements of Plumbing Code pertaining to

installation of plumbing fixtures.

3. Verify locations and coordinate with architectural designs and other devices and equipment, as approved by Engineer before roughing-in connections.
4. Examine floors, substrates, and conditions under which fixture work to be accomplished.
5. Correct incorrect locations of piping and other unsatisfactory conditions for installation of plumbing fixtures.
6. Do not proceed with Work until unsatisfactory conditions corrected.
7. Operation of fixtures shall be tested for proper operation and adjusted for field connections and service use, as required.
8. Fasten plumbing fixtures securely to indicated supports or building structure level and plumb. Secure plumbing supplies behind or within wall construction to be rigid and not subject to pull or push movement.
9. Protect installed fixtures from damage during remainder of construction period.
10. Do not use new fixtures during construction unless approved in writing by Owner.
11. Upon completion of installation and after units are water pressurized, test fixtures to demonstrate capability and compliance with requirements. When possible, correct malfunctioning units at site, then retest to demonstrate compliance, or remove and replace with new units and proceed with retesting.
12. Inspect each installed unit for damage to finish. If feasible, restore and match finish to original at site, or remove fixture and replace with new unit. Feasibility and match to be judged by Engineer. Remove cracked or dented units and replace with new units.
13. Clean plumbing fixtures, trim, and strainers of dirt and debris upon completion of installation.

B. Rough-in Schedule:

Fixture	Hot Water (inch)	Cold Water (inch)	Waste (inch)	Vent (inch)
Emergency Eye Wash	-	½	1-1/4	1-1/4
Emergency Shower Head	-	1-1/4	-	-

3.05 EQUIPMENT

A. General:

1. Install in accordance with manufacturer's written installation instructions and with local plumbing codes.
2. Verify locations and coordinate with architectural designs and other devices and equipment, as approved by Engineer before roughing-in connections.
3. Operation of fixtures shall be tested for proper operation and adjusted for field connections and service use, as required.

3.06 VALVES

A. Install valves in accordance with manufacturer's written installation instructions and local plumbing code.

B. Sectional Valves - Install on each branch and riser, close to main, where branch or riser serves 2 or more plumbing fixtures or equipment connections, and elsewhere as indicated.

C. Shutoff Valves - Install on inlet of each piece of plumbing equipment, and on inlet of each plumbing fixture, and elsewhere as indicated.

D. Drain Valves - Install on each plumbing equipment item located to completely drain equipment for service or repair. Install at base of each riser, at base of each riser or drop in piping system, and elsewhere when indicated or required to completely drain domestic water piping system.

E. Pressure Reducing Valves – Install per Manufacturer's written installation instructions. Adjust pressure settings as indicated. Provide pressure gauge upstream and downstream of valve. Provide reducers as required to transition from line size indicated on Drawings to valve size selected by manufacture.

F. Pressure Reducing and Pressure Sustaining Valves – Install per manufacturer's written installation instructions. Adjust pressure settings as indicated.

G. Backflow Preventers:

1. Maintain minimum clearances for servicing and testing.
2. Provide indirect waste piping with air gap installation from relief opening to above hub drain or floor drain.
3. Provide initial registration, testing and report filing required by local plumbing code. List the name and address of the building that the backflow preventer installations occur in.

H. Pressure Reducing and Relief Valves – Install per Manufacturer's written installation instructions. Install pressure gauges upstream and downstream of reducing valves. Adjust pressure settings as indicated.

3.07 PIPE INSULATION

A. Insulate all TPW piping systems in their entirety.

B. Install pipe insulation in accordance with manufacturer's written installation instructions.

C. Insulation shall not be installed until testing and acceptance of piping systems has been completed.

D. Install insulation for each continuous run of piping with full-length units, do not use scraps or cut pieces abutting each other.

E. Install insulation on domestic hot, cold and horizontal storm water piping.

F. Cover valves, fittings and similar items in each piping system with equivalent thickness and composition of insulation, install factory molded or precut on job fabricated units.

3.08 CLEANING AND STERILIZATION

A. Clean and sterilize domestic water piping systems as required by health authorities having jurisdiction and in accordance with local plumbing code.

B. All water lines 3 inch and larger shall be disinfected, samples from two consecutive days must be taken to an approved lab, and the lab analysis reports must be submitted to the Development Services Department showing that the samples have passed the tests for two consecutive days per ANSI/AWWA C651-92, the AWWA Standard for Disinfecting Water Mains.

C. Plate count must be less than 10 spc/ml.

3.09 TESTING PIPING SYSTEMS

A. Test piping system in accordance with Section 40 05 10, local plumbing code, and as follows.

B. All testing shall be completed prior to concealment of piping in any form unless approved by local Plumbing Inspector in advance. Means of concealment includes but is not limited to: pipe burial, installation of insulating systems, and enclosure in a wall.

C. All testing shall be witnessed by local Plumbing Inspector unless Inspector has waived testing requirements. If testing requirements waived by local Inspector, testing shall be witnessed by Owner or Owner' representative. Contractor shall provide no less than 5 working days notice prior to testing.

D. Sanitary drain and vent and storm water piping shall be tested by tightly plugging all openings and filling piping system with a minimum ten foot deep column of water. Piping system shall maintain liquid level in the column without any refilling for a minimum duration of 15 minutes.

E. Water piping systems shall be tested:

1. At a minimum pressure of 80-psig downstream of building regulating valve or for the entire system where no building regulating valve installed.
2. At a minimum pressure of 125-psig upstream of building regulating valve.
3. Test shall be held for a duration as required to visibly inspect all joints, but no less than 15 minutes with no visible leakage on any pipe or joint.
4. Testing fluid shall be potable water.

F. If testing is unsuccessful, complete corrective actions and retest until systems pass.

G. Submit documentation of testing and witnessing of all successful pipe testing in the form of a pipe test report. Documentation shall include at a minimum:

1. Date of test.
2. Description of tested system.
3. Test Pressure.
4. Name of testing witness.
5. Initials of testing witness.

3.10 FIELD QUALITY CONTROL

A. Manufacturer's Field Services:

1. Supplier's or manufacturer's representative for equipment specified herein shall be present at jobsite or classroom designated by Owner for workdays indicated, travel time excluded, for assistance during plant construction, plant startup, and training of Owner's personnel for plant operation. Include:

a. 1/2 workday for Installation Services.
b. 1/2 workday for Instructional Services.
c. 1/2 workday for Post Startup Services

2. Supplier or manufacturer shall direct services to system and equipment operation, maintenance, troubleshooting, and equipment and system-related areas other than wastewater treatment process. See Section 01 61 00.
3. In addition to the services specified above, provide manufacturer's services as required to successfully complete systems demonstration as specified in Section 01 79 10.

END OF SECTION

DIVISION 26

ELECTRICAL

SECTION 26 05 19
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Building wires and cables and associated splices, connectors, and terminations for wiring systems rated 600 volts and less.

1.02 DEFINITIONS

A. Underfloor Conduits.

1. Conduits run underground within perimeter of building walls under building floor. This may consist of 1 conduit, or several conduits grouped together.

B. Duct Bank Conduits

1. Conduits run underground outside perimeter of building walls. This may consist of 1 conduit, or several conduits grouped together.

C. Underground Conduits

1. Underground conduits are both underfloor conduits and duct bank conduits.

1.03 SUBMITTALS

A. Submittals are not required if Contractor supplies materials or equipment as specified. If Contractor proposes substitutions to material or equipment submittals identified below are required.

1. Product data.
2. Submit in accordance with Section 01 33 00.

1.04 QUALITY ASSURANCE

A. Items provided under this Section shall be listed or labeled by Underwriters Laboratories, Inc. (UL) or other Nationally Recognized Testing Laboratory (NRTL).

1. Term "NRTL" shall be as defined in Occupational Safety and Health Administration (OSHA) Regulation 1910.7.
2. Terms "listed" and "labeled" shall be as defined in National Electrical Code, Article 100.

B. Regulatory Requirements:

1. National Electrical Code (NEC): Components and installation shall comply with National Fire Protection Association (NFPA) 70.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver wire and cable according to National Electrical Manufacturers Association (NEMA) WC 26.

PART 2 – PRODUCTS

2.01 BUILDING WIRES AND CABLES

A. UL-listed building wires and cables with conductor material, insulation type, cable construction, and rating as required to meet application and NEC requirements.

B. Wire and cable for 600 volts and below: Soft drawn, copper wire with 600 volt insulation.

1. Conductors:

a. Annealed copper in accordance with American Society for Testing and Materials (ASTM) B3.
b. Stranding: Class B in accordance with ASTM B8.

2. Insulations and Coverings:

a. Conform to NEMA WC 70

C. 480V feeders, branch circuits, service conductors, motor conductors, duct bank conduits: Single conductor Type XHHW-2.

D. Panel Board Branch Circuits 240V and Below:

1. Single Conductor Type THHN/THWN (90 degrees Celsius): Above ground and underfloor conduits.
2. Single Conductor Type XHHW-2: Duct bank conduit.
3. 12 American Wire Gauge (AWG) minimum size (unless otherwise noted) for branch circuit wiring, including motor circuits.
4. Size 120 volt branch circuits for length of run on following basis.

a. 0 to 50 feet Run From Panelboard to first outlet/equipment: 12 AWG minimum.
b. 51 to 100 feet Run: Increase one wire size, i.e., 12 AWG becomes 10 AWG.
c. 101 to 150 feet Run: Increase two wire sizes, i.e., 12 AWG becomes 8 AWG.
d. 151 feet and above: Wiring sized for 3% maximum voltage drop.

5. For other branch circuits, voltage drop for branch circuits and feeder circuit combined shall not exceed requirements of the NEC 215.

E. Control Circuits:

1. Single Conductor Type THHN/THWN (90 degrees Celsius): Above ground and underfloor conduits.
2. 14 AWG minimum size (unless otherwise noted).
3. Multi-wire cable assembly: Duct bank conduits.

F. Non-shielded Instrumentation, Graphic Indication, and Other Control Wiring Operating at Less Than 120 volt: 14 AWG except as otherwise indicated with same insulation as control circuits.

1. Single conductor Type THHW/THWN (90 degrees Celsius), above ground and underfloor conduits.
2. Multi-wire cable assembly: Duct bank conduits.

G. Shielded instrumentation and Resistance Temperature Detector (RTD) wiring, above ground and underfloor conduits:

1. Polyvinyl Chloride (PVC) insulation, tinned copper (19 by 29) stranded, 16 AWG, twisted pair or triplet cabled with aluminum mylar shielding, stranded, tinned, 18 AWG copper drain wire, and overall black FR-PVC, 90 degrees C, 600 volt jacket.
2. Multi-wire cable assembly: duct bank conduits.

H. Multi-Wire Control and Instrumentation Cable Assemblies:

1. Multi-conductor, color-coded cable with number and size of conductors indicated.
2. Where spare conductors are not indicated provide 10% spare conductors. One pair minimum.
3. Control and non-shielded instrumentation.

a. Bare soft stranded 14 or 12 AWG copper in accordance with ASTM B3.
b. Class B stranded in accordance with ASTM B8.
c. Type XLPE insulation also meeting requirements of NEMA WC-57.
d. Color coded in accordance with ICEA Method 1, Table E-2.
e. Cabled with suitable fillers.
f. Overall black FR-PVC, 90 degrees Celsius, 600 volt sunlight resistant jacket.

4. Shielded Instrumentation:

a. Bare soft stranded 16 AWG copper in accordance with ASTM B3.
b. Class B stranded copper in accordance with ASTM B8.
c. PVC with nylon armor insulation.
d. Twisted pairs color coded in accordance with ICEA Method 1, Table E-2, and numbered.
e. Individual and overall aluminum mylar shields and seven strand tinned copper drain wires.
f. Overall black FR-PVC 90 degrees C 600 volt sunlight resistant jacket.

2.02 CONNECTORS AND SPLICES

A. UL-listed factory-fabricated wiring connectors of size, ampacity rating, material, and type and class for application and for service indicated.

B. Select to comply with Project's installation requirements and as required to meet application.

C. Conductors 10 AWG and Smaller: 3M Electric Products, Skotchlok, or equal pre insulated spring connector. Comply with manufacturer's packaging requirements for number, size, and combination of conductors.

D. Conductors 8 AWG and Larger: Bronze 2-bolt type connectors with spacer.

E. Splices: Burndy Or Equal.

2.03 TERMINATIONS

A. Power Conductors: Compression crimp type or mechanical lugs.

B. Control and Instrumentation Conductors: Compression crimp type fork tongue, insulated support type lugs on terminal strips. Do not splice.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install wires and cables as indicated, according to manufacturer's written instructions and

National Electrical Contractors Association (NECA) "Standard of Installation".

B. Remove existing wire from raceway before pulling in new wire and cable.

C. Run wire and cable in conduit unless otherwise indicated on Drawings. Pull conductors into raceway simultaneously where more than 1 is being installed in same raceway.

1. Use pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation.
2. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage cables or raceway.
3. Do not draw conductor into conduits until building is enclosed, watertight, and work causing cable damage has been completed.

D. Install cable supports for vertical feeders in accordance with NEC. Provide split wedge type which firmly clamps each individual cable and tightens due to cable weight.

E. For panelboards, cabinets, wireways, switches, and equipment assemblies, neatly form, train, and tie cables in individual circuits.

F. Seal cable and wire entering building from underground between wire and conduit, where cable exits conduit, with non-hardening approved compound.

G. Install wire and cables in separate raceway systems as follows:

1. ac Control.
2. dc control.
3. Shielded instrumentation.
4. Network Cables.
5. Fiber Optic Cables.
6. As required by NEC.

H. Where control or instrumentation cables are run in underground //and/or outdoor// conduit and ducts provide multi-wire cable assemblies.

I. Where power cables, instrument/signal cables, and intrinsically safe cables enter and pass through same distribution box, steel barrier or separate raceways shall continue through box to isolate the cables from each other to avoid magnetic and physical interaction between power cables, instrumentation cables, and intrinsically safe cables.

J. Do not run instrumentation cables into control cabinets or Motor Control Center (MCC) unless cables are terminated in cabinet or MCC.

K. Drawings do not designate number of conductors in conduit nor does location of branch circuits and switch legs indicated on Drawings designate location or routing. Route branch circuits and switch legs as dictated by construction and these Specifications.

3.02 TERMINATIONS AND SPLICES

A. Terminate control, instrumentation, and communication cables on terminal strips in separate terminal cabinets located near conduit entrances of buildings or as shown on Drawings.

B. Power Cable Splices (no splices in cables unless approved by Engineer):

1. Provide continuous lengths of cable without splices in motor circuits and feeders unless otherwise noted. Splices may be installed in motor circuits and feeders with prior approval by

Engineer.

2. Install splices and taps that possess equivalent or better mechanical strength and insulation ratings than conductors being spliced.
3. Use splice and tap connectors that are compatible with conductor material.
4. Where pre-insulated spring connectors are used for equipment connections, tape connector to wire to prevent loosening under vibration.
5. Each tap, joint or splice in conductors 8 AWG and larger shall be taped with two half-lap layers of vinyl plastic electrical tape and finish wrap of color coding tape where required by code.
6. Cable splices shall be made only in manholes, handholes, wireways, distribution boxes, and junction boxes.

C. Power Cable Terminations:

1. Termination of wires with full compression type or mechanical lugs installed with appropriate hand or hydraulic tool. Use proper dies to achieve the desired compression.
2. For screw type terminal blocks, terminations for stranded conductors shall be made with T & B lock-on fork connector with insulated sleeves.
3. Motor lead conductor terminations shall be made with a T & B or approved equal, full compression lug, full ring type, bolted, and taped as required. For connecting motor lead to service wiring fasten full ring lugs together with cadmium plated steel cap screws, and cover with a minimum of 2 layers 1/2 lap, 3M Scotch No. 33 tape; option: T & B "Motor Stub Splice Insulator".

3.03 CONTROL CIRCUITS

A. Control circuit home runs from same area for the same system returning to same panel, (e.g., Local Controls Panel (LCP), Control Station (CS), etc.,) may be combined provided signal and voltage types are not mixed.

B. Following types of home runs shall not be combined with other types:

1. 4-20 milliamp direct current analog; Type 2 shielded cable.
2. 24 volts direct current discrete (e.g., field or LCP powered dry contacts).

3.04 BRANCH CIRCUITS

A. Motor branch circuits and branch circuits for 3 phase circuits shall not be combined.

B. Branch circuits for single phase equipment devices from same Lighting Panel (LP) or Power Panel (PP) may be combined provided that such combining does not result in having to derate ampacity of conductors.

3.05 FEEDERS:

A. Extend feeders at full capacity from origin to termination.

B. Each conduit raceway shall contain only those conductors constituting single feeder circuit unless otherwise indicated.

C. Where multiple raceways are used for single feeder, each raceway shall contain conductor of each phase and neutral if used.

D. Where feeder conductors are run in parallel, conductors shall be of same length, material, circular-mil area, insulation type, and terminated in same manner.

E. Where parallel feeder conductors run in separate raceways, raceways shall have same physical characteristics.

F. Confine feeders to insulated portions of building unless otherwise shown.

G. On network systems, neutral shall be run with phase wires. Unbalanced neutral current shall not exceed normal or derated conductor capacity.

3.06 MOTORS AND EQUIPMENT WIRING

A. Provide motor circuits in accordance with diagrams and schedules on Drawings and code requirements, from source of supply to associated motor starter and starter to motor terminal box, including necessary and required intermediate connections.

B. Do not include associated control conductors in same conduit with power conductors, unless otherwise indicated.

C. Provide branch circuits to conform with NEC requirements and nameplate ratings. Contractor responsible for verification of ratings of motors and installing proper branch circuits.

3.07 COLOR CODING

A. Conductors for Lighting and Power Wiring:

Phase	208/120 volts	480/277 volts
A	Black	Brown
B	Red	Orange
C	Blue	Yellow
Travelers	Pink	Purple
Neutral	White	White with non-green stripe
Ground	Green	Green

B. Colored pressure-sensitive plastic tape.

1. Apply in half overlapping turns for minimum of three inches at terminal points, and in junction boxes, pull boxes, troughs, manholes, and handholes.
2. 3/4 inch wide with colors as specified.
3. Apply last two laps of tape with no tension to prevent possible unwinding.
4. Where cable markings are covered by tape, apply tags to cable stating size and insulation type.

C. For modifications and additions to existing wiring systems, color coding shall conform to existing wiring system.

D. Color code for insulated power system wiring shall be in accordance with NEC.

E. Color code for intrinsically safe systems shall be light blue.

3.08 CONTROL, COMMUNICATION AND SIGNAL SYSTEM IDENTIFICATION

A. Install permanent wire marker at termination.

B. Identifying numbers and letters on wire markers shall correspond to those on terminal blocks or

wiring diagrams used for installing systems.

C. Plastic sleeve or self adhesive vinyl cloth.

D. Comply with Section 10 14 10.

3.09 FEEDER IDENTIFICATION

A. Manholes, handholes, pullboxes, and junction boxes, install metal tags on circuit cables and wires to clearly designate circuit identification and voltage.

B. Provide tags of embossed brass type, in manholes and handholes showing cable type and voltage rating. Attach tags to cables with slip-free plastic cable lacing units.

C. Comply with Section 10 14 10.

3.10 FIELD QUALITY CONTROL

A. Visual and Mechanical Inspection:

1. Inspect cables for physical damage and proper connection in accordance with single-line diagram.
2. Test cable mechanical connections to manufacturer's recommended values using calibrated torque wrench.
3. Check cable color coding with specifications and NEC standards.

B. Electrical Tests:

1. Perform insulation-resistance test on each conductor with respect to ground and adjacent conductors. Applied potential shall be 1000 volts direct current for 1 minute.
2. Perform continuity test to insure proper cable connection.
3. Perform tests on the following conductors:

    a. Motor feeders 30HP and greater.

C. Test Values:

1. Evaluation results by comparison with cables of same length and type. Investigate any value less than 50 megohms.
2. Submit reports summarizing the results of the testing.

END OF SECTION

SECTION 26 05 26
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Grounding of electrical systems and equipment and basic requirements for grounding for protection of life, equipment, circuits, and systems.
2. Grounding requirements specified in this Section may be supplemented in other Sections of these Specifications.

1.02 SUBMITTALS

A. Report of Field Tests and Observations: Certified by Contractor.

B. Test Results:

1. Certified field tests and observation reports indicating and interpreting test reports for compliance with performance requirements.

C. Submit in accordance with Section 01 33 00.

1.03 QUALITY ASSURANCE

A. Comply with Underwriters Laboratories, Inc (UL) 467.

B. Items provided under this section shall be listed or labeled by UL or other Nationally Recognized Testing Laboratory (NRTL).

1. Term "NRTL" shall be as defined in Occupational Safety and Health Administration (OSHA) Regulation 1910.7.
2. Terms "listed" and "labeled" shall be as defined in National Electrical Code (NEC), Article 100.

C. Regulatory Requirements:

1. NEC: Components and installation shall comply with National Fire Protection Association (NFPA) 70.

PART 2 – PRODUCTS

2.01 GROUNDING AND BONDING PRODUCTS

A. Governing Requirements: Where types, sizes, ratings, and quantities indicated are in excess of NEC requirements, more stringent requirements and greater size, rating, and quantity indications govern.

2.02 WIRE AND CABLE GROUNDING CONDUCTORS

A. Conform to NEC Table 8, except as otherwise indicated, for conductor properties, including stranding.

1. Material: Copper.

B. Equipment Grounding Conductors: Insulated with green color insulation.

PART 3 – EXECUTION

3.01 APPLICATION

A. Equipment Grounding Conductors: Comply with NEC Article 250 for types, sizes, and quantities of equipment grounding conductors, except where specific types, larger sizes, or more conductors than required by NEC are indicated.

1. Install equipment grounding conductor with circuit conductors for items below in addition to those required by Code:

a. Feeders and branch circuits.
b. Lighting circuits.
c. Receptacle circuits.
d. Single-phase motor or appliance branch circuits.
e. Three-phase motor or appliance branch circuits.
f. Flexible raceway runs.
g. Armored and metal-clad cable runs.

B. Signal and Communication Systems: For telephone, alarm, voice and data, and other communication systems, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding-electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.

1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on 1/4 by 2 by 12 inches (6 by 50 by 300 millimeter) grounding bus.
2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

C. Separately Derived Systems: Where NEC requires grounding, ground according to NEC Paragraph 250-30.

3.02 INSTALLATION

A. Ground electrical systems and equipment according to NEC requirements, except where Drawings or Specifications exceed NEC requirements.

3.03 CONNECTIONS

A. Equipment Grounding-Wire Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.

END OF SECTION

SECTION 26 05 29
HANGERS AND SUPPORTING FOR ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Supports from building structure for electrical items by means of hangers, supports, anchors, sleeves, inserts, seals, and associated fastenings.

1.02 QUALITY ASSURANCE

A. Items provided under this section shall be listed and labeled by Underwriters Laboratories, Inc. (UL) or other Nationally Recognized Testing laboratory (NRTL).

1. Term "NRTL" shall be as defined in Occupational Safety and Health Administration (OSHA) Regulation 1910.7.
2. Terms "listed" and "labeled" shall be as defined in National Electrical Code (NEC), Article 100.

B. Regulatory requirements:

1. NEC: Components and installation shall comply with National Fire Protection Association (NFPA) 70.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Refer to Space Environment and Hazardous Ratings Schedule on Drawings for determination of the Exposure type of each space in which hangers and supports are to be installed. Refer to Material Schedule on Drawings for material type to be utilized within each Exposure type.

B. As otherwise indicated and as required by NEC.

C. Provide dissimilar metal separation where metallic conduit materials differ from metallic hangers and supports materials.

2.02 MANUFACTURED SUPPORTING DEVICES

A. Raceway Supports: Clevis hangers, riser clamps, conduit straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring steel clamps.

B. Fasteners: Types, materials, and construction features as follows:

1. Expansion Anchors: Stainless steel wedge or sleeve type.
2. Toggle Bolts: All stainless steel springhead type.
3. Powder-Driven Threaded Studs: Heat-treated stainless steel, designed specifically for intended service.
4. Nuts, Washers, and Bolts: Stainless steel.

C. Cable Supports for Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug for nonarmored electrical cables in riser conduits. Provide plugs with number and size of conductor gripping holes as required to suit individual risers.

D. U-Channel Systems: Channels, with 9/16-inch diameter holes, at minimum of 8 inch on center, in top surface. Provide fittings and accessories that mate and match with U-channel and are of same manufacture.

2.03 FABRICATED SUPPORTING DEVICES

A. Shop- or field-fabricate supports or manufacture supports assembled from U-channel components.

B. Brackets: Fabricated of angles, channels, and other standard structural shapes. Connect with welds and machine bolts to form rigid supports. Comply with Section 05 50 00.

C. Pipe Sleeves: Provide pipe sleeves of one of following:

1. Sheet Metal: Fabricate from galvanized sheet metal; round tube closed with snaplock joint, welded spiral seams, or welded longitudinal joint. Fabricate sleeves from following gage metal for sleeve diameter noted:

a. 3 inch and smaller: 20 gauge.
b. 4 inch to 6 inch: 16 gauge.
c. Over 6 inch: 14 gauge.

2. Steel Pipe: Fabricate from Schedule 40 galvanized steel pipe.
3. Plastic Pipe: Fabricate from Schedule 80 PVC plastic pipe.

2.04 FIRE RESISTANT JOINT SEALERS

A. Manufacturers:

1. "Dow Corning Fire Stop Foam," Dow Corning Corp.
2. "Pensil 851," General Electric Co.
3. Or equal.

B. Two-part, foamed-in-place, silicone sealant formulated for use in through-penetration fire-stopping around cables, conduit, pipes, and duct penetrations through fire-rated walls and floors.

C. Sealants and accessories shall have fire-resistance ratings indicated, as established by testing identical assemblies in accordance with American Society for Testing and Materials (ASTM) E 814, by Underwriters' Laboratories, Inc., or other testing and inspection agency acceptable to authorities having jurisdiction.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install supporting devices to fasten electrical components securely and permanently in accordance with NEC requirements.

B. Coordinate with structural system and with other electrical installation. Coordinate with light fixtures to ensure hangers and supports are not mounted lower or below light fixtures causing shadows.

C. Raceway Supports: Comply with NEC and following requirements:

1. Conform to manufacturer's recommendations for selection and installation of supports.

2. Strength of each support shall be adequate to carry present and future load multiplied by safety factor of at least four. Where this determination results in safety allowance of less than 200 pounds, provide additional strength until there is minimum of 200 pounds safety allowance in strength of each support.
3. Install individual and multiple (trapeze) raceway hangers and riser clamps as necessary to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assembly and for securing hanger rods and conduits.
4. Support parallel runs of horizontal raceways together on trapeze-type hangers.
5. Support individual horizontal raceways by separate pipe hangers. Spring steel fasteners may be used in lieu of hangers only for 1 inch and smaller raceways serving lighting and receptacle branch circuits above suspended ceilings only. For hanger rods with spring steel fasteners, use 1/4 inch diameter or larger threaded steel. Use spring steel fasteners that are specifically designed for supporting single conduits or tubing.
6. In vertical runs, arrange support so load produced by weight of raceway and enclosed conductors is carried entirely by conduit supports with no weight load on raceway terminals.

D. Vertical Conductor Supports: Install simultaneously with installation of conductors.

E. Miscellaneous Supports: Support miscellaneous electrical components as required to produce same structural safety factors as specified for raceway supports. Install metal channel racks for mounting cabinets, panelboards, disconnects, control enclosures, pull boxes, junction boxes, transformers, and other devices.

F. Sleeves: Install in walls and other fire-rated floors and walls for raceways and cable installations. For sleeves through fire rated-wall or floor construction, apply UL listed firestopping sealant in gaps between sleeves and enclosed conduits and cables.

1. Provide 14 gauge minimum copper box complete with watertight soldered seams and flanged to serve as pitch pocket for each conduit.
2. Install conduit and pitch pocket in advance of roofing work.

G. Fastening: Unless otherwise indicated, fasten electrical items and their supporting hardware securely to building structure, including but not limited to conduits, raceways, cables, cable trays, busways, cabinets, panelboards, transformers, boxes, disconnect switches, and control components in accordance with following:

1. Fasten by means of wood screws or screw-type nails on wood, toggle bolts on hollow masonry units, concrete inserts or expansion bolts on concrete or solid masonry, and machine screws, welded threaded studs, or spring-tension clamps on steel. Threaded studs driven by powder charge and provided with lock washers and nuts may be used instead of expansion bolts and machine or wood screws. Do not weld conduit, pipe straps, or items other than threaded studs to steel structures. In partitions of light steel construction, use sheet metal screws.
2. Holes cut in concrete shall not cut main reinforcing bars. Fill holes that are not used.
3. Load applied to any fastener shall not exceed 25% of proof test load. Use vibration- and shock- resistant fasteners for attachments to concrete slabs.

END OF SECTION

SECTION 26 05 33.13
CABINETS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Outlet and device boxes.
2. Pull and junction boxes.
3. Cabinets.
4. Hinged door enclosures.

B. Conduit-body-type electrical enclosures and wiring fittings are specified in Section 26 05 33.16.

1.02 DEFINITIONS

A. Cabinets: Enclosure designed either for surface or for flush mounting and having frame, or trim in which door or doors may be mounted.

B. Device Box: Outlet box designed to house receptacle device or wiring box designed to house switch.

C. Enclosure: Box, case, cabinet, or housing for electrical wiring or components.

D. Hinged Door Enclosure: Enclosure designed for surface mounting and having swinging doors or covers secured directly to and telescoping with walls of box.

E. Outlet Box: Wiring enclosure where current is taken from wiring system to supply utilization equipment.

F. Wiring Box: Enclosure designed to provide access to wiring systems or for mounting of indicating devices or of switches for controlling electrical circuits.

1.03 SUBMITTALS

A. Product Data: Submit for cabinets and enclosures with classification higher than National Electrical Manufacturers Association (NEMA) 1.

B. Submit in accordance with Section 01 33 00.

1.04 QUALITY ASSURANCE

A. Items provided under this section shall be listed or labeled by Underwriters Laboratories, Inc. (UL) or other Nationally Recognized Testing Laboratory (NRTL).

1. Term "NRTL" shall be as defined in Occupational Safety and Health Administration (OSHA) Regulation 1910.7.
2. Terms "listed" and "labeled" shall be as defined in National Electrical Code (NEC), Article 100.

B. Regulatory Requirements:

1. NEC: Components and installation shall comply with National Fire Protection Association (NFPA 70).

PART 2 – PRODUCTS

2.01 CABINETS, BOXES, AND FITTINGS, GENERAL

A. Electrical Cabinets, Boxes, and Fittings: Of indicated types, sizes, and NEMA enclosure classes. Where not indicated, provide units of types, sizes, and classes appropriate for use and location. Provide items complete with covers and accessories required for intended use. Provide gaskets for units in damp or wet locations.

2.02 MISCELLANEOUS MATERIALS AND FINISHES

A. Fasteners for General Use: Corrosion resistant screws and hardware including cadmium and zinc plated items.

B. Fasteners for Exterior or Wet Locations: Stainless steel screws and hardware.

C. Fittings for Boxes, Cabinets, and Enclosures: Conform to UL 514B. Malleable iron or zinc plated steel for conduit hubs, bushings and box connectors.

D. Finishes:

1. Exterior Finish: Galvanized or Gray baked enamel for items exposed in finished locations except as otherwise indicated.
2. Interior Finish: Where indicated, white baked enamel.

E. Fastener style:

1. Stainless steel door clamp assembly (Hoffman SSLP (SS6LP for 316 SS) series, Wiegmann SSN4 series or equal) for stainless steel boxes. Screw-down clamps are not acceptable.
2. Snap-hinge covers or quarter turn semi-flush oil tight latch for non-metallic boxes.
3. External quick-release or quarter turn semi-flush oil tight latch latches for galvanized boxes.
4. Spring loaded, stainless steel, triple-thread, captive hex-head bolts for cast metal boxes.

2.03 METAL OUTLET, DEVICE, AND SMALL WIRING BOXES

A. General:

1. Conform to UL 514A and UL 514B.
2. Boxes shall be of type, shape, size, and depth to suit each location and application.

B. Steel Boxes: Conform to NEMA OS 1. Boxes shall be sheet steel with stamped knockouts, threaded screw holes and accessories suitable for each location including mounting brackets and straps, cable clamps, exterior rings and fixture studs.

C. Galvanized Cast-Iron Boxes: Iron alloy, waterproof, with threaded raceway entries and features and accessories suitable for each location, including mounting ears, threaded screw holes for devices and closure plugs.

2.04 PULL AND JUNCTION BOXES

A. General: Comply with UL 50 for boxes over 100 cubic inch volume. Unless otherwise noted, boxes shall have continuous hinge on one side with fastening mechanism on the opposite side. Cover shall be of material same as box and shall be of size and shape to suit application.

B. Galvanized Steel Boxes: Flat rolled, code gauge, sheet steel with welded seams. Where necessary to provide rigid assembly, construct with internal structural steel bracing. Hot-dip galvanized after fabrication. Cover shall be gasketed.

C. Stainless-Steel Boxes: Fabricate of stainless steel conforming to Type 316 of American Society for Testing and Materials (ASTM) A167. Where necessary to provide rigid assembly, construct with internal structural stainless steel bracing. Cover shall be gasketed.

D. Galvanized Cast-Iron Boxes: Molded of cast iron alloy with gasketed cover and integral threaded conduit entrances.

E. Boxes Approved for Classified Locations: Cast metal or cast nonmetallic boxes conforming to UL 886 listed and labeled for use in specific location, classification, and with specific hazardous material encountered. Conduit entrances shall be integral threaded type. When located outdoors or in wet locations provide O-ring/gasket or equivalent making box suitable for outdoor use.

F. Cast Nonmetallic Boxes: Indoor and outdoor rated, corrosion resistant, nonconductive, high impact-fiberglass reinforced polyester (RFP) boxes with gasketed cover and integral mounting flanges.

G. Cast Nonmetallic Boxes: Ultra-violet stabilized, nonconductive, high impact-resistant Polyvinyl Chloride (PVC) boxes with gasketed cover and integral mounting flanges.

2.05 CABINETS

A. Comply with UL 50.

B. Construction: Flat rolled, code gauge, galvanized, sheet steel, NEMA 1 class except as otherwise indicated. Cabinet shall consist of box and front consisting of 1 piece frame and hinged door. Arrange door to close against rabbet placed around inside edge of frame, with uniformly close fit between door and frame. Provide concealed fasteners, not over 24 inch apart, to hold fronts to cabinet boxes and provide for adjustment. Provide flush or concealed door hinges not over 24 inch apart and not over 6 inch from top and bottom of door. For flush cabinets, make front approximately 3/4 inch larger in each dimension. For surface mounted cabinets make front same height and width as box.

C. Doors: Double doors for cabinets wider than 24 inch Telephone cabinets wider than 48 inch may have sliding or removable doors.

D. Locks: Combination spring catch and key lock, with each lock for cabinets of same system keyed alike. Locks may be omitted on signal, power, and lighting cabinets located within wire closets and mechanical-electrical rooms. Locks shall be of type to permit doors to latch closed without locking.

2.06 STEEL ENCLOSURES WITH HINGED DOORS

A. Comply with UL 50 and NEMA ICS 6.

B. Construction:

1. Sheet steel, 16 gauge, minimum, with continuous welded seams. NEMA class as indicated; arranged for surface mounting.
2. Stainless steel.

C. Doors: Hinged directly to cabinet and removable, with approximately 3/4 inch flange around

each edge, shaped to cover edge of box. Provide handle operated, key locking latch. Individual door width shall be no greater than 24 inch. Provide multiple doors where required.

D. Mounting Panel: Provide painted removable internal mounting panel for component installation.

E. Enclosure: NEMA 12 except as otherwise indicated. Where door gasketing is required, provide neoprene gasket attached with oil-resistant adhesive, and held in place with steel retaining strips. For enclosures of class higher than NEMA 1, use hubbed raceway entrances.

2.07 CAST METAL ENCLOSURES WITH HINGED DOORS

A. Copper free aluminum with bolted, hinged doors. Where used at hazardous (classified) locations, enclosures shall conform to UL and shall be listed and labeled for location and classification of hazard involved. When located outdoors or in wet locations provide O-ring/gasket or equivalent making box suitable for outdoor use.

2.08 MOLDED NONMETALLIC ENCLOSURES WITH HINGED DOOR

A. Molded, glass fiber reinforced high impact strength polyester with bolt or screw secured doors and solid neoprene gaskets.

2.09 TERMINAL STRIPS

A. Manufacturers:

1. Square D.
2. Buchanan.
3. Or equal.

B. Channel mount snap-on type.

C. Individual gangable with nylon bases.

D. Solderless box lug type rated at 600 volts to accommodate No. 22 to 8 American Wire Gauge (AWG) wire or as otherwise indicated.

E. Provide 50% spare terminals.

PART 3 – EXECUTION

3.01 INSTALLATION, GENERAL

A. Locations: Install items where indicated and where required to suit code requirements and installation conditions.

B. Cap unused knockout holes where blanks have been removed and plug unused conduit hubs.

C. Support and fasten items in accordance with Section 26 05 29.

D. Sizes shall be adequate to meet NEC volume requirements, but in no case smaller than sizes indicated.

E. Remove sharp edges where they may come in contact with wiring or personnel.

3.02 APPLICATIONS

A. Cabinets: Flush mounted, NEMA Type 1 enclosure except as otherwise indicated.

B. Hinged Door Enclosures:

1. Refer to Space Environment and Hazardous Ratings Schedule on Drawings for determination of the Exposure type of each space in which hinged door enclosure is to be installed. Refer to Material Schedule on Drawings for material and NEMA enclosure type to be utilized within each Exposure type.
2. As otherwise indicated and as required by NEC.

C. Outlet Boxes and Fittings: Install outlet and device boxes and associated covers and fittings of materials and NEMA types for each location in conformance with following requirements unless otherwise noted:

1. Refer to Space Environment and Hazardous Ratings Schedule on Drawings for determination of the Exposure type of each space in which box is to be installed. Refer to Material Schedule on Drawings for material and NEMA enclosure type to be utilized within each Exposure type.
2. Metal Door Jambs: Narrow partition boxes with internal ears.
3. As otherwise indicated and as required by NEC.

D. Pull and Junction Boxes: Install pull and junction boxes of materials and NEMA types for each location in conformance with following requirements unless otherwise noted:

1. Refer to Space Environment and Hazardous Ratings Schedule on Drawings for determination of the Exposure type of each space in which box is to be installed. Refer to Material Schedule on Drawings for material and NEMA enclosure type to be utilized within each Exposure type.
2. As otherwise indicated and as required by NEC

3.03 INSTALLATION OF OUTLET BOXES

A. Outlets at Windows and Doors: Locate close to window or door trim.

B. Column and Pilaster Locations: Locate outlet boxes for switches and receptacles on columns or pilasters so centers of columns are clear for future installation of partitions.

C. Locations in Special Finish Materials: For outlet boxes for receptacles and switches mounted in desks or furniture cabinets or in glazed tile, concrete block, marble, brick, stone or wood walls, use rectangular shaped boxes with square corners and straight sides. Install boxes without plaster rings. Saw cut recesses for outlet boxes in exposed masonry walls.

D. Gasketed Boxes: At following locations use cast metal, threaded hub type boxes with gasketed weatherproof covers:

1. Exterior locations.
2. Where surface mounted on unfinished walls, columns or pilasters. (Cover gaskets may be omitted in dry locations).
3. Where exposed to moisture laden atmosphere.
4. Where indicated.

E. Mounting: Mount outlet boxes for switches with long axis vertical or as indicated. Mount boxes for receptacles vertically. Gang boxes shall be mounted with long axis horizontal. Locate box covers or device plates so they will not span different types of building finishes either vertically or horizontally. Locate boxes for switches near doors on side opposite hinges and close to door trim, even though electrical floor plans may show them on hinge side.

F. Ceiling Outlets: For fixtures, where wiring is concealed, use outlet boxes 4 inch sq by 1-1/2 inch deep, minimum with raised plaster or tile cover. Provide 3/8 inch fixture stud.

G. Cover Plates for Surface Boxes: Use plates sized to box front without overlap.

H. Protect outlet boxes to prevent entrance of plaster, and debris. Thoroughly clean foreign material from boxes before conductors are installed.

I. Concrete Boxes: Use extra deep boxes to permit side conduit entrance without interfering with reinforcing, but do not use such boxes with over 6 inch depth.

J. Secure boxes rigidly to substrate upon which being mounted or solidly embed boxes in concrete or masonry. Do not support from conduit, mechanical ductwork or piping.

K. Set boxes in concealed conduit runs, flush with wall surfaces, with or without covers as required.

L. Do not install boxes back to back or through wall. Offset outlet boxes on opposite sides of wall minimum 12 inch

M. Set outlet boxes parallel to construction, securely mounted and adjusted to set true and flush with finished surface.

N. Do not burn holes, use knockout punches or saw.

O. Use handy boxes only where specifically indicated.

P. Provide outlet box divider barriers between 277/480 volt and 120/240 volt devices as required per NEC.

Q. Where emergency switches occur adjacent to normal light switches, install in separate boxes in accordance with NEC and device plate color coding separation.

R. Existing Outlet Boxes: Where extension rings are required to be installed, drill new mounting holes in rings to align with mounting holes on existing boxes where existing holes are not aligned.

3.04 OUTLET BOX LOCATIONS

A. Locate flush mounted wall boxes in corner of nearest brick or block to keep cutting to minimum.

B. Location of outlets and equipment as shown on Drawings is approximate and exact location to be verified and shall be determined by:

1. Construction or code requirements.
2. Conflict with equipment or other trades.
3. Equipment manufacturer's drawings.

C. Minor modification in location of outlets and equipment considered incidental up to distance of 10 feet with no additional compensation, provided necessary instructions given prior to roughing in of outlet.

D. Mounting heights for devices and equipment to be measured from finished floor to centerline of device and unless otherwise noted on Drawings as follows.

1. Switches: 48 inch above floor.

3.05 INSTALLATION OF PULL AND JUNCTION BOXES

A. Box Selection: For boxes in main feeder conduit runs, use sizes not smaller than 8 inch sq by 4 inch deep. Do not exceed 6 entering and 6 leaving raceways in single box. Quantities of conductors (including equipment grounding conductors) in pull or junction box shall not exceed following:

Size of Largest Conductors in Box	Maximum No. of Conductors in Box
No. 4/0 AWG	30
250 Kcmil	20
500 Kcmil	15
Over 500 Kcmil	10

1. Cable Supports: Install clamps, grids, or devices to which cables may be secured. Arrange cables so they may be readily identified. Support cable at least every 30 inch inside boxes.
2. Mount pull boxes in inaccessible ceilings with covers flush with finished ceiling.
3. Size: Provide pull and junction boxes for telephone, signal, instrumentation, control, and other systems at least 50% larger than would be required by the NEC for boxes smaller than 24 inch by 24 inch, or as indicated. Locate boxes strategically and provide shapes to permit easy pulling of future wires or cables of types normal for such systems.

3.06 INSTALLATION OF CABINETS AND HINGED DOOR ENCLOSURES

A. Mount with fronts straight and plumb.

B. Install with tops 78 inch above floor.

C. Set cabinets in finished spaces flush with walls.

D. Terminate wires and cables on terminal strips.

3.07 GROUNDING

A. Electrically ground metallic cabinets, boxes, and enclosures. Where wiring to item includes grounding conductor, provide grounding terminal in interior of cabinet, box or enclosure.

3.08 CLEANING AND FINISH REPAIR

A. Upon completion of installation, inspect components. Remove burrs, dirt, and construction debris and repair damaged finish including chips, scratches, abrasions, and weld marks.

B. Galvanized Finish: Repair damage using zinc-rich paint recommended by manufacturer.

C. Painted Finish: Repair damage using matching corrosion inhibiting touch-up coating.

END OF SECTION

SECTION 26 05 33.16
CONDUIT FOR ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes:

1. Raceways:

a. Galvanized rigid steel conduit (GRS).
b. Polyvinyl chloride (PVC) externally coated galvanized rigid steel conduit (CGRS).
c. Flexible metal conduit (FMC).
d. Liquidtight flexible metal conduit (LFMC).
e. Liquidtight flexible non-metallic conduit (LFNC)
f. Rigid nonmetallic polyvinyl chloride conduit (PVC).
g. Reinforced Thermosetting Resin Conduit (RTRC)(Fiberglass Conduit)

1.02 DEFINITIONS

A. Underfloor Conduits.

1. Conduits which run underground within perimeter of building walls under building floor. This may consist of one conduit, or several conduits grouped together.

B. Duct Bank Conduits

1. Conduits which run under ground outside perimeter of building walls. This may consist of one conduit, or several conduits grouped together.

C. Underground Conduits

1. Underground conduits are both underfloor conduits and duct bank conduits.

1.03 SUBMITTALS

A. Submittals are not required if Contractor supplies materials or equipment as specified. If Contractor proposes substitutions to material or equipment submittals identified below are required.

1. Product data.
2. Submit in accordance with Section 01 33 00.

1.04 QUALITY ASSURANCE

A. Items provided under this section shall be listed or labeled by Underwriters Laboratories, Inc. (UL) or other Nationally Recognized Testing Laboratory (NRTL).

1. Term "NRTL" shall be as defined in Occupational Safety and Health Administration (OSHA) Regulation 1910.7.
2. Terms "listed" and "labeled" shall be as defined in National Electrical Code (NEC), Article 100.

B. Regulatory Requirements:

1. NEC: Components and installation shall comply with National Fire Protection Association

(NFPA) 70.

C. Comply with National Electrical Contractors Association (NECA) "Standard of Installation."

PART 2 – PRODUCTS

2.01 METAL CONDUIT

A. Galvanized Rigid Steel Conduit: American National Standards Institute (ANSI) C80.1.

B. Plastic-Coated Steel Conduit and Fittings: National Electrical Manufacturers Association (NEMA) RN 1 and ETL Verified Polyvinyl Chloride-001 Labeled.

C. Flexible Metal Conduit: Zinc-coated steel.

D. Liquidtight Flexible Metal Conduit: Flexible steel conduit with Polyvinyl Chloride (PVC) jacket.

E. Liquidtight Flexible Non-Metallic Conduit: Flexible non-metallic conduit with rigid PVC reinforcement embedded within flexible PVC wall, crush-resistant construction.

2.02 NONMETALLIC CONDUIT

A. Rigid Nonmetallic Polyvinyl Chloride (PVC) Conduit: NEMA TC 2, PVC Chloride

1. Concrete Encased: Schedule 40.
2. Direct Buried: Schedule 80.

B. PVC Conduit Fittings: NEMA TC 3; match to conduit type and material.

2.03 REINFORCED THERMOSETTING RESIN CONDUIT (RTRC)(FIBERGLASS CONDUIT)

A. Manufacturer: Champion Fiberglass or equal.

B. Manufacturing:

1. Single circuit filament winding process.
2. E-glass grade “A” roving.
3. Carbon black ultraviolet inhibitor. Conduit and elbows shall be black in color.
4. Internal conduit and elbows walls shall be smooth and all fibers embedded in the epoxy.

C. Mechanical Characteristics:

1. ASTM D2105: Tensile strength, axial, 11,000 psi.
2. ASTM D695: Compressive strength, axial, 12,000 psi.
3. API 15LR: Glass content, 65-75%.
4. ASTM D2583: Barcol Hardness, 52-56.
5. ASTM D2444: Impact resistance.
6. ASTM D2412: Stiffness at 5% deflection.

D. UL Listed:

1. UL 2515 Above Ground Standard
2. UL 2420 Below Ground Standard.

2.04 FITTINGS

A. Fittings and conduit bodies for steel conduits:

1. Steel or malleable iron, zinc galvanized, or cadmium plated.
2. Do not use set screw or indentor type fittings.
3. Do not use aluminum or die cast fittings.
4. GRS Connectors and Couplings:

    a. Threaded.
    b. Insulated throat.
    c. Gland compression type.
    d. Rain and concrete type.

5. Comply with NEMA FB 1, compatible with conduit materials.

B. Fittings for flexible metal conduit.

1. Insulated throat type.
2. Threaded.
3. Grounding type.
4. Liquidtight: 1 piece sealing "O" rings with connectors when entering boxes or enclosures.

C. Fittings for liquidtight flexible non-metallic conduit.

1. Insulated throat type.
2. Threaded.
3. Non-metallic nylon type.
4. One piece sealing "O" rings with connectors when entering boxes or enclosures.

D. PVC Conduit Fittings:

1. NEMA TC 3; match to conduit type and material.

E. RTRC Conduit Fittings:

1. NEMA TC 14:

    a. Watertight: Conduit joints and fitting joints shall use manufacturer's epoxy adhesive for a permanent watertight bond.

F. Expansion Joints:

1. Conduit expansion fittings complete with copper bonding jumper, Crouse-Hinds Type XJ.
2. Conduit expansion/deflection fittings with copper bonding jumper, Crouse-Hinds Type XD.

G. Seals:

1. Wall entrance, OZ/Gedney Type FSK or FSC.

H. Drain Fittings:

1. Condensate Drain:

    a. Conduit outlet body, Type T.
    b. Threaded, galvanized plug with 3/16 inch drilled holed through plug.

2.05 RACEWAY/DUCT SEALING COMPOUND

A. Nonhardening, putty-like consistency workable at temperatures as low as 35^{o}F.

B. Compound shall not slump at temperature of 300 °F and shall readily adhere to clean surfaces of plastic ducts, metallic conduits, conduit coatings, concrete, masonry, lead, cable sheaths, cable jackets, insulation materials, and common metals.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine surfaces to receive raceways, wireways, and fittings for compliance with installation tolerances and other conditions affecting performance of raceway system.

B. Coordinate layout and installation of raceway and boxes with other construction elements to ensure adequate headroom, working clearance, and access. Coordinate layout and installation of raceway and boxes with light fixtures to ensure raceway and boxes are not mounted lower or below light fixtures causing shadows.

3.02 WIRING METHODS

A. Exterior or Wet Locations:

1. Refer to Space Environment and Hazardous Ratings Schedule on Drawings for determination of the Exposure type of each space in which conduit is to be installed. Refer to Material Schedule on Drawings for conduit material to be utilized within each Exposure type.
2. Underground Power, Single Run: Rigid nonmetallic (PVC) conduit or RTRC fiberglass conduit.

    a. Concrete encased except for area lighting branch circuits or as otherwise noted on Drawings.

3. Underground Power, Grouped: Rigid nonmetallic (PVC) conduit or RTRC fiberglass conduit.

    a. Concrete encased.

4. Underground Shielded Instrumentation Cables, Single Run or Grouped: PVC-coated steel conduit.

    a. Concrete encased.

5. Connection to Vibrating Equipment (including transformers and hydraulic, pneumatic, or electric solenoid or motor-driven equipment): Liquidtight flexible metal conduit.

B. Indoor Dry Locations:

1. Refer to Space Environment and Hazardous Ratings Schedule on Drawings for determination of the Exposure type of each space in which conduit is to be installed. Refer to Material Schedule on Drawings for conduit material to be utilized within each Exposure type.
2. Connection to Vibrating Equipment (including transformers and hydraulic, pneumatic, or electric solenoid or motor-driven equipment): Liquidtight flexible metal conduit.

C. Chemical Spaces:

1. Refer to Space Environment and Hazardous Ratings Schedule on Drawings for determination of the Exposure type of each space in which conduit is to be installed. Refer to Material Schedule on Drawings for conduit material to be utilized within each Exposure type.
2. Flexible conduit: Liquidtight flexible non-metallic conduit and non-metallic conduit fittings.

D. Use 3/4 inch minimum size unless otherwise noted except conduit runs to room light switches

may be 1/2 inch.

E. Underground conduits:

1. PVC-coated steel conduit may be used without encasing in concrete for underfloor shielded instrumentation cables or where specifically indicated on Drawings.
2. PVC conduit may be used without encasing in concrete for underfloor power and control conduit or where specifically indicated on Drawings.
3. Underground conduit shall be minimum of 1 inch outside of the building and minimum 3/4 inch within the building, buried at depth of not less than 24 inch below grade.
4. Provide conduits or ducts terminating below grade with means to prevent entry of dirt and moisture.
5. When using underfloor and/or concrete encased PVC conduit or RTRC fiberglass conduit provide either:

    a. PVC coated galvanized rigid steel elbows.
    b. RTRC fiberglass elbows with factory installed PVC couplings when connecting to PVC conduit.

6. Curves and Bends: Use manufactured elbows for stub-ups at equipment and at building entrances. For other curves and bends, except as otherwise indicated, use manufactured long sweep bends with minimum radius of 36 inches in both horizontal and vertical directions.

F. In precast areas, run conduits in insulation space or in floor topping without crossing conduits, using 3/4 inch maximum conduit size.

G. Raceways Embedded in Slabs: Install in middle third of slab thickness where practical and leave at least 1 inch (25 millimeter) concrete cover.

1. Use PVC-coated steel conduit for shielded instrumentation cables.
2. Use PVC conduit for power and control cables.
3. When using PVC conduit provide either:

    a. PVC coated galvanized rigid steel elbows.
    b. RTRC fiberglass elbows with factory installed PVC couplings when connecting to PVC conduit.

4. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.
5. Space raceways laterally to prevent voids in concrete.
6. Run conduit larger than 1 inch trade size parallel to or at right angles to main reinforcement and spaced on center of at least 3 times conduit trade diameter with minimum 2 inch concrete covering. Conduits over 1 inch may not be installed in slab without approval of Engineer.
7. When at right angles to reinforcement, place conduit close to slab support.
8. Conduits embedded in concrete frame shall comply with applicable provisions of American Concrete Institute (ACI) 318.

H. Where conduits penetrate existing building walls, conduits shall be grouted in (flush with wall on inside and outside) and building walls (internal and external shall be patched to match existing. Provide link seal where indicated on Drawings.

I. Provide dissimilar metal separation when transitioning from one metallic conduit material to another metallic conduit material.

3.03 INSTALLATION

A. Cap conduits after installation to prevent entry of debris.

B. Conceal raceways by enclosing within finished walls, ceilings, and floors, unless otherwise indicated.

C. Provide watertight conduit system where installed in wet places, underground or where buried in masonry or concrete.

D. Use threaded hubs when entering top of enclosures.

E. Use sealing type locknuts when entering sides or bottom of enclosures.

F. Install two spare 1 inch conduits from top of each flush mounted panelboard to area above ceiling for future use. On flush mounted panelboards located on first and higher level floors, provide two spare 1 inch conduits from bottom of panelboard to ceiling area of floor below for future use.

G. Keep raceways at least 6 inch (150 millimeter) away from parallel runs of flues and steam or hot water pipes. Install horizontal raceway runs above water and steam piping.

H. Install raceways level and square and at proper elevations. Provide adequate headroom.

I. Complete raceway installation before starting conductor installation.

J. Support raceway as specified in Section 26 05 29. Provide dissimilar metal separation where metallic conduit materials differ from metallic hangers and supports.

K. Use temporary closures to prevent foreign matter from entering raceway.

L. Run concealed raceways with minimum of bends in shortest practical distance considering type of building construction and obstructions, except as otherwise indicated.

M. Install exposed raceways parallel to or at right angles to nearby surfaces or structural members and follow surface contours as much as practical.

    1. Mount exposed horizontal runs as high above floor as possible, and in no case lower than 7 foot above floors, walkways, or platforms in passage areas.
    2. Run parallel or banked raceways together, on common supports where practical.
    3. Make bends in parallel or banked runs from same center line to make bends parallel. Use factory elbows only where they can be installed parallel; otherwise, provide field bends for parallel raceways.

N. Join raceways with fittings designed and approved for purpose and make joints tight.

    1. Make raceway terminations tight. Use bonding bushings or wedges at connections subject to vibration. Use bonding jumpers where joints cannot be made tight.
    2. Use insulating bushings to protect conductors.

O. Terminations: Where raceways are terminated with locknuts and bushings, align raceway to enter squarely, and install the locknuts with dished part against the box. Use two locknuts, one inside and one outside the box. Use insulating bushings. Provide insulated grounding bushings to terminate ground wire.

P. Where terminating in threaded hubs, screw raceway or fitting tight into the hub so the end bears against the wire protection shoulder. Where chase nipples are used, align the raceway so the coupling is square to box, and tighten chase nipple so no threads are exposed.

Q. Install pull wires in empty raceways. Use monofilament plastic line having not less than 200 pound (90 kilogram) tensile strength. Leave not less than 12 inch (300 millimeter) of slack at each end of pull wire.

R. Signal System Raceways 2 inch Trade Size and Smaller: In addition to above requirements, install in maximum lengths of 150 foot (45 meters) and with maximum of two 90 degree bends or equivalent. Install pull or junction boxes where necessary to comply with these requirements.

S. PVC Externally Coated Galvanized Rigid Steel Conduit: Use only fittings approved for use with that material. Field cuts on all male threads of conduit sections, elbows, and nipples shall be protected by application of a conductive, non-corrosive protection. Patch nicks and scrapes in PVC coating after installing conduit. All installers shall be field certified by the PVC Coated manufacturer for installation and provide proof of certification.

T. Conduit runs extending through areas of different temperature or atmospheric conditions or partly indoors and partly outdoors shall be sealed, drained, and installed in manner preventing drainage of condensed or entrapped moisture into cabinets, motors or equipment enclosures.

3.04 CONDUIT STUB-UPS

A. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portion of bends is not visible above finished slab.

B. Transition under floor conduit to PVC coated galvanized rigid steel conduit before rising above floor such that entire vertical riser is PVC coated galvanized rigid steel conduit. Under floor conduit elbows shall be PVC coated galvanized rigid steel conduit. Extend the PVC coated galvanized rigid steel conduit portion of the stub-up minimum 12 inch above floor or slab.

3.05 CONDUIT BENDS

A. Make bends and offsets so inside diameter is not reduced. Unless otherwise indicated, keep legs of bend in same plane and straight legs of offsets parallel.

B. Provide NEMA standard conduit bends, except for conduits containing medium voltage cable, fiber optic cable, or conductors requiring large radius bends.

C. Provide large radius conduit bends for conduits containing 5 kilovolt and 15 kilovolt cables as follows:

Conduit Trade Size	Bend Radius
2 inch - 2-1/2 inch	24 inch
3 inch - 4 inch	36 inch
5 inch	48 inch

1. Where physical limitations do not permit use of above, conduit bends with radius of at 8 times diameter of largest cable passing through conduit may be used.

3.06 FLEXIBLE CONNECTIONS

A. Use maximum of 6 foot (1830 millimeter) of flexible conduit for recessed and semi-recessed lighting fixtures.

B. Terminate conduits at motor terminal boxes, motor operated valve stations or pipe-mounted instruments and other equipment subject to vibration with maximum of 3 foot (915 millimeter) liquidtight flexible metal conduit unless otherwise indicated.

C. Use liquidtight flexible conduit in wet, damp, and corrosive locations.

D. Use flexible conduit and connections suitable for hazardous classified locations in hazardous classified locations.

E. Install separate ground conductor inside flexible conduit connections.

F. Do not route flexible conduit through walls, floors, ceilings, or roofs.

3.07 FITTINGS

A. Install raceway sealing fittings according to manufacturer's written instructions. Locate fittings at suitable, approved, accessible locations and fill them with UL-listed sealing compound. Install raceway sealing fittings at following points and elsewhere as indicated:

1. Where conduits pass from warm locations to cold locations, such as boundaries of refrigerated spaces and air-conditioned spaces.
2. Where otherwise required by NEC.

B. Use raceway fittings compatible with raceway and suitable for use and location. For GRS use threaded conduit fittings, except as otherwise indicated.

C. Install automatic breather drain fittings according to manufacturers written instructions. Locate fittings to drain conduit system and prevent condensate from entering device enclosures. Install automatic breather drain fittings at following points and elsewhere as indicated. Fittings shall be installed such that condensate is directed away from electrical and mechanical equipment and/or toward sump area or floor drain.

1. Where vertical seals are installed.
2. Low points in conduit system.
3. Where conduits enter panels or junction boxes in damp locations.

    a. Where conduits enter the top of enclosures, breather drains shall be installed on the lowest portion of enclosure for moisture prevention and drainage.

4. Where conduits pass from outside of building to inside.
5. Where conduits pass between rooms that have significant temperature differences.
6. Below field instruments at junction of flexible and rigid conduit.
7. Where otherwise required by NEC.

D. Install wall entrance seal as dictated by application where conduits pass through foundation walls below grade.

E. Install conduit expansion fittings complete with bonding jumper in following locations.

1. Conduit runs crossing structural expansion joint.
2. Conduit runs attached to 2 separate structures.
3. Conduit runs where movement perpendicular to axis of conduit may be encountered.

F. Conduit shall be firmly packed at fitting nearest wall or floor line with Johns-Manville Duxseal to depth of at least 1 inch after wires and cables are pulled in; or, if conduit enters directly into equipment, it shall be fitted with seal and drain fitting to prevent water entering equipment. Provide at the following locations:

1. Conduit entries into Electrical or Control Rooms via the floor
2. Where conduit passes from inside of building to outdoors

3.08 GROUNDING

A. Ground in accordance with Section 26 05 26.

B. Provide grounding connections for raceway, boxes, and components as indicated and instructed by manufacturer. Tighten connectors and terminals, including screws and bolts, according to equipment manufacturer's published torque-tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals according to tightening torques specified in UL 486A.

3.09 PROTECTION

A. Provide final protection and maintain conditions, in manner acceptable to manufacturer and Installer, to ensure that coatings, finishes, and cabinets are without damage or deterioration at Substantial Completion.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC or paint finishes with matching touch-up coating recommended by manufacturer.

3.10 CLEANING

A. Upon completion of installation of system, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish, including chips, scratches, and abrasions.

END OF SECTION

SECTION 26 05 43
UNDERGROUND DUCTS FOR ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Ducts.
2. Duct banks.

1.02 DEFINITIONS

A. Duct: General term for electrical conduit and other raceway, either metallic or nonmetallic, specified for use underground, embedded in earth or concrete.

B. Duct Bank: Group of 2 or more ducts in continuous run between two points.

C. Underfloor Conduits.

1. Conduits which run underground within perimeter of building walls under building floor. This may consist of 1 conduit, or several conduits grouped together.

D. Duct Bank Conduits

1. Conduits which run underground outside perimeter of building walls. This may consist of 1 conduit, or several conduits grouped together.

E. Underground Conduits

1. Underground conduits are both underfloor conduits and duct bank conduits.

1.03 SUBMITTALS

A. Submittals identified below are required.

1. Product data.
2. Duct entrances to buildings detailing conduit materials and a sketch showing elevations of conduits in relation to the building floor slabs, footings and frost walls.
3. Submit in accordance with Section 01 33 00.

1.04 QUALITY ASSURANCE

A. Items provided under this section shall be listed or labeled by Underwriters Laboratories, Inc. (UL) or other Nationally Recognized Testing Laboratory (NRTL).

1. Term "NRTL" shall be as defined in OSHA Regulation 1910.7.
2. Terms "listed" and "labeled" shall be as defined in National Electrical Code (NEC), Article 100.

B. Regulatory Requirements:

1. NEC: Components and installation shall comply with National Fire Protection Association (NFPA) 70.

1.05 SEQUENCING AND SCHEDULING

A. Coordination of Work:

1. Coordinate layout, elevations, and installation of ductbanks with final arrangement of ducts as influenced by actual final location of other utilities in field.
2. Establish locations and elevations to suit field conditions and assure duct runs drain to manholes, handholes, or as shown on Drawings.

PART 2 – PRODUCTS

2.01 DUCTS AND FITTINGS

A. Comply with Section 26 05 33.16.

2.02 CAST-IN-PLACE CONCRETE

A. Comply with Section 03 30 00 for concrete and Section 03 20 00 for reinforcing.

B. Aggregate For Duct Encasement: 3/8 inch maximum size.

C. Strength: 3,000 pounds per square inch (psi) minimum 28 day compressive strength.

D. Top layer of concrete encased conduit duct bank shall be dyed red.

2.03 DUCT BANK ACCESSORIES

A. Duct Supports: Rigid Polyvinyl Chloride (PVC) spacers selected to provide minimum duct spacings and concrete cover depths indicated, while rigidly supporting ducts during concreting.

2.04 RACEWAY/DUCT SEALING COMPOUND

A. Compound:

1. Nonhardening, putty-like consistency workable at temperatures as low as 35 degrees Fahrenheit.
2. Compound shall not slump at temperature of 300 degrees Fahrenheit and shall readily adhere to clean surfaces of plastic ducts, metallic conduits, conduit coatings, concrete, masonry, lead, cable sheaths, cable jackets, insulation materials, and common metals.

PART 3 – EXECUTION

3.01 WIRING METHOD

A. General: Install ducts for wiring runs indicated. Provide sizes as indicated.

B. Underground Power and Control, Single Run: Rigid nonmetallic PVC conduit or RTRC fiberglass conduit

1. Concrete encased except for area lighting branch circuits or as otherwise noted on Drawings.

C. Underground Shielded Instrumentation Cables, Single Run: PVC coated steel conduit.

1. Concrete encased except or as otherwise noted on Drawings.

D. Duct Banks:

1. Power and Control Conduits: Rigid nonmetallic conduit, Schedule 40, encased in concrete or RTRC fiberglass conduit encased in concrete. When using concrete encased PVC conduit or RTRC fiberglass conduit provide either:

a. PVC coated galvanized rigid steel elbows.
b. RTRC fiberglass elbows with factory installed PVC couplings when connecting to PVC conduit.

2. Instrumentation Conduits: PVC-coated steel conduit encased in concrete.

3.02 EXCAVATION AND BACKFILL

A. Conform to Section 31 23 00 except as modified below:

1. Do not use heavy-duty, hydraulic-operated compaction equipment.
2. Excavation: Cut trenches neatly and uniformly, and slope uniformly to required pitch.

3.03 INSTALLATION OF DUCTS

A. Slope: Pitch ducts to drain towards manholes and handholes and away from buildings and equipment unless otherwise shown on Drawings. Minimum slope shall be 4 inch in 100 foot Where necessary to achieve this between manholes, slope ducts from high point in run to drain in both directions.

B. Curves and Bends: Use manufactured elbows for stub-ups at equipment and at building entrances. For other curves and bends, except as otherwise indicated, use manufactured long sweep bends with minimum radius of 36 inches in both horizontal and vertical directions. Conduit elbows in duct banks shall be PVC coated galvanized rigid steel or RTRC fiberglass elbows with factory installed PVC couplings when connecting to PVC conduit.

C. Make joints in ducts and fittings watertight in accordance with manufacturer's instructions. Stagger couplings so those of adjacent ducts do not lie in same plane.

D. Duct Entrances to Buildings: Transformations from underground PVC duct to PVC-coated steel conduit shall be made 10 foot minimum unless otherwise indicated on drawings, outside building wall and shall use fittings manufactured for purpose. Install in accordance with following:

1. Concrete-Encased Ducts: Install reinforcing in duct banks and coordinate duct bank with structural design at wall so duct bank is supported at wall without reducing structural or watertight integrity.
2. Waterproof Entrances: Where ducts enter buildings through waterproofed floor or wall, watertight entrance-sealing device shall be installed with sealing gland assembly on inside. Anchor device securely into masonry construction with one or more integral flanges and membrane waterproofing secured to device in permanently watertight manner.

E. Concrete-Encased Ducts: Support on plastic separators coordinated with duct size and required duct spacing, and install in accordance with following:

1. Separator Installation: Space separators close enough to prevent sagging and deforming of ducts, and secure separators to earth and to ducts to prevent floating during concreting. Do not use tie wires or reinforcing steel in such way as to form conductive or magnetic loops around ducts or duct groups.
2. Reinforcing: Reinforce duct banks. Size and arrange reinforcing steel as indicated on

Drawings.

3. Concreting: Spade concrete carefully during pours to prevent voids under and between conduits and at exterior surface of envelope. Do not use power-driven agitating equipment unless specifically designed for duct bank application. Pour each run of envelope between manholes or other terminations in one continuous operation unless approved by Engineer. Where more than one pour is necessary, terminate each pour in vertical plane and continue duct bank reinforcing minimum of 18 inch beyond termination of pour. Top layer of concrete encased conduit duct bank shall be dyed red.
4. Forms: Walls of trench may be used to form side walls of duct bank provided soil is self-supporting and concrete envelope can be poured without soil inclusions. Use forms where soil is not self-supporting.
5. Minimum Clearances: 3 inch between ducts and exterior envelope wall, 3 inch between ducts for like services, and 6 inch between power and ducts for other systems.
6. Depth: Except as otherwise indicated, top of duct bank shall be 24 inch below finished grade, minimum, in nontraffic areas, and 30 inch below finished grade, minimum, in vehicular traffic areas.

F. Stub-ups: Duct stub-ups to equipment shall be PVC coated galvanized rigid steel. For equipment mounted on outdoor concrete pads, PVC coated rigid steel conduit shall extend minimum of 5 foot away from edge of pad. Install insulated grounding bushings on terminations. Couple steel conduits to ducts with adapters designed for purpose and encased concrete.

G. Sealing: For ducts to be wired in this Project, provide temporary closure at terminations. For spare ducts, seal bore of ducts at terminations. Use sealing compound and plugs as required to withstand 15 psi minimum hydrostatic pressure.

H. Pulling Cord: Provide 100 pound test nylon cord in ducts including spares.

I. Marker Tape: Provide plastic marker tape over ducts at 12 inch below finished grade in accordance with Section 10 14 10.

3.04 TESTING

A. Field Quality Control:

1. Grounding: Test manhole grounding provisions to ensure electrical continuity of bonding and grounding connections. Make ground-resistance test at each ground rod and submit report of results. Use an instrument specifically designed for ground-resistance measurements.
2. Duct Integrity: Rod ducts with mandrell 1/4 inch smaller in diameter than internal diameter of ducts. Where rodding indicates obstructions in ducts, remove obstructions and retest.

3.05 CLEANING AND RESTORATION

A. Clean Ducts: Clean full length of ducts with round bristle brush with diameter 1/2 inch greater than internal diameter of duct.

B. Clean Manholes: Clean internal surfaces of manholes including sump. Remove foreign material.

3.06 RESTORATION

A. Restore surface features at areas disturbed by excavation and reestablish original grades except as otherwise indicated.

B. Restore all areas disturbed by trenching, storing of dirt, cable laying, and other work to their original condition.

C. Include necessary topsoiling, fertilizing, liming, seeding, sodding, sprigging, or mulching.

D. Restore disturbed paving as indicated.

END OF SECTION

SECTION 26 05 84
ELECTRIC MOTORS

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Electric motors for use on ac power systems up to 600 Volts.
2. Motors that are factory-installed as part of equipment.
3. Field-installed motors.

B. Motors furnished under other sections of these Specifications as part of equipment items shall conform to requirements of this section except as noted otherwise in that section or indicated otherwise on Drawings or schedules.

C. Section does not include manufacturer’s definite purpose, direct current, synchronous or wound rotor motors.

1.02 SUBMITTALS

A. General:

1. Include motor submittal as part of equipment submittal for equipment specified in other sections.
2. Include identification of equipment by name and tag number as indicated in Specifications or on Drawings.

B. Product Data:

1. Complete nameplate data in accordance with National Electrical Manufacturers Association (NEMA) standards.
2. Full load power factor and maximum recommended power factor correction capacitor kilovolt amperes reactive (kVAr) rating for motors 5 horsepower and larger.
3. Nominal efficiency in accordance with Institute of Electrical and Electronics Engineers (IEEE) 112.
4. Motor dimensions and frame size.
5. Manufacturer's printed data on each motor type being provided to indicate compliance with specified performance and construction.
6. Service manual to include storage and alignment instructions.

C. Submit in accordance with Section 01 33 00.

D. Operation and Maintenance (O&M) Data:

1. Operating instructions, maintenance requirements and parts list.
2. Submit with specification section of equipment of which motor is a part.
3. Submit in accordance with Section 01 78 23.

1.03 QUALITY ASSURANCE

A. Items provided under this section shall be listed or labeled by Underwriters Laboratories, Inc. (UL) or other Nationally Recognized Testing Laboratory (NRTL).

1. Terms "NRTL" shall be as defined in OSHA Regulation 1910.7.
2. Terms "listed" and "labeled" shall be as defined in National Electrical Code, Article 100.

B. Comply with National Electrical Manufacturers Association (NEMA) MG 1, "Motors and Generators."

C. Comply with UL 1004, "Motors, Electric".

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Siemens

B. General Electric

C. U.S. Motors

D. Toshiba

E. WEG

F. TECO Westinghouse

2.02 GENERAL

A. Requirements below apply to motors covered by this Section except as otherwise indicated.

B. Motors 1/2 horsepower and Larger: Polyphase.

C. Motors Smaller Than 1/2 horsepower: Single-phase.

D. Frequency Rating: 60 Hertz.

E. Voltage Rating: Determined by voltage of circuit to which motor is connected for following motor voltage ratings (utilization voltages):

1. 120 volt Circuit: 115 volt - motor rating.
2. 208 volt Circuit: 200 volt - motor rating.
3. 240 volt Circuit: 230 volt - motor rating.
4. 480 volt Circuit: 460 volt - motor rating.

F. Service factors indicated for motors are minimum values and apply at frequency and utilization voltage at which motor is connected. Provide motors which will not operate in service factor range when supply voltage is within 10% of motor voltage rating.

G. Capacity: Sufficient to start and operate connected loads at designated speeds in indicated environment, and with indicated operating sequence, without exceeding nameplate ratings. Provide motors rated for continuous duty at 100% of rated capacity.

H. Temperature Rise: Based on 40 degrees Celsius ambient except as otherwise indicated.

I. Enclosure: Totally Enclosed Fan Cooled (TEFC) unless otherwise indicated in other sections and as required by NEC.

1. Explosion proof motors approved for specific hazard classifications covered by NEC.
2. Weather proof motors designed for outdoors and in wet areas.
3. Chemical resistant motors designed for severe duty applications, including high humidity, corrosive, dirty or salty atmospheres.

J. Copper Windings.

2.03 POLYPHASE MOTORS

A. Squirrel-cage induction-type conforming to following requirements except as otherwise indicated.

B. NEMA Design Letter Designation: "B"

C. Bearings: Double-shielded, prelubricated ball bearings suitable for radial and thrust loading for application.

D. Motor Efficiencies:

1. General purpose motors (not inverter duty/vector duty or explosion proof): NEMA Premium Energy Efficient Motors with nominal efficiency equal to or greater than that stated in NEMA MG 1 for NEMA Premium Energy Efficient Motors for that type and rating of motor.
2. Inverter Duty and/or Vector Duty Motors: NEMA Premium Energy Efficient Motors with nominal efficiency equal to or greater than that stated in NEMA MG 1 for NEMA Premium Energy Efficient Motors for that type and rating of motor.
3. Explosion proof motors: NEMA Premium Energy Efficient Motors with nominal efficiency equal to or greater than that stated in NEMA MG 1 for NEMA Premium Energy Efficient Motors for that type and rating of motor.

E. Inverter Duty and/or Vector Duty Motors with Manufacturer's Premium Insulation System that is Specifically for Use with Solid-State Drives/ Variable Frequency Drives (VFD): Squirrel-cage induction, NEMA Design B units with ratings, characteristics, and features coordinated with and approved by drive manufacturer conforming to or exceeding the requirements of NEMA MG 1, Part 31.

1. Include adequate thermal capacity for continuous operation under worst case temperature conditions with motor operating at rated torque, without reduction in insulation life of motor, under the range of conditions specified.
2. Motors operating on VFD shall be protected from circulating shaft currents with either a grounding ring or insulated bearings:

a. Provide factory installed motor shaft grounding system sized for the motor shaft:

1) AEGIS SGR grounding ring, bolted to the motor frame
2) Helwig Carbon bearing protection kit, bracket connected to the motor frame
3) Or equal

b. Provide factory installed insulated motor bearing on non-drive end of motors installed in hazardous classified locations.

F. Internal Thermal Overload Protection for Motors: For motors so indicated, protection automatically opens control circuit arranged for external connection. Protection operates when winding temperature exceeds safe value calibrated to temperature rating of motor insulation.

G. Motors for Reduced Inrush Starting: Coordinate with indicated reduced inrush controller type and with characteristics of driven equipment load. Provide required wiring leads in motor terminal box to suit control method.

H. Torque:

1. Breakdown torque shall be 200% or more of maximum torque load placed on motor shaft.
2. Provide necessary WK2 curves for special loads to coordinate with motors.
3. Supply special motors where load requirements exceed standard design.

I. Open Drip Proof (ODP).

1. Energy Efficient.
2. Protected Openings.
3. Class B Insulation.
4. 1.15 Service Factor.
5. Cast iron construction.

J. Totally Enclosed Fan Cooled (TEFC) and Totally Enclosed Non Ventilated (TENV).

1. Energy Efficient.
2. 1.15 service factor, Class "F" insulation.
3. Cast iron construction; frame, conduit box, end shields, fan cover, inner caps for 143T frames and larger.
4. Positive lubrication systems.
5. Removable eyebolt.
6. Suitable for indoor and outdoor installations.
7. Diagonally split, neoprene gasketed, rotatable oversized conduit box with NPT threaded lead hole.
8. Conduit box mounted, UL approved clamp type grounding lug.
9. Permanently numbered non-wicking leads.
10. Rust inhibitive non-washing lubricant.
11. Stainless steel nameplate with.

    a. NEMA nominal efficiency.
    b. Anti Friction Bearing Manufacturers Association (AFBMA) bearing numbers.
    c. Lubrication instructions.

K. Corrosion Resistant (Mill and Chemical Duty).

1. Same features as TEFC, except as noted below.
2. Neoprene lead seal separator gasket mounted between motor frame and conduit box.
3. Anti-static corrosion resistant fan.
4. Zinc plated hex head hardware.
5. Stainless steel T drains and breather fittings.
6. Stator and rotor completely epoxy coated for corrosion protection.
7. Non-metallic V-ring shaft slinger.
8. Double shielded bearings.
9. Double-coated epoxy enamel exterior finish.
10. Stainless steel nameplate.

L. Submersible pump and mixer motors.

1. As specified in equipment specification sections.
2. 1.10 service factor, unless otherwise indicated in equipment specification sections.

2.04 SINGLE-PHASE MOTORS

A. One of following types as selected to suit starting torque and other requirements of specific motor application:

1. Permanent Split Capacitor.
2. Split-Phase Start, Capacitor-Run.
3. Capacitor-Start, Capacitor-Run.

B. Shaded-Pole Motors: Use only for motors smaller than 1/20 horsepower.

C. Internal Thermal Overload Protection for Motors: For motors so indicated, protection automatically opens power supply circuit to the motor, or control circuit arranged for external connection. Protection operates when winding temperature exceeds safe value calibrated to temperature rating of motor insulation. Provide device that automatically resets when motor temperature returns to normal range except as otherwise indicated.

D. Bearings, belt connected motors and other motors with high radial forces on motor shaft shall be ball bearing type. Sealed, prelubricated sleeve bearings may be used for other single phase motors.

2.05 SOURCE QUALITY CONTROL

A. Testing:

1. Perform individual motor test on motors over 1 horsepower.
2. Test shall be standard NEMA routine production test in accordance with NEMA MG 1.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Field install motors in accordance with manufacturer's instructions and following:

1. Direct Connected Motors: Mount securely in accurate alignment.
2. Belt Drive Motors: Use adjustable motor mounting bases. Align pulleys and install belts. Use belts furnished by manufacturer and tension belts in accordance with manufacturer recommendations.

3.02 COMMISSIONING

A. Check operating motors, both factory and field-installed, for unusual conditions during normal operation. Coordinate with commissioning of equipment for which motor is part.

B. Report unusual conditions.

C. Correct deficiencies of field-installed units.

3.03 ALIGNMENT

A. Installer of motor is responsible for alignment.

B. Check alignment of motors prior to startup.

C. Motors over 50 horsepower: Laser alignment and balance check using test equipment specially designed for this purpose.

3.04 FIELD QUALITY CONTROL

A. Inspect wire and connections for physical damage and proper connection.

B. Conduct insulation resistance (megger) test on each motor 25 horsepower and larger before energizing. Conduct test with 500 or 1,000 volts direct current megger. Test each phase separately and follow procedures listed below.

1. Disconnect voltage sources, lightning arrestors, capacitors, and other potential low insulation sources from motor before connecting megger to motor.
2. When testing phase, connect phases not under test to ground.

3. Apply test voltage, phase to ground on each phase being tested. Record resistance reading at 30 sec and at 1 min after test voltage is applied. Divide 1 minute reading by 30 second reading to obtain dielectric absorption ratio (DAR). DAR shall be 1.25 or greater for phase to pass test.
4. If phases have DAR of 1.25 or greater, attach tag to motor and mark tag "Insulation Resistance Test OK" and sign.
5. If phases have DAR of less than 1.25, attach tag to motor and mark tag “Insulation Resistance Test Failed” and sign. Provide new motor and retest. Notify Engineer of failure and actions taken to correct.
6. Connect equipment removed in Item 1 above.

C. Before energizing motor, record motor's nameplate current on record drawing line diagrams. Size motor starter overload heaters with starter manufacturer's recommendation for given motor nameplate current, service factor, and power factor correcting capacitors, if provided.

D. Check rotation of motor before connecting to driven equipment; before couplings are bolted or belts installed. Before motor is started to check rotation, determine that motor is lubricated. When rotation is correct, mark insulation resistance test tag "Rotation OK". Sign or initial test tag by person who checked motor rotation.

E. Supplier or manufacturer shall direct services to system and equipment operation, maintenance, troubleshooting, and equipment and system-related areas other than wastewater treatment process. See Section 01 61 00.

F. In addition to the services specified above, provide manufacturer’s services as required to successfully complete systems demonstration as specified in Section 01 79 10.

END OF SECTION

SECTION 26 29 00
LOW-VOLTAGE CONTROLLERS

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Alternating Current (AC) motor-control devices rated 600 Volts and less that are supplied as enclosed units.

1.02 SUBMITTALS

A. Product Data:

1. Include dimensions, ratings, and data on features and components.

B. Shop Drawings: For each controller center specified in this Section. Include dimensioned plans, elevations, and component lists. Show ratings, including short-time and short-circuit ratings.

1. Schedule of features, characteristics, ratings, and factory settings of individual units.
2. Wiring Diagrams: Interconnecting wiring diagrams pertinent to class and type specified for and schematic diagram of each type of controller unit indicated.

C. Test Results:

1. Certified reports of field tests and observations.

D. Operation and Maintenance Data (O&M):

1. Maintenance data for motor controllers.
2. Submit in accordance with Section 01 78 23.

E. Miscellaneous:

1. Load-Current and Overload-Relay Heater List: Compile after motors have been installed and arrange to demonstrate that selection of heaters suits actual motor nameplate full-load currents.

F. Submit in accordance with Section 01 33 00.

1.03 QUALITY ASSURANCE

A. Manufacturer Qualifications: Maintain, within 100 miles (160 kilometers) of Project site, service center capable of providing training, parts, and emergency maintenance and repairs.

B. Source Limitations: Obtain similar motor-control devices through one source from single manufacturer.

C. Items provided under this section shall be listed or labeled by UL or other Nationally Recognized Testing Laboratory (NRTL).

1. Term "NRTL" shall be as defined in Occupational Safety and Health Administration (OSHA) Regulation 1910.7.
2. Terms "listed" and "labeled" shall be as defined in National Electrical Code, Article 100.

D. Regulatory Requirements:

1. National Electrical Code (NEC): Components and installation shall comply with National Fire Protection Association (NFPA) 70.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Rockwell Automation - Allen-Bradley Co.

B. ABB Corporation

C. Eaton Corporation

D. Schneider Electric

2.02 ENCLOSURE

A. Refer to Space Environment and Hazardous Ratings Schedule on Drawings for determination of the Exposure type of each space in which motor starter is to be installed. Refer to Material Schedule on Drawings for material and NEMA enclosure type to be utilized within each Exposure type.

B. As otherwise indicated and as required by NEC.

2.03 MAGNETIC MOTOR CONTROLLERS

A. Solid-State, Reduced-Voltage Controller: NEMA ICS 2, suitable for use with standard NEMA MG 1, Design B, polyphase, medium induction motors.

1. Adjustable acceleration rate control uses voltage or current ramp, and adjustable starting torque control has up to 500% current limitation for 20 sec.
2. Surge suppressor in solid-state power circuits provides 3 phase protection against damage from supply voltage surges 10% or more above nominal line voltage.
3. Light Emitting Diode (LED) indicators show motor and control status, including following conditions:

a. Control power available.
b. Controller on.
c. Overload trip.
d. Loss of phase.
e. Shorted silicon-controlled rectifier.

4. Motor running contactor operates automatically when full voltage is applied to motor.

B. Control Circuit: 120 Volt; obtained from integral control power transformer, unless otherwise indicated. Include control power transformer with adequate capacity to operate connected pilot, indicating and control devices, plus 100% spare capacity.

C. Combination Controller: Factory-assembled combination controller and disconnect switch with or without overcurrent protection as indicated.

1. Fusible Disconnecting Means: NEMA KS 1, heavy-duty, fusible switch with rejection-type fuse clips rated for fuses indicated. Select and size fuses to provide Type 2 protection according to IEC 947-4-1, as certified by Nationally Recognized Testing Laboratory.
2. Nonfusible Disconnect: NEMA KS 1, heavy-duty, nonfusible switch.

3. Circuit-Breaker Disconnect: NEMA AB 1, motor-circuit protector with field-adjustable short-circuit trip coordinated with motor locked-rotor amperes.

D. Overload Relay:

1. Electronic solid state type with inverse-time-current characteristic, phase loss and phase unbalance protection for size 2 and larger.
2. Provide NEMA Class 20 heaters or sensors in each phase matched to nameplate full load current of specific motor to which connected with appropriate adjustment for duty cycle.
3. Enhanced Protection Overload Relay: Provide overload relays with NEMA Class 10 or better tripping characteristics for submersible equipment or where indicated. Select to protect motor against voltage unbalance and single phasing.

E. Time Delay Restart Relays: Solid-state sensing circuit with isolated output contacts for hard-wired connection.

1. Provide in starter enclosure for Size 2 and larger starters.
2. Delay initial motor start.
3. Delay motor restart due to starter dropout caused by undervoltage or starter coil circuit interruption for maintained control circuits.
4. Adjustable on delay from 0.15 to 30.0 seconds set at 10.0 seconds.
5. Connect control relay in motor starter coil circuit.
6. Coordinate control relay section with motor starter to cause motor starter to drop out at voltage slightly higher than dropout voltage of starter and have dropout time slightly faster than motor starter to ensure if motor starter drops out, relay will drop out.

2.04 ACCESSORIES

A. Provide devices when indicated. Factory install in controller enclosure, where indicated.

B. Push-Button Stations, Pilot Lights, and Selector Switches: NEMA ICS 2, heavy-duty type.

C. Stop and Lockout Push-Button Station: Momentary-break push-button station with factory-applied hasp arranged so padlock can be used to lock push button in depressed position with control circuit open.

D. Control Relays: Auxiliary and adjustable time-delay relays.

E. Elapsed Time Meters: Heavy duty with digital readout in hours.

F. Meters: Panel type, 2-1/2 inch (60 millimeter) minimum size with 90 or 120 degree scale and plus or minus 2% accuracy. Where indicated, provide transfer device with off position. Meters indicate following:

1. Ammeter: To indicate output current, with current sensors rated to suit application.
2. Voltmeter: To indicate output voltage.
3. Frequency Meter: To indicate output frequency.

G. Transient Voltage Surge Suppressors: IEEE C62.41, selected to meet requirements for medium-exposure category. Impulse sparkover voltage coordinated with system circuit voltage. Factory mounted with Nationally Recognized Testing Laboratory listed and labeled mounting device.

PART 3 – EXECUTION

3.01 APPLICATIONS

A. Select features of each motor controller to coordinate with ratings and characteristics of supply circuit and motor; required control sequence; duty cycle of motor, drive, and load; and configuration of pilot device and control circuit affecting controller functions.

B. Select horsepower rating of controllers to suit motor controlled.

C. Use fractional-horsepower manual controllers for single-phase motors, unless otherwise indicated.

D. Use manual controllers for 3 phase motors only as indicated.

E. Push-Button Stations: In covers of magnetic controllers for manually started motors where indicated, start contact connected in parallel with sealing auxiliary contact for low-voltage protection.

F. Hand-Off-Automatic Selector Switches: In covers of manual and magnetic controllers of motors started and stopped by automatic controls or interlocks with other equipment where indicated.

3.02 INSTALLATION

A. Install independently mounted motor-control devices according to manufacturer's written instructions.

B. Location: Locate controllers within sight of motors controlled, unless otherwise indicated.

C. For control equipment at walls, bolt units to wall or mount on lightweight structural-steel channels bolted to wall. For controllers not at walls, provide freestanding racks conforming to Section 26 05 29.

D. Motor-Controller Fuses: Install indicated fuses in each fusible switch.

3.03 IDENTIFICATION

A. Identify motor-control components and control wiring according to Section 10 14 10

3.04 CONTROL WIRING INSTALLATION

A. Install wiring between motor-control devices according to Section 26 05 19.

B. Bundle, train, and support wiring in enclosures.

C. Connect hand-off-automatic switch and other automatic control devices.

1. Connect selector switches to bypass only manual and automatic control devices that have no safety functions when switch is in hand position.
2. Connect selector switches with motor-control circuit in both hand and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor overload protectors.

3.05 CONNECTIONS

A. Tighten connectors, terminals, bus joints, and mountings. Tighten field-connected connectors and terminals, including screws and bolts, according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A.

3.06 FIELD QUALITY CONTROL

A. Manufacturer's Field Services:

1. Supplier's or manufacturer's representative for equipment specified herein shall be present at jobsite or classroom designated by Owner for minimum workdays indicated, travel time excluded, for assistance during plant construction, plant startup, and training of OWNER'S personnel for plant operation. Include:

    a. 1/2 workday for Installation Services.
    b. 1/2 workday for Instructional Services.

2. Supplier or manufacturer shall direct services to system and equipment operation, maintenance, troubleshooting, and equipment and system-related areas other than wastewater treatment process. See Section 01 61 00.
3. In addition to the services specified above, provide manufacturer's services as required to successfully complete systems demonstration as specified in Section 01 79 10.
4. Manufacturer's Field Services: Provide services of factory-authorized service representative to supervise field assembly and connection of components, including pretesting and adjustment of solid-state controllers.

B. Testing:

1. Reports: Notify Engineer in writing indicating defective materials and workmanship and unsatisfactory test results. Include records of repairs and adjustments made.
2. On completing installation of system, perform following tests.

    a. Test insulation resistance of conducting parts of motor control components; and of connecting supply, feeder, and control circuits. For devices containing solid-state components, use test equipment and methods recommended by manufacturer.
    b. Make continuity tests of circuits.
    c. Review updating of final system configuration and parameters where they supplement or differ from those indicated in original Contract Documents.
    d. Review manufacturer's written instructions for installation and testing of motor control devices.

3. Visual and Mechanical Inspection: Include following inspections and related work.

    a. Motor Control Device Ratings and Settings: Verify ratings and settings as installed are appropriate for final loads and final system arrangement and parameters. Recommend final protective device ratings and settings where differences found. Use accepted revised ratings or settings to make final system adjustments.
    b. Inspect for defects and physical damage and nameplate compliance with Drawings.
    c. Exercise and perform operational tests of mechanical components and other operable devices in accordance with manufacturer's written instructions.
    d. Check tightness of electrical connections of devices with calibrated torque wrench. Use manufacturer's recommended torque values.
    e. Clean devices using manufacturer's approved methods and materials.
    f. Verify proper fuse types and ratings in fusible devices.

4. Electrical Tests: Perform following in accordance with manufacturer's written instructions.

    a. Insulation resistance test of motor control devices conducting parts to extent permitted by manufacturer's written instructions. Insulation resistance less than 100 megohms not acceptable.
    b. Use primary current injection to check performance characteristics of motor circuit protectors and for overload relays of controllers for motors 15 hp and larger. Trip characteristics not within manufacturer's published time-current tolerances not acceptable.

c. Make adjustments for final settings of adjustable trip devices.
d. Test auxiliary protective features such as loss of phase, phase unbalance, and undervoltage to verify operation.
e. Check for improper voltages at terminals in controllers having external control wiring when controller disconnect opened. Voltage over 30 volts unacceptable.

5. Correct deficiencies and retest motor control devices. Verify by system tests that specified requirements are met.

C. Retesting:

1. Correct deficiencies identified by tests and completely retest equipment.
2. Verify by system test that total system meets specification requirements.

3.07 ADJUSTING

A. Time Delay Restart Relay:

1. Adjust control relay to cause motor starter to drop out at voltage slightly higher than dropout voltage of starter and have dropout time slightly faster than motor starter to ensure if motor starter drops out, relay will drop out.

B. Set field-adjustable pick-up and time-sensitivity ranges as indicated.

3.08 CLEANING

A. Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish. Clean devices internally, using methods and materials recommended by manufacturer.

END OF SECTION

SECTION 26 51 00
INTERIOR LIGHTING

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Interior lighting fixtures
2. Light emitting diodes
3. Emergency lighting units
4. Drivers
5. Accessories.

1.02 DEFINITIONS

A. Emergency Lighting Unit: Fixture with integral emergency battery-powered supply and means for controlling and charging battery. Also known as an emergency light set.

B. Fixture: Complete lighting unit, exit sign, or emergency lighting unit. Fixtures include lamps and parts required to distribute light, position and protect lamps, and connect lamps to power supply. Internal battery-powered exit signs and emergency lighting units also include battery and means for controlling and recharging battery. Emergency lighting units include ones with and without integral lamp heads.

C. Average Life: Time after which 50% fails and 50% survives under normal conditions.

1.03 SUBMITTALS

A. Product Data

1. Describe fixtures, lamps, ballasts, and emergency lighting units. Arrange Product Data for fixtures in order of fixture designation.
2. Include data on features and accessories and following:

a. Outline drawings indicating dimensions and principal features of fixtures.
b. Electrical Ratings and Photometric Data: Certified results of laboratory tests for fixtures and lamps.
c. Battery and charger data for emergency lighting units.

B. Shop Drawings:

1. Detail nonstandard fixtures and indicate dimensions, weights, method of field assembly, components, features, and accessories.

C. Maintenance and Operating Data (O&M):

1. Maintenance data for fixtures to include operation and maintenance information.

D. Submit in accordance with Section 01 33 00.

1.04 QUALITY ASSURANCE

A. Items provided under this section shall be listed or labeled by UL or other Nationally Recognized Testing Laboratory (NRTL).

1. Term "NRTL" shall be as defined in OSHA Regulation 1910.7.
2. Terms "listed" and "labeled" shall be as defined in National Electrical Code, Article 100.
3. Special Listing and Labeling: Provide fixtures for use in damp or wet locations, underwater, and recessed in combustible construction that are specifically listed and labeled for such use. Provide fixtures for use in hazardous (classified) locations that are listed and labeled for specific hazard.

B. Regulatory Requirements:

1. National Electrical Code (NEC): Components and installation shall comply with National Fire Protection Association (NFPA) 70.

C. Coordinate fixtures, mounting hardware, and trim with ceiling system and other items, including work of other trades, required to be mounted on ceiling or in ceiling space.

PART 2 – PRODUCTS

2.01 FIXTURES AND FIXTURE COMPONENTS

A. Metal Parts: Free from burrs, sharp corners, and edges.

B. Sheet Metal Components: Steel, except as indicated. Form and support to prevent warping and sagging.

C. Reflecting Surfaces: Minimum reflectance as follows, except as otherwise indicated:

1. White Surfaces: 85%.
2. Specular Surfaces: 83%.
3. Diffusing Specular Surfaces: 75%.
4. Laminated Silver Metallized Film: 90%.

D. Lenses, Diffusers, Covers, and Globes: 100% virgin acrylic plastic or water white, annealed crystal glass, except as otherwise indicated.

1. Plastic: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
2. Lens Thickness: 0.125 inch (3 millimeter) minimum; except where greater thickness is indicated.

E. Fixture Support Components: Comply with Section 26 05 29.

1. Single-Stem Hangers: 1/2 inch (12 millimeter) steel tubing with swivel ball fitting and ceiling canopy. Finish same as fixture.
2. Twin-Stem Hangers: Two, 1/2 inch (12 millimeter) steel tubes with single canopy arranged to mount a single fixture. Finish same as fixture.
3. Rod Hangers: 3/16 inch (5 millimeter) minimum diameter, zinc-plated, threaded steel rod.
4. Hook Hanger: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

F. Light Emitting Diodes (LED):

1. Recessed Fixtures

a. LEDs rated for 50,000 hour life minimum.
b. Embedded controls shall allow fixture to communicate with other nLight enabled controls included but not limited to dimmers, switches, occupancy sensors, and photocontrols.
c. Lumen Management system (N80) provides onboard intelligence that actively manages

the LED light source so that constant lumen output is maintained over the system life.
d. LED AccuDrive: driver delivers full-range dimming from 0-10V control signal.
e. CSA Certified.
f. Tested to LM80 standards.
g. UL listed driver.

2. Non-recessed Fixtures

a. LED rated for 100,000 hour life.
b. Embedded controls shall allow fixture to communicate with other nLight enabled controls included but not limited to dimmers, switches, occupancy sensors, and photocontrols
c. 0-10V dimming.
d. Damp rated.
e. CSA Certified.
f. UL listed driver.

G. Emergency Lighting Units: Conform to UL 924. Provide self-contained units with following features:

1. Battery: Sealed, maintenance-free, lead-acid type with minimum 10 year nominal life and special warranty.
2. Charger: Minimum 2-rate, fully automatic, solid-state type, with sealed transfer relay.
3. Operation: Relay automatically turns fixture on when supply circuit voltage drops to 80% of nominal voltage or below. Fixture automatically disconnects from battery when voltage approaches deep-discharge level. Relay disconnects lamps and battery and automatically recharges and floats on trickle charger when normal voltage is restored.

2.02 FINISHES

A. Manufacturer's standard, except as otherwise indicated, applied over corrosion-resistant treatment or primer, free of streaks, runs, holidays, stains, blisters, and similar defects.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Set units plumb, square, and level with ceiling and walls, and secure according to manufacturer's written instructions and approved Shop Drawings. Support fixtures according to Section 26 05 29.

B. Support for Recessed and Semi-recessed Grid-Type Fixtures: Support Units from suspended ceiling support system. Install ceiling support system rods or wires at minimum of 4 rods or wires for each fixture, located not more than 6 inch (150 millimeter) from fixture corners.

1. Install support clips for recessed fixtures, securely fastened to ceiling grid members, at or near each fixture corner.
2. Fixtures Smaller than Ceiling Grid: Install minimum of 4 rods or wires for each fixture and locate at corner of ceiling grid where fixture is located. Do not support fixtures by ceiling acoustical panels.
3. Fixtures of Sizes Less than Ceiling Grid: Center in acoustical panel. Support fixtures independently with at least two 3/4 inch (20 millimeter) metal channels spanning and secured to ceiling tees.

C. Support for Suspended Fixtures: Brace pendants and rods over 48 inch (1200 millimeter) long to limit swinging. Support stem-mounted, single-unit, suspended fluorescent fixtures with twin-stem hangers. For continuous rows, use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of chassis, including one at each end.

3.02 CONNECTIONS

A. Ground lighting units. Tighten electrical connectors and terminals, including grounding connections, according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A.

3.03 FIELD QUALITY CONTROL

A. Inspect each installed fixture for damage. Replaced damaged fixtures and components.

1. Verify normal operation of each fixture after fixtures have been installed and circuits have been energized with normal power source.
2. Give advance notice of dates and times for field tests.
3. Provide instruments to make and record test results.
4. Interrupt electrical energy to demonstrate proper operation of emergency lighting installation. Include following information in tests of emergency lighting equipment:

   a. Duration of supply.
   b. Low battery voltage shutdown.
   c. Normal transfer to battery source and retransfer to normal.
   d. Low supply voltage transfer.
   e. Replace or repair malfunctioning fixtures and components, then retest. Repeat procedure until all units operate properly.
   f. Report results of tests.

B. Replace fixtures that show evidence of corrosion during Project warranty period.

3.04 ADJUSTING AND CLEANING

A. Clean fixtures after installation. Use methods and materials recommended by manufacturer.

B. Adjust aimable fixtures to provide required light intensities.

END OF SECTION

DIVISION 31

EARTHWORK

SECTION 31 10 00
SITE CLEARING

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Protection of existing surface features
2. Stripping topsoil.
3. Locating existing pipes and electrical conduits.
4. Removal from site and disposal of stockpiled landfill material.

1.02 SUBMITTALS

A. Submit coordinates and elevation of each located underground pipe.

B. Submit in accordance with Section 01 33 00.

PART 2 – PRODUCTS

(NOT USED)

PART 3 – EXECUTION

3.01 PREPARATION

A. Provide a minimum of 3 working days notice, prior to construction, to owners of existing utilities and surface features.

B. Protect existing utilities and surface features indicated to remain. Restore damaged existing utilities and surface features to condition equal to condition prior to construction.

C. Protect trees, shrubs, and other land resources, where indicated to remain. Provide fencing no closer than “drip line” of trees and shrubs and of sufficient height so features will not be damaged. Comply with requirements of Section 01 57 19.

D. Do not remove or cut down trees unless identified for removal on drawings, or located within limits of excavation, proposed structures or paving as indicated on Drawings.

E. Do not trim trees unless shown on Drawings.

F. Use means necessary to prevent dust becoming a nuisance to the public, to neighbors, and to other work being performed on or near the site.

G. Maintain access to site.

H. Install erosion control measures prior to start of any earth-disturbing activities.

3.02 REMOVALS

A. Remove obstructions such as mounds of dirt, stones, or debris located within construction limits.

B. Remove surface features including pavements and other miscellaneous items.

C. Full depth saw cut all pavement, sidewalk and curbing to be removed.

D. Conform to requirements of Section 01 35 16.

3.03 STRIPPING TOPSOIL

A. After area has been cleared of vegetation, remove existing topsoil to entire depth in areas where grade is to be adjusted and in areas to be covered by structures or paving.

B. Stripped topsoil shall be free of clay lumps, sand and gravel, stones, vegetation, and debris.

C. Stockpile on site in an area clear of new construction. Strip stockpile areas of vegetation prior to stockpiling.

D. Maintain the stockpile in a manner which will not obstruct the natural flow of drainage.

1. Protect from erosion.
2. Maintain stockpile free from debris and trash.
3. Immediately stabilize stockpiles and surround stockpiles as needed with silt fence or other perimeter control if stockpiles will remain inactive for 7 days or longer.

E. Owner has first right to excess topsoil not used in Work. Obtain Owners approval before removing any topsoil not required for work. Remove excess topsoil not required by Owner from site.

3.04 DISPOSAL

A. Remove brush, grass, roots, trash, and other material from site preparation operations from site.

B. Do not store or permit debris to accumulate on the job site.

C. Do not burn debris at the site.

D. Dispose of materials removed by clearing and grubbing in accordance with applicable regulations.

3.06 DEMOLITION

A. Conform to Section 01 35 16.

3.07 EXPLORATION FOR EXISTING UNDERGROUND PIPING AND ELECTRICAL CONDUITS

A. Prior to initiating work, Contractor shall determine exact location and elevation of underground piping and conduits at locations specified.

1. Excavate and expose top and sides of piping or conduit.
2. Locate top and outer edges of piping or conduit by surveying with equipment capable of locating each point to within 0.1 ft. accuracy.

3. Tie survey coordinate information to state plane coordinate system shown on drawings.
4. Probing to locate outer edges of piping may be permissible if exposing sides of piping would compromise the structural integrity of the piping, provided the size and invert elevation can be determined from the information available.
5. Each point to be surveyed shall consist of a set of three (3) survey points. One set of points shall consist of coordinates on each side of the pipe or conduit and the top center elevation of pipe or conduit.

B. The Contractor shall excavate the following locations. Should additional location information be needed, contact the Engineer.

1. The locations of the existing force main, electrical, and natural gas lines where crossings with the proposed concrete trench system are shown.
2. Along the storm drains for the trench system to their outfall manholes.

C. Submit location survey information in hard copy and electronic form to Engineer. Engineer will evaluate information for its impact on proposed structures and will revise the design as required to avoid impacting the existing piping and conduits.

D. Contractor shall backfill and compact the backfill over the exposed piping and conduits in accordance with the requirements of Section 31 23 00 – Excavation and Backfill and/or 31 23 33 Trenching and Backfill as appropriate for the location.

E. Disposal of excess soil material shall be in accordance with Section 31 22 00.

END OF SECTION

SECTION 31 22 00
GRADING

PART 1 – GENERAL

1.01 SUMMARY

A. Excavation, filling, and rough and finish grading the site to the elevations shown on the Drawings and as needed to meet the requirements of the Contract Documents.

1.02 DEFINITIONS

A. Influence Zone Under Foundations, Pavements, or Sidewalks: Area below foundation or pavement or sidewalk subbase bounded by 1 horizontal to 2 vertical slope extending outward from 1-ft beyond outer edge of foundation or pavement or sidewalk subbase.

B. Influence Zone Under Piping or Electrical Ducts: Area below limits bounded by line 6 in. below pipe or electrical duct and by 1 horizontal to 2 vertical slope extending outward from that line 1-foot beyond outer edge of pipe or duct.

C. Unsuitable Material: Topsoil, peat, organic soils, and materials containing slag, cinders, foundry sand, debris, and rubble or soil with less than required bearing capacity as determined by Engineer.

1.03 REFERENCES

A. ASTM: American Society for Testing and Materials

1.04 SUBMITTALS

A. Test Results.

1. Compaction test results.
2. Proctor test results.

B. Miscellaneous Submittals.

1. Test results to verify fill materials meet Specifications.

C. Submit in accordance with Section 01 33 00.

1.05 QUALITY ASSURANCE

A. Testing shall be provided by Contractor in accordance with Section 01 45 29 and this section.

1.06 PROJECT / SITE CONDITIONS

A. Notify owners of above or below ground utilities encountered during grading operations.

B. Cap and remove or relocate services in accordance with instructions of owners of such utilities.

C. Protect, support, and maintain conduits, wires, pipes or other utilities that are to remain in accordance with requirements of owners of such utilities.

D. Use means necessary to prevent dust from becoming a nuisance to the public, to neighbors, and to other work being performed on or near the site.

E. Maintain access to adjacent areas at all times.

PART 2 – PRODUCTS

2.01 FILL MATERIALS

A. Structural Fill: Conform to requirements of Section 31 23 00.

B. Earth Fill: Natural soils free of topsoil, wood, peat, cinders, organic and deleterious matter or other rubbish.

2.02 TOPSOIL

A. Friable, fertile soil of loamy character, containing an amount of organic matter normal to the region, capable of sustaining healthy plant life, and free from subsoil, roots, heavy or stiff clay, sand and gravel, stones larger than 1/2 inch, noxious weeds, sticks, brush, litter, and other deleterious matter.

B. Acidity Range: pH 5.0 minimum, 7.0 maximum.

C. Obtain topsoil from source stockpiled under Section 31 10 00, or provide imported topsoil obtained from sources outside the project limits, or from both sources. Stockpiled topsoil shall be screened to meet specified requirements.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work such as areas loosened by frost action or softened by flooding or weather, or existence of unsuitable material. Do not proceed until unsatisfactory conditions are corrected.

3.02 PREPARATION

A. Fill settled areas where excavations or trenches were backfilled and holes made by demolition, tree removal, and site preparation.

B. Proof roll areas to receive fill material to detect soft or loose zones prior to placing fill. Remove and replace soft or loose zones.

C. Natural soils or fill softened by frost, flooding or weather shall be removed and replaced.

D. Remove unsuitable material within influence zone under foundations, pavements, sidewalks, piping or electrical ducts.

E. Keep construction site free draining.

F. Plow, step, or bench slopes steeper than 1 vertical to 4 horizontal. Disc level surfaces.

3.03 EXCAVATION

A. Perform excavation to the lines, grades, and elevations indicated and specified herein.

B. Method of excavation shall be consistent with soil types encountered and result in undisturbed subgrade. Loosened soils shall be recompacted or removed and replaced.

C. Excavation of Rock:

1. Where rock, boulders, or similar material is encountered, and where such material cannot be removed or excavated by conventional earth moving or ripping equipment, remove or excavate such material by means which will neither cause additional cost to the Owner endanger buildings or structures on or off the site.
2. Do not use explosives without written permission from the Engineer.

D. Cut ditches and gutters accurately to the cross sections, grades, and elevations shown.

3.04 FILL USAGE

A. Structural: Within influence zone under foundations, pavements, sidewalks, piping or electrical ducts.

B. Earth: Other areas not previously specified.

3.05 PLACING FILL

A. Notify Engineer before placing fill material.

B. Do not use frozen material or place fill on frozen subgrade.

C. Do not operate power-operated earth moving equipment closer to foundation walls or other structures than distance equal to 1/2 height of fill above footing.

D. Place and compact fill materials in lift thickness and to densities listed.

1. Degree of compaction: ASTM D1557, Modified Proctor.
2. Moisture Content: Within 3% of optimum.

3.06 ROUGH GRADING

A. Grade to 6 inches below finished grade in areas to receive topsoil.

B. Grade to bottom of base course in areas to receive sidewalk or paving.

C. Rough grading, including excavated or filled sections and adjacent transition areas, shall be reasonably smooth, compacted, and free from irregular surface changes.

3.07 FINISH GRADING

A. Uniformly grade the areas within limits of grading, including adjacent transition areas, with uniform levels or slopes between points where elevations are shown on the Drawings, or between such points and existing grades.

B. Where a change of slope is indicated on the Drawings, construct a rolled transition section having a minimum radius of approximately 8 ft, unless adjacent construction will not permit

such a transition, or if such a transition defeats positive control of drainage.

C. Grade areas adjacent to buildings or structures to achieve drainage away from the structures, and to prevent ponding.

D. Maximum allowable variation from design elevation is 1 inch in 10 feet.

3.08 FIELD QUALITY CONTROL

A. Testing:

1. One field density test for each 200 cubic yards of structural fill, minimum one each lift.
2. One field density test for each 1000 cubic yards of earth fill.
3. Determine in-place density of fill at maximum intervals specified in accordance with ASTM D1556, D2167, D2922 or D2937.

3.09 ADJUSTMENT AND CLEANING

A. Remove and dispose of all unsuitable excavated material.

3.10 MAINTENANCE

A. Protection of Newly Graded Areas:

1. Protect newly graded areas from traffic and erosion, and keep free from trash and weeds.
2. Repair and reestablish grades in settled, eroded, and rutted areas to the specified tolerances.

B. Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify the surface, reshape, and compact to the required density prior to further construction.

END OF SECTION

SECTION 31 23 00
EXCAVATION AND FILL

PART 1 – GENERAL

1.01 SUMMARY

A. Excavation and backfilling for structures to elevations shown on Drawings and as needed to meet requirements of Contract Documents.

1.02 REFERENCES

A. ASTM: American Society for Testing and Materials

1.03 DEFINITIONS

A. Influence Zone Under Foundations, Pavements, or Sidewalks: Area below foundation or pavement or sidewalk subbase bounded by 1 horizontal to 2 vertical slope extending outward from 1-foot beyond outer edge of foundation or pavement or sidewalk subbase.

B. Influence Zone Under Piping or Electrical Ducts: Area below limits bounded by line 6 inches below pipe or electrical duct and by 1 horizontal to 2 vertical slope extending outward from that line 1-foot beyond outer edge of pipe or duct.

C. Unsuitable Material: Topsoil, peat, organic soils, and materials containing slag, cinders, foundry sand, debris, and rubble or soil with less than required bearing capacity as determined by Engineer.

1.04 SUBMITTALS

A. Test Results.

1. Compaction test results.
2. Proctor test results.

B. Miscellaneous Submittals.

1. Test results to verify fill materials meet Specifications.

C. Submit in accordance with Section 01 33 00.

1.05 QUALITY ASSURANCE

A. Testing shall be provided by Contractor in accordance with Section 01 45 29 and this Section.

B. Sheeting, Shoring, and Bracing:

1. Sheeting, shoring, and bracing shall conform to safety requirements of federal, state, and local agencies.
2. Sheeting, shoring, and bracing shall not affect structural integrity of new construction, water tightness or waterproofing of new construction, and shall allow for sufficient clearances necessary to install associated appurtenances adjacent to new construction.
3. Sheeting, shoring, and bracing shall not penetrate walls or slabs of new construction unless approved by Engineer.

1.06 PROJECT / SITE CONDITIONS

A. Notify Owners of above or below ground utilities encountered during excavation operations.

B. Cap and remove or relocate services in accordance with instructions of Owners of such utilities.

C. Protect, support, and maintain conduits, wires, pipes or other utilities that are to remain in accordance with requirements of Owners of such utilities.

D. Use means necessary to prevent dust from becoming a nuisance to the public, to neighbors, and to other work being performed on or near the site.

E. Maintain access to adjacent areas at all times.

PART 2 – PRODUCTS

2.01 FILL MATERIALS

A. Structural Fill:

1. Well-graded sand, well-graded sand and gravel, well-graded crushed stone or gravel, or other approved material, of 2 inch maximum size, free from organic and deleterious materials.
2. Plasticity Index: ASTM D4318, 6 or less. Plasticity Index shall be performed on fraction of material that passes the No. 40 sieve.
3. Maximum Fines: ASTM D422, 10% passing No. 200 sieve.
4. Uniformity Coefficient: 5 or greater.
5. Concrete may be used as Structural Fill when approved by Engineer.

B. Flowable Fill: Lean concrete with Portland cement, fly ash, fine and coarse aggregate, foaming agent or lightweight synthetic particles, lightweight aggregate, and admixtures as required to achieve a flowable mix with a minimum compressive strength of 30 pounds per square inch and a maximum unit weight of 60 pounds per cubic foot.

C. Earth Fill: Natural soils free of topsoil, wood, peat, cinders, organic and deleterious matter or other rubbish.

D. Free-Draining Fill:

1. ASTM C33, Size No. 67.
2. Washed crushed stone.
3. Maximum Fines: ASTM D422, 1% passing No. 200 sieve.

2.02 FILTER FABRIC

A. Porous non-woven fabric with multiple layers of randomly arranged fibers, min 4.0 ounce per square yard (typical).

B. Manufacturers:

1. Mirafi 140N by Mirafi, Inc.
2. Typar 340I by DuPont.
3. C-40NW by Contech.
4. FX-40HS by Carthage Mills.

5. Or Equal.

2.03 SHEETING, SHORING, AND BRACING

A. Type, design, detail, and installation of sheeting, shoring, and bracing shall be determined by and sole responsibility of Contractor.

2.04 SOURCE QUALITY CONTROL

A. Testing:

1. One sieve analysis, plasticity index, and uniformity coefficient for each source of structural fill.
2. One sieve analysis for each source of free-draining fill.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of Work, such as areas loosened by frost action or softened by flooding or weather, or existence of unsuitable material. Do not proceed until unsatisfactory conditions are corrected.

B. Proof-roll and examine surfaces to receive fill and subgrades within influence zone to determine existence of soft areas, areas loosened by frost action or softened by flooding, groundwater or weather or existence of unsuitable materials.

C. Where sensitive soils are encountered, requirement for proof rolling shall be waived, and Contractor shall perform alternative field testing to determine existence of soft areas. Method of alternative testing shall be approved by Engineer.

3.02 PREPARATION

A. Fill settled areas where excavations or trenches were backfilled and holes made by demolition, tree removal, and site preparation.

B. Natural soils or fill softened by frost, flooding or weather shall be removed and replaced.

C. Remove unsuitable material within influence zone under foundations, pavements, sidewalks, piping or electrical ducts.

D. Remove frozen soils within influence zone.

3.03 SHEETING, SHORING, AND BRACING

A. Whenever necessary to prevent caving during excavation and to protect adjacent piping, structures, property, workers, and the public; excavations shall be sheeted, shored, and braced.

B. When sheeting, shoring, and bracing is required, install to prevent soil from entering excavation below or through sheeting.

C. Keep sheeting, shoring, and bracing in place until structure is placed, tested, and backfilled.

D. Remove sheeting, shoring, and bracing in manner not damaging to structure or permitting voids within backfill.

E. Fill settled areas after sheeting, shoring, and bracing has been removed.

3.04 DEWATERING

A. Contractor shall dewater excavation site prior to starting excavation and shall maintain groundwater minimum of 12 inches below bottom of excavation.

B. Contractor is responsible for choosing method of groundwater control.

C. If Contractor chooses to use deep wells or well points, wells and well points shall be designed, installed, and operated to prevent removal of in-situ materials.

D. Keep construction site free-draining. Keep excavations free of water.

E. Remove soil disturbed by pressure or flow of groundwater.

F. Maintain dewatering system to prevent uplifting of or damage to structures.

G. Protect adjacent utilities, structures, and properties from damage resulting from dewatering operations.

H. Drill, maintain, and abandon dewatering wells in accordance with federal, state, and local ordinances.

3.05 EXCAVATION

A. Excavate to the lines, grades, and elevations indicated and necessary to complete construction.

B. Method of excavation shall be consistent with soil types encountered and result in undisturbed subgrade. Loosened soils shall be recompacted or removed and replaced.

C. Over-excavate to limits noted on Drawings.

D. Protect excavated areas from freezing.

3.06 FILL USAGE

A. Structural: Within influence zone under footings and foundations, floor slabs, pavements, sidewalks, piping or electrical ducts. Provide a minimum 6 inch layer under floor slabs when subbase material is not granular in nature.

B. Flowable: Where noted.

C. Free-Draining: Where noted.

D. Earth: Other areas not previously specified.

3.07 PLACING FILL

A. Notify Engineer before placing fill material.

B. Do not use frozen material or place fill on frozen subgrade.

C. Place filter fabric where indicated in accordance with manufacturer's recommendations.

D. Do not backfill until concrete is properly cured and has reached 85% of design strength, coatings approved, and required tests accepted.

E. Place fill simultaneously on both sides of free standing structures.

F. Do not operate power-operated earth moving equipment closer to foundation walls or other structures than distance equal to ½ height of fill above footing.

G. Begin compaction of each layer at structure wall to minimize lateral forces against structure due to wedging action of soil.

H. Stop backfill at specified grade to allow for placing topsoil or sidewalk or pavement subbase.

I. Place and compact fill materials in lift thickness and to densities listed.

1. Degree of compaction: ASTM D1557, Modified Proctor.
2. Moisture Content: Within 3% of optimum.

Location	Maximum Lift Thickness	Modified Proctor (%)
Footing, Foundation Slab, or Floor Slab Influence Zone	8 inches	95 minimum
Sidewalk, Pavement, Piping, or Electrical Duct Influence Zone	8 inches	90 minimum
Lawn and Landscaped Areas	12 inches	80 minimum, 90 maximum

J. Free-draining fill below tanks and foundations shall be compacted in max 8-in. lifts with min 10-ton smooth vibratory roller. Make a minimum of 3 passes in each direction. In areas not accessible to roller, compact with equipment acceptable to Engineer.

3.08 FIELD QUALITY CONTROL

A. Testing:

1. One field density test for each 25 cubic yards of structural fill, minimum one each lift.
2. One field density test for each 500 cubic yards of earth fill.
3. Determine in-place density of fill at maximum intervals specified in accordance with ASTM D1556, D2167, D2922 or D2937.

3.09 ADJUSTMENT AND CLEANING

A. Remove excess material not required by Owner, material not suitable for backfilling or site grading, and unsuitable materials from site.

B. Conform to the requirements of Section 31 23 33.

END OF SECTION

SECTION 31 23 33
TRENCHING AND BACKFILL

PART 1 – GENERAL

1.01 SUMMARY

A. Trenching and backfilling to elevations shown on Drawings and as needed for installation of underground piping and utilities associated with Work and to meet requirements of Contract Documents.

1.02 REFERENCES

A. ASTM: American Society for Testing and Materials

1.03 DEFINITIONS

A. Influence Zone Under Foundations, Pavements, or Sidewalks: Area below foundation or pavement or sidewalk subbase bounded by 1 horizontal to 2 vertical slope extending outward from 1-foot beyond outer edge of foundation or pavement or sidewalk subbase.

B. Influence Zone Under Piping or Electrical Ducts: Area below limits bounded by line 6 in. below pipe or electrical duct and by 1 horizontal to 2 vertical slope extending outward from that line 1-foot beyond outer edge of pipe or duct.

C. Unsuitable Material: Topsoil, peat, organic soils, and materials containing slag, cinders, foundry sand, debris, and rubble or soil with less than required bearing capacity as determined by Engineer.

1.04 SUBMITTALS

A. Test Results.

1. Compaction test results.
2. Proctor test results.

B. Miscellaneous Submittals.

1. Test results to verify fill materials and bedding and cover materials meet Specifications.

C. Submit in accordance with Section 01 33 00.

1.05 QUALITY ASSURANCE

A. Testing shall be provided by Contractor in accordance with Section 01 45 29 and this Section.

B. Sheeting, shoring, and bracing shall conform to safety requirements of federal, state, and local agencies.

1.06 PROJECT / SITE CONDITIONS

A. Notify owners of above or below ground utilities encountered during trenching operations.

B. Cap and remove or relocate services in accordance with instructions of owners of such utilities.

C. Protect, support, and maintain conduits, wires, pipes or other utilities that are to remain in accordance with requirements of owners of such utilities.

D. Use means necessary to prevent dust becoming a nuisance to the public, to neighbors, and to other work being performed on or near the site.

E. Maintain access to adjacent areas at all times.

F. Trenching and backfilling within influence zone of new or existing structures shall conform to the requirements of Section 31 23 00.

PART 2 – PRODUCTS

2.01 BEDDING MATERIALS

A. Subgrade stabilizing aggregate, if required, shall be INDOT No. 2 crushed stone or Class B concrete.

B. Pipe bedding material shall be INDOT No. 8 or 11 crushed stone or fractured face aggregate.

C. Bedding for manholes or trench stabilizing material shall be INDOT No. 2 crushed stone.

2.02 COVER MATERIALS

A. To the extent shown on the drawings, INDOT No. 8 or 11 crushed stone or fractured face aggregate shall be used for all pipe materials.

2.03 BACKFILL MATERIALS

A. To the extent shown on the drawing, structural backfill shall be used for all areas under pavement and sidewalk.

B. See Section 31 23 00 for definitions of structural and flowable fills.

2.04 FILTER FABRIC

A. Porous non-woven fabric with multiple layers of randomly arranged fibers, min 4.0 ounce per square yard (typical).

B. Manufacturers:

1. Mirafi 140N by Mirafi, Inc.
2. Typar 340I by DuPont.
3. C-40NW by Contech.
4. FX-40HS by Carthage Mills.
5. Or Equal.

2.05 SHEETING, SHORING, AND BRACING

A. Type, design, detail, and installation of sheeting, shoring, and bracing shall be determined by and sole responsibility of Contractor.

2.06 SOURCE QUALITY CONTROL

A. Testing:

1. One sieve analysis, plasticity index, and uniformity coefficient for each source of structural fill.
2. One sieve analysis for each source of bedding material and cover material.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work such as areas loosened by frost action or softened by flooding or weather, or existence of unsuitable material. Do not proceed until unsatisfactory conditions are corrected.

3.02 PREPARATION

A. Natural soils or fill softened by frost, flooding or weather shall be removed and replaced.

B. Remove unsuitable material from within trenches. Engineer and contractor will inspect subgrade materials and determine suitability for placing bedding material.

C. Stabilize trench bottom and replace unsuitable materials with INDOT No. 2 stone.

D. Where placement of coarse aggregate will not provide an adequate foundation for laying pipe due to instability of existing materials and where ordered by Engineer, place geotextile fabric on top of unstable subgrade materials prior to placing coarse aggregate. Sufficient geotextile fabric shall be used to completely enclose foundation materials and pipe.

3.03 SHEETING, SHORING, AND BRACING

A. Whenever necessary to prevent caving during excavation and to protect adjacent piping, structures, property, and workers, trenches shall be sheeted, shored, and braced.

B. When sheeting, shoring, and bracing is required, install to prevent soil from entering excavation below or through sheeting.

C. Remove sheeting, shoring, and bracing after backfilling, or when approved by Engineer as backfill is being placed.

D. Remove sheeting, shoring, and bracing in manner not damaging to facility or permitting voids within backfill.

E. Fill settled areas after sheeting, shoring, and bracing has been removed.

3.04 DEWATERING

A. Dewater excavation site prior to starting trenching and maintain groundwater minimum of 12 inches below bottom of trench. Dewatering system shall be of a sufficient size and capacity as required to control hydrostatic pressure on trench sides and bottom to allow material to be excavated, pipe chase installed and backfill placed, all in a dry condition.

B. Contractor is responsible for choosing method of groundwater control. Deep-well or wellpoint system may be required in portions of this Project. Sequence of installation of components of

dewatering system shall be in accordance with the approved dewatering plan. System shall remain in continuous operation until pipe is installed and backfilled.

C. If Contractor chooses to use deep wells or well points, wells and well points shall be designed, installed, and operated to prevent removal of in-situ materials.

D. Drill, maintain, and abandon dewatering wells in accordance with federal, state, and local ordinances.

E. Keep construction site free-draining. Keep trenches free of water.

F. Remove soil disturbed by pressure or flow of groundwater.

G. Maintain dewatering system to prevent uplifting of or damage to facilities.

H. Protect adjacent utilities, structures, and properties from damage resulting from dewatering operations.

I. Direct discharge of trench dewatering pumps to sediment traps before conveying to natural drainage channels or storm water drains.

3.05 EXCAVATION

A. Excavate to the lines, grades, and elevations indicated and necessary to complete construction.

B. Method of excavation shall be consistent with soil types encountered and result in undisturbed subgrade. Loosened soils shall be recompacted or removed and replaced.

C. Where possible, excavated materials shall be placed in areas that will not block existing vehicle and pedestrian traffic and drainageways.

D. Conduct excavating operations to carefully expose all in-place underground structures without damage. Wherever excavation extends under or approaches close to an existing structure, precautions and protective measures shall be taken as necessary to preserve the structure and provide temporary support. Use hand excavation methods to probe for and expose such critical or hazardous installations as gas pipe and power or communication cables.

E. Excavation of Rock:

1. Where rock, boulders, or similar material is encountered, and where such material cannot be removed or excavated by conventional earth moving or ripping equipment, remove or excavate such material by means which will neither cause additional cost to the Owner nor endanger buildings or structures on or off site.
2. Do not use explosives without written permission from Engineer.

F. Trench Tolerances:

1. Maximum width of trench at top of pipe shall be outside diameter of pipe plus 24 inches. When sheeting, shoring, and bracing required, width of trench may be increased to allow for their use, provided provisions for excess width of trench are met.
2. Where trench width below top of pipe exceeds specified limit, Contractor, at his expense, shall furnish pipe with strength adequate for actual trench width.
3. Minimum trench width shall be outside diameter of pipe plus 18 inches

4. Top of concrete encasement for electrical duct or top of conduit shall be minimum of 24-inches below final grade or as shown on Drawings.
5. Trench width at ground surface shall be the minimum allowable based on OSHA standards and soil types.

G. Do not excavate within influence zone of existing footings or foundations without prior approval of Engineer.

H. Excavation through Rigid Pavement:

1. Remove pavement a minimum of 1 foot beyond anticipated edge of excavation.
2. Saw cut pavement to ensure straight joint.
3. Pavement replacement shall match existing.

I. Excavation, backfill, and pavement replacement of roadways shall conform to requirements of local highway authority. In no case shall the replacement pavement edges bear on less than 12 inches of undisturbed soil.

3.06 FILL USAGE

A. Bedding Material:

1. Plastic, Copper, Fiberglass or Reinforced Plastic Pipe, and Electrical Conduit or Ducts: INDOT No. 23
2. Other Pipe 18-inch diameter or less: INDOT No. 8
3. Other Pipe over 18-inch diameter: INDOT No. 8

B. Bedding Material Limits:

1. Electrical Ducts:

a. Hand grade bottom of trench to established uniform grade of not less than 4 inches / 100 feet.
b. Use bedding material to bring grade to desired elevation.

2. Bedding material shall be placed over entire width of trench bottom such that after pipe has been placed thereon, imbedded to grade and aligned, there remains a 6 inch minimum depth of material below pipe barrel and a minimum of 5 inches below the bell.
3. Bell holes shall be excavated so that entire pipe barrel rests on bedding.

C. Cover Material:

1. Copper, Fiberglass or Reinforced Plastic Pipe and Electrical Conduit: INDOT No. 23
2. Other Piping: INDOT No. 8
3. Electrical Ducts: Structural Fill or Excavated Trench Material.
4. Bedding material may be substituted for cover material.

D. Cover Material Limits:

1. Electrical Conduit: Minimum 6 inches above and 9 inches each side.
2. Piping: Minimum of 12 inches above top of pipe and 12 inches each side.

E. Structural Fill: Within trenches under pavements and sidewalks and within piping, electrical duct or structure influence zone.

F. Excavated Trench Material: Other areas not previously specified.

G. Flowable Fill: Where noted.

3.07 PLACING FILL

A. Notify Engineer before placing fill material.

B. Do not use frozen material or place fill on frozen subgrade.

C. Place filter fabric where indicated in accordance with manufacturer's recommendations.

D. Do not backfill until concrete is properly cured and has reached design strength, coatings approved, and required tests accepted.

E. Place fill simultaneously on both sides of freestanding structures.

F. Where pipes leave structures, protect by backfilling pipe influence zone down to undisturbed soil with bedding material.

G. Where pipes or electrical ducts cross, protect piping or ducts at higher elevation by backfilling trench within influence zone of higher pipe or duct with structural fill.

H. Where pipes or electrical ducts leave structures, protect by backfilling within influence zone of pipe or duct with structural fill.

I. Provide mechanical compaction. Jetting, flooding, puddling, or vibroflotaion methods shall not be used for compaction.

J. Place and compact bedding, cover and fill materials in lift thickness and to densities listed below:

1. Degree of compaction: ASTM D1557, Modified Proctor.
2. Moisture Content: Within 3% of optimum.

Location	Maximum Lift Thickness	Modified Proctor (%)
Bedding Material or Cover Material	6 inches	90 minimum
Fill material under Footing, Foundation Slab, Floor Slab Influence Zone, **Trenwa System**	8 inches	95 minimum
Fill material under Sidewalk, Pavement, Crushed Aggregate Base Course, Piping, or Electrical Duct Influence Zone	8 inches	90 minimum
Fill material under Lawn and Landscaped Areas	12 inches	80 minimum, 90 maximum

3.08 FIELD QUALITY CONTROL

A. Testing:

1. One field density test for each 50 cubic yards, bedding material and cover material, minimum one each lift.
2. Trench Backfill Material: One field density test for each 100 cubic yards.
3. Determine in-place density of fill at maximum intervals specified in accordance with ASTM D1556, D2167, D2922 or D2937.

4. Recompact and retest areas of backfill tested that did not meet minimum requirements.
5. Trenwa System bedding shall be tested every 10 feet, to standards described in section 3.07 J.

3.09 ADJUSTMENT AND CLEANING

A. Stockpile material suitable for backfill where designated by Engineer. Place no fill where trenches for sewers, water line, or other utilities will be located.

B. Remove and dispose of all unsuitable excavated material.

C. Conform to excess material requirements in Section 31 22 00.

END OF SECTION

SECTION 31 25 00
EROSION AND SEDIMENTATION CONTROL

PART 1 – GENERAL

1.01 SUMMARY

A. Section describes requirements for control of erosion on construction sites. Contractor shall provide necessary materials, equipment, and labor to control erosion by methods specified herein. If no specific quantities are shown on Plans, Contractor shall use whatever quantities are necessary to prevent sediment transport into adjacent storm water conveyance systems or water bodies.

B. Section includes:

1. Silt Fence
2. Temporary Seeding
3. Temporary Mulch
4. Concrete Washout Basin

1.02 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit data on all products.

1.03 QUALITY ASSURANCE

A. In accordance with the Indiana Department of Transportation Standard Specifications, Drawings and Special Provisions, Latest Revision and the Indiana Department of Environmental Management, Indiana Storm Water Quality Manual, Latest Edition, unless otherwise directed by these specifications

B. All work shall be in accordance with requirements in Indiana Administrative Code 27 IAC-15-1 and 327 IAC-15-5 “Rule 5 Storm Water Run-off Associated with Construction Activity” and any and all subsequent additions and revisions.

C. Temporary sediment and erosion control may also include work outside the known construction limits such as borrow pit and disposal operations, equipment, and material storage sites, waste areas, and temporary plant sites. Once established, the contractor shall incorporate these areas into the Revised Erosion and Sediment Control Plan.

D. Temporary erosion control measures contained herein shall be coordinated with the permanent erosion control measures specified as part of this contract to the extent practical to assure economical, effective and continuous erosion control throughout the construction period.

PART 2 – PRODUCTS

2.01 TEMPORARY SILT FENCE, TYPE A

A. Geotextile Fabric is 36-inches wide, may be woven or non-woven, made from polypropylene, polyethylene, or polyamide, and shall contain sufficient UV inhibitors so that it will last for 6 months in outdoor exposure at temperatures between zero and 120 degrees F.

B. The manufacturer shall have either an approved color mark yarn in the fabric or label the

fabricated silt fence with both the manufacturer and fabric name every 100 feet.

C. Fabric shall have the following properties:

1. Grab tensile strength: 90 lbs, ASTM D4632
2. Elongation at 45lbs: 50% maximum, ASTM D-4632
3. Burst strength: 175psi, ASTM D3786
4. Apparent opening size: #20 sieve size, ASTM D4751
5. Water Flow Rate: 0.00016 GPM (gallons per minute)
6. UV Degradation: 70% at 500 hours, ASTM D 4355
7. Filtration Efficiency: 85%

2.04 SILT FENCE POSTS & STAKES

A. Type 'A' Silt Fence posts shall be made from oak or approved hardwood, at least 1-1/4-inch by 1- 3/4-inch and minimum 48-inches long.

B. Manufactured Surface Protection Products, RECP Staples shall be made from No. 11 gage (3 mm) or heavier wire, 1 or 2 in. wide at the throat and 8 in. from top to bottom after bending. The staples shall be packaged in cartons.

2.05 TEMPORARY SEED MIXTURE, TYPE T

A. Temporary Seeding: Shall be in accordance with Section 205.04 of the Indiana Department of Transportation Standard Specifications, Latest Revision and with the Indiana Department of Environmental Management, Indiana Storm Water Quality Manual, Latest Edition.

B. Seed mixture T shall be used for surface stabilization and temporary ground cover. The mix shall be Rolled Erosion Control Products (RECP) where the slopes are steeper than 3:1.

C. No surface application of fertilizer shall be applied on the project site for the duration of construction.

2.06 TEMPORARY MULCH

A. Temporary Mulching: Shall be in accordance with Section 205.04 of the Indiana Department of Transportation Standard Specifications, Latest Revision and with the Indiana Department of Environmental Management, Indiana Storm Water Quality Manual, Latest Edition.

2.07 CONCRETE WASHOUT BASIN

A. Shall be in accordance with applicable sections of the Indiana Department of Transportation Standard Specifications, Latest Revision and with the Indiana Department of Environmental Management, Indiana Storm Water Quality Manual, Latest Edition.

B. Small amounts of excess or residual concrete (not washout water) may be disposed of in areas that will not result in flow to an area that is to be protected.

C. Locate concrete washout systems at least 50 feet from any creeks, wetlands, ditches karst features, or storm drains/man made conveyance systems.

D. The structure or system shall be designed to contain the anticipated washout water associated with construction activities.

E. A system designed and built above grade shall be a minimum of ten feet wide by ten feet long, but sized to contain all liquid and waste that is expected to be generated between scheduled clean out periods. The size of the containment system may be limited by the size of polyethylene available. The polyethylene lining shall be of adequate size to extend over the berm or containment system.

F. Polyethylene sheeting shall be a minimum of ten mills that is free of holes, tears, and other defects. The sheeting selected shall be of an appropriate size to fit the washout system without seams or overlap of the lining.

PART 3 – **EXECUTION**

3.01 SITE STABILIZATION

A. Incorporate erosion control devices indicated on the Drawings into the Project at the earliest practicable time.

B. Install concrete washout basin into the Project before paving activities begin.

C. Sediment and erosion control measures may be adjusted to meet field conditions. If adjustments in the field are necessary, the Contractor shall submit the nature of the adjustments, and locations of the adjustments to the Engineer/Owner, in writing.

D. Before any earth moving activities commence, all perimeter protection measures shall be installed.

E. When there are established lawns in the work area, the turf shall be covered and/or protected or replaced after construction operations. Identify existing surface features that are to be preserved on site by appropriate tags and protect in accordance with the details shown on the drawings.

F. All mud/dirt and other construction debris tracked on existing city/state/county roads from this site, due to construction, shall be promptly removed by the Contractor at minimum of twice daily.

G. Stabilize any disturbed area of affected erosion control devices on which activity has ceased and which will remain exposed for more than 14 days in accordance with all applicable portions of the Indiana Department of Transportation Standard Specifications, Latest Revision.

H. Perform work in accordance with the Indiana Department of Environmental Management, Indiana Storm Water Quality Manual, Latest Edition, unless otherwise directed by these specifications.

I. Manufactured Surface Protection Products, RECP shall be utilized in locations where grass stabilization has been directed as Post Construction Stabilization and in temporary locations where the slopes are 3:1 or steeper.

3.02 INSTALLATION OF EROSION CONTROL MEASURES

A. All erosion control measures shall be installed in accordance with applicable portions of Sections 205 and 621 of the Indiana Department of Transportation Standard Specification, Latest Revision.

B. All erosion control measures shall be installed in accordance with Manufacturer's recommendations, specifications and installation guidance manuals.

C. Legible copies of all necessary current manufacturers' installation manuals shall be provided prior to installation. Required warning systems shall be in accordance with applicable local and federal laws and regulations.

3.03 REMOVAL OF SEDIMENT AND EROSION CONTROL MEASURES

A. Keep the sediment and erosion control measures in place until construction and all land-disturbing activities have been completed and the area has been stabilized, as directed by the Engineer/Owner, Project is accepted.

B. Remove all temporary erosion and sediment control measures in a manner that minimizes land disturbance. Areas left void of protective cover due to the removal of a measure shall be permanently stabilized immediately.

C. All parts of the sediment and erosion control measures and silt accumulations shall be removed in accordance with applicable portions of Section 202 and 205 of the Indiana Department of Transportation Standard Specification, Latest Revision.

END OF SECTION

DIVISION 32

EXTERIOR IMPROVEMENTS

SECTION 32 11 23
AGGREGATE BASE COURSES

PART 1 – GENERAL

1.01 SUMMARY

A. Provide crushed aggregate base course where shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

1.02 DEFINITIONS

A. INDOT Specs: Indiana Department of Transportation Standard Specification, latest edition

B. ASTM: American Society for Testing and Materials

C. AASHTO: American Association of State Highway and Transportation Officials

1.03 SUBMITTALS

A. General:

1. Submit Product Data in sufficient detail to confirm compliance with requirements of this Section. Submit Product Data and Shop Drawings in one complete submittal package. Partial submittals are unacceptable.

B. Source of Aggregates

C. Test Results of Quality Assurance Testing

D. Submit in accordance with Section 01 33 00.

1.04 QUALITY ASSURANCE

A. Perform the following testing:

1. Aggregate Gradation in accordance with AASHTO T 27

B. Test Aggregate Gradation during placement, one test per day.

PART 2 – PRODUCTS

2.01 PAVEMENT MATERIALS

A. Aggregate:

1. Furnish aggregate from local Department of Transportation approved sources.
2. Conform to INDOT Section 904 for gradation requirements.
3. INDOT #53

PART 3 – **EXECUTION**

3.01 PREPARATION

A. Check subbase for soundness, outline, and contour. Prepare areas for base course placement on subbase by scraping down or filling irregularities. Compact subbase prior to basecourse placement.

B. Proof roll the prepared subbase. Make multiple passes to test entire area. Remove and replace areas where displacement in base (yielding, heaving, cracking or other signs of instability), in the opinion of the Engineer, is more than 1 inch under a fully-loaded tandem-axle dump truck. Excavate and backfill displaced areas with new base course material, compact, and retest. Do not begin placement of base course until deficient areas have been corrected.

C. Excess material shall be handles in accordance with Section 31 22 00.

3.02 DELIVERY, STORAGE, AND HANDLING

A. Adjust weight, type, capacity, haul routes, and method of operation of hauling vehicles such that there is no damage to existing streets, subgrade, or base course.

B. Owner has final authority to designate haul routes, procedures, and operation times

3.03 INSTALLATION

A. Construct aggregate base course in two or more layers of approximately equal thickness.

B. Maximum compacted thickness of layer shall not exceed 6 inches.

C. Deposit material on foundation or previously placed layer to minimize segregation and facilitate spreading to uniform layer.

D. Compact after each layer has been placed and spread to thickness, width, and contour to 95% of maximum density (Standard Proctor), in accordance with ASTM D-1557, before succeeding layer is placed.

3.04 FIELD QUALITY CONTROL

A. Check in-place base course for surface irregularities and repair unacceptable areas.

END OF SECTION

SECTION 32 12 16
ASPHALT PAVING

PART 1- GENERAL

1.01 SUMMARY

A. Provide asphalt pavement where shown on Drawings, as specified herein, and as needed for a complete and proper installation.

B. Asphalt Pavement thickness:

1. Upper Layer (Surface Course): 2 inches
2. Base Layer (Binder Course): 2.5 inches

1.02 DEFINITIONS

A. INDOT Specifications: Indiana Department of Transportation Standard Specification, latest edition

B. ASTM: American Society for Testing and Materials

C. AASHTO: American Association of State Highway and Transportation Officials

1.03 SUBMITTALS

A. General:

1. Submit Product Data in sufficient detail to confirm compliance with requirements of this Section. Submit Product Data and Shop Drawings in one complete submittal package. Partial submittals are unacceptable.

B. Source of Aggregates showing use on previous local Department of Transportation Projects.

C. Asphalt Mix Design, including aggregate gradation, showing use on previous local Department of Transportation Projects.

D. Test Results of Quality Assurance Testing

E. Submit in accordance with Section 01 33 00.

1.04 QUALITY ASSURANCE

A. Asphalt supplier shall have a minimum of 5 years of experience producing asphalt mixes for the Department of Transportation.

B. Do not commence placement of asphalt until mix design has been reviewed and approved by Engineer.

C. Perform the following testing during asphalt mix production:

1. Aggregate Gradation in accordance with AASHTO T 27
2. Asphalt Content.
3. Air Voids by calculation in accordance with AASHTO T 269.

4. Voids in Mineral Aggregate (VMA) by calculation in accordance with AASHTO R 35.

D. One sample per day per source of asphalt shall be obtained regardless of quantity placed.

E. Testing shall be provided by Contractor in accordance with Section 01 45 29 and this section.

PART 2 - PRODUCTS

2.01 PAVEMENT MATERIALS

A. Aggregate:

1. Furnish coarse aggregate from local Department of Transportation approved sources.

2. Aggregate for Bituminous Base:

a. Sound, angular crushed stone, crushed gravel, or crushed slag, sand, stone or slag screenings.
b. Uncrushed gravel may be used in base course mixture if required to suit local material availability.
c. Gradation: Well graded between limits specified and shall conform to INDOT Specs Subsection 401.05, gradation No. 8, Class D or higher.

3. Aggregate for Bituminous Surface:

a. Crushed stone, crushed gravel, crushed slag, and sharp-edged natural sand.
b. Sand prepared from stone, blast-furnace slag, gravel, or combinations thereof may be used if required to suit local material availability.
c. Gradation: Well graded between limits specified and shall conform to INDOT Specs Subsection 401.05, gradation No. 11, Class B or higher.

4. Mineral Filler: Rock or slag dust, hydraulic cement, or other inert material complying with ASTM D242.

B. Bituminous Materials:

1. Asphalt Cement: Performance Grade PG 58-28 in accordance with ASTM D946.

C. Mix Design:

1. Conform to Section 401.04 of INDOT Specifications.
2. ESAL Category 2.

D. Tack Coat

1. Tack Coat: Emulsified asphalt meeting the one of the following Types per AASHTO M 140: AE-T, AE-PMT, SS-1h

E. Recycled Asphalt Pavement

1. Stockpile recycled asphalt pavement separately from virgin materials and list each as individual job mix formula components.
2. Conform to the following maximum allowable percent binder replacement (ratio of recovered binder to total binder):
   a. Lower Layer: 35%
   b. Upper layer: 25%

PART 3 - EXECUTION

3.01 WEATHER LIMITATION

A. Apply tack coats when ambient temperature is above 35 degrees Fahrenheit. Do not apply when base is wet or contains standing water.

B. Place asphalt material when atmospheric temperature is above 45 degrees Fahrenheit and rising, and when base is dry.

C. Do not place asphalt material on frozen subgrade or base.

3.02 PREPARATION

A. Check base course for soundness, outline, and contour. Prepare base course for areas to be paved by scraping down or filling irregularities. Compact base course prior to paving.

B. Proof roll prepared aggregate base course to check for unstable areas and areas requiring additional compaction. Make multiple passes to test entire area to be paved. Remove and replace any area where displacement in base (yielding, heaving, cracking or other signs of stability), in opinion of Engineer, is more than 1 inch under a fully-loaded tandem-axle dump truck. Excavate and backfill displaced area with new base material, properly compacted and retested. Do not begin paving work until deficient areas have been corrected.

C. Tack Coat:

1. Apply to contact surfaces of previously paved surfaces abutting or projecting into areas to be paved.
2. Apply to surface free of loose dirt, dust or other foreign matter.
3. Apply at a rate of 0.025 gallon per square yard of surface.
4. Apply only to areas expected to be paved in the same day.
5. Allow to dry prior to paving.
6. Avoid tracking or smearing bituminous materials onto adjoining surfaces. Remove material tracked or smeared to adjoining surfaces.

3.03 DELIVERY, STORAGE, AND HANDLING

A. Transport asphalt materials in covered trucks during rainy weather and when air temperature falls below 65 degrees F.

B. Adjust weight, type, capacity, haul routes, and method of operation of hauling vehicles such that no damage results to existing streets, subgrade, or base course.

C. Owner has final authority to designate haul routes, procedures, and operation times.

3.04 PLACING ASPHALT MIX

A. Place asphalt mixture on prepared surface, spread, and strike-off. Spread mixture at a temperature within 20 degrees Fahrenheit of temperature the asphalt material supplier recommends.

B. Place using a self-propelled paver to ensure uniform spreading and strike-off of mix. Provide a smooth mixture free of tearing and segregation. Place mixture to required grade, cross-section, and compacted thickness.

C. Place inaccessible and small areas by hand. Place mixture to required grade, cross-section, and compacted thickness.

D. Joints: Place asphalt continuously to limit the number of joints. Make joints between old and new pavements and between successive days' work, to ensure continuous bond between adjoining work. Clean contact surfaces and apply tack coat. Construct joints to have same texture, density, and smoothness as other sections of asphalt pavement.

3.05 COMPACTION

A. Compact asphalt mix while still hot. Compact each layer by uniformly rolling.

B. In small areas not accessible by a roller, compact using mechanical tampers.

C. Compact until no further consolidation is visible under action of the compaction equipment.

D. Keep roller wheels moistened to avoid sticking.

E. Compact upper layer to 91.5% of the maximum density. Compact lower layers constructed over aggregate base to 89.5% of the maximum density. Do not re-roll compacted mixtures falling below required densities. If densities fall below the required densities, stop placement and identify and correct problem.

3.06 FIELD QUALITY CONTROL

A. Pavement Testing:

1. General: Test in-place asphalt courses for compliance with requirements for surface smoothness and thickness. Repair or remove and replace unacceptable paving.

2. Thickness Tolerance: In-place compacted thickness will not be acceptable if actual thickness exceeds the following allowable variation from required thickness:

   a. Binder Course: 1/4 inch.
   b. Surface Course: 1/8 inch.

3. Surface Smoothness Tolerances: Test finished surface of each asphalt concrete course for smoothness, using 10 foot straight edge applied parallel with, and at right angles to, the centerline of paved area. Surfaces will not be acceptable if deviations exceed 1/8 inch.

4. Provide nuclear density testing, 3 random locations per lift.

END OF SECTION

SECTION 32 16 23
SIDEWALKS

PART 1 – GENERAL

1.01 SUMMARY

A. Provide portland cement concrete sidewalk including form work and reinforcement, base materials with compaction, where shown on Drawings, as specified herein, and as needed for a complete and proper installation.

1.02 REFERENCES

A. ASTM: American Society for Testing and Materials

B. CRSI: Concrete Reinforcing Steel Institute

C. NRMCA: National Ready Mixed Concrete Association

1.03 SUBMITTALS

A. General:

1. Submit Product Data in sufficient detail to confirm compliance with requirements of this section.

B. Product Data:

1. Verification of concrete mix design.

C. Test Results:

1. Tests indicating compliance of reinforcement with referenced standards.
2. Concrete test results.
3. Base material test results.
4. Concrete delivery tickets: With each load of concrete delivered, provide duplicate tickets, one for Contractor, one for Engineer, with following information.

a. Serial number of ticket.
b. Date and truck number.
c. Name of supplier.
d. Class of concrete.
e. Type of cement and cement content in bags/cubic yard.
f. Admixture brand names.
g. Aggregate size.
h. Time loaded.
i. Amount of concrete in load.
j. Gallons of water added at site and slump of concrete after addition of water.
k. Temperature of concrete at delivery.
l. Time unloaded.

5. Certified reports of field tests and observations.

D. Submit in accordance with Section 01 33 00.

1.04 QUALITY ASSURANCE

A. Plant Certification: Plant or concrete supplier shall comply with requirements of NRMCA certification plan as regards material storage and handling, batching equipment, central mixer, truck mixers with counters, agitators, nonagitating units, and ticketing system.

B. Do not commence placement of concrete until mix designs have been reviewed and approved by Engineer.

C. Concrete Testing: Testing shall be provided by Contractor in accordance with Section 01 45 29 and this Section.

1. Conduct tests on sample material in accordance with methods listed below:

a. Slump: ASTM C143.
b. Air-Entrainment: ASTM C231.
c. Compressive Strength: ASTM C31 and ASTM C39.

PART 2 – PRODUCTS

2.01 BASE MATERIAL

A. Aggregate Base Courses in accordance with Section 32 11 23, or

2.02 FORMS

A. Construct forms to exact sizes, shapes, lines, and dimensions shown, and as required to obtain accurate alignment, location, grades, and level and plumb work in finished concrete. All forms must be inspected and approved by Engineer, prior to placement of concrete.

B. Forms shall be straight and of sufficient strength to resist pressure of concrete without bending, tipping, or other deformation. Bracing and staking of forms shall be such that the forms remain in both horizontal and vertical alignment until their removal.

C. Forms shall not be removed from freshly placed concrete until it has hardened sufficiently to resist spalling, cracking or any other damage.

D. Slip form machines may be used provided sidewalk can be constructed to the requirements of specifications.

2.03 CONCRETE

A. Conform to Section 03 30 00.

1. Class A2.

2.04 OTHER MATERIALS

A. Curing Compounds:

1. AASHTO M148, Type 2.

B. Preformed Expansion Joint Material:

1. Meet requirements of ASTM D 1751.
2. 1/2 inch thick and premolded.

PART 3 – EXECUTION

3.01 PREPARATION

A. Place base material in accordance with Section 32 11 23.

B. Check base course outline, and contour. Scrape down or fill irregularities.

C. Compact base course prior to paving.

D. Set castings and frames of manholes, catch basins, etc. to required alignment and grade. Hand vibrate concrete adjacent to structures.

E. Remove foreign matter accumulated in formwork. Forms may be oiled, if necessary.

F. Comply with Section 31 22 00 with excavated materials.

3.02 MIXING AND DELIVERY

A. Use ready mixed concrete conforming to ASTM C94.

B. Deliver and complete discharge within 1-1/2 hours of commencing of mixing. Limitations may be waived by Engineer if concrete slump, after 1-1/2 hours, is sufficient so that concrete can be placed without addition of water. In hot weather, time criteria may be reduced by Engineer.

C. Do not use concrete that has stood for over 30 minutes after leaving the mixer.

3.03 CONVEYING CONCRETE

A. Perform concrete placement at such a rate that concrete which is being integrated with fresh concrete is still plastic.

B. Deposit concrete as nearly as practicable in its final location so as to avoid separation due to rehandling and flowing.

C. Do not use concrete which becomes non-plastic and unworkable, does not meet required quality control limits, or has been contaminated by foreign materials.

D. Remove rejected concrete from job site.

3.04 CONCRETE PLACEMENT

A. Deposit concrete in a continuous operation, within limits of construction joints, until placing of a section is complete.

B. Consolidate concrete immediately after placing by use of internal concrete vibrators supplemented by hand spading, rodding, or tamping.

C. Do not vibrate forms or reinforcement.

D. Do not use vibrators to transport concrete inside the forms.

E. Bring surfaces to correct level with straightedge, and then strike off.

F. Use bullfloats or darbies to smooth surface, leaving surface free from bumps and hollows.

3.05 CONCRETE FINISHING

A. Check sidewalk with 10-foot straight edge. For areas showing irregularities of 0.25 inches or more cut down high areas or fill depressions with freshly mixed concrete and strike off, consolidate and refinish concrete Do not add water to correct surface deficiencies.

B. Provide a light broom finish perpendicular to direction of travel.

C. Expansion joints:

1. Extend entire width of sidewalk, at intervals not to exceed 50 feet.
2. Install full depth of sidewalk.
3. Install at all construction joints and where sidewalk abuts castings or other rigid structures.
4. Place expansion joints perpendicular to sidewalk.

D. Control Joints:

1. Spacing: Maximum intervals of 6 feet.

2. Formed control joints:

a. Depth of not less than 1/4 the sidewalk depth
b. Use 0.25 inch radius jointing tool.

3. Sawed joints:

a. Not less than 1.25 inches deep
b. Make within 24 hours after concrete placement.

E. Finish all edges with 0.25 inch radius edging tool.

F. Apply curing compound to all exposed surfaces immediately after finishing operations have been completed and surface water has disappeared.

3.06 PROTECTION FROM FREEZING

A. These provisions shall be followed when the atmospheric temperature is 35°F, or is expected to drop below 35°F during the curing period.

B. Heating of aggregates and water:

1. Concrete temperature shall be at least 50°F and not more than 80°F at the time of placing.
2. Heating equipment or methods which alter or prevent the entrainment of the required amount of air in the concrete shall not be used.
3. The equipment shall be capable of heating the materials uniformly.
4. Neither aggregates nor water used for mixing shall be heated to a temperature exceeding 150°F.
5. Materials containing frost or lumps of frozen material shall not be used.
6. When either aggregates or water are heated to 100°F, they shall be combined first in the mixer before cement is added.

C. Immediately after a pour is completed, the freshly placed concrete and forms shall be covered so as to form a protective enclosure and the air in the enclosure kept at a temperature above 50°F for at least 72 hours.

3.07 FIELD QUALITY CONTROL

A. Conform to Section 03 30 00.

B. If tests verify Work in-place is not in conformance with Specifications, Engineer will determine if Work in-place is adequate for intended use. If Work in-place is determined to be inadequate, Contractor shall follow such remedial or replacement measures which Engineer may require. Contractor shall bear costs associated with testing, engineering analysis, remedial work, and replacement required under terms of this paragraph

END OF SECTION

SECTION 32 92 00
TURF AND GRASSES

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Preparing ground surface.
2. Seed.
3. Fertilizer.
4. Maintenance.

B. Except for paved, riprapped, or built-up areas, all areas of site which are disturbed and areas noted on Drawings shall be seeded.

1.02 REFERENCES

A. ASTM: American Society for Testing and Materials

1.03 SUBMITTALS

A. General:

1. Submit Product Data in sufficient detail to confirm compliance with requirements of this Section. Submit Product Data and Shop Drawings in one complete submittal package. Partial submittals are unacceptable.
2. Mix analysis and names of seed mixes.

B. Test Results:

1. Topsoil test results including fertilizer and lime requirements.

C. Submit in accordance with Section 01 33 00.

1.04 QUALITY ASSURANCE

A. Meet or exceed specifications of Federal, State, and local laws requiring inspection for plant disease and insect control.

B. Seed shall conform to U.S. Department of Agriculture Rules and Regulations under Federal Seed Act and requirements of state seed laws.

C. Contractor shall engage certified soils testing laboratory to perform a soils evaluation of existing and/or imported topsoil to determine fertilizer and lime requirements.Provide a minimum of 1 composite soil sample, consisting of 5 test borings, for every 5 acres to be seeded.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Provide seed mixture in sealed containers showing percentage of seed mix, year of production, net weight, date of packaging, and location of packaging.

B. Deliver fertilizer to site in waterproof bags showing weight, chemical analysis, and name of manufacturer.

1.06 WARRANTY

A. Warranty lawn areas for period of 1 year after acceptance of seeding to be alive and in satisfactory growth at end of warranty period.

1. For purpose of establishing acceptable standard, scattered bare spots, none larger than 1 square foot, will be allowed up to a maximum of 3% of lawn area.

PART 2 – PRODUCTS

2.01 SEED

A. Fresh, recleaned, new crop seed in specified varieties and proportions indicated.

B. Weed content shall not exceed 0.25%.

C. Mulched Seeding Seed mixture shall conform to the requirements for Seed Mixture U as described in Section 621.06(b) of the INDOT Specifications.

2.02 FERTILIZER

A. Commercial balanced, uniform in composition, free flowing, conforming to state and federal laws.

B. Contain percentage by weight as follows, or as modified by topsoil test recommendations.

1. Prior to seeding: 6-24-24.
2. After seeding: 18-5-9.

C. 50% of elements shall be derived from organic sources.

2.03 ACCESSORIES

A. Mulch: Dry oat or wheat straw or wood cellulose fiber free of weeds and foreign matter detrimental to plant life. Hay or chopped corn stacks are not acceptable.

B. Water: Furnished by Owner from existing on-site source. Provide pumps, tankage, hose, piping, and attachments as required to bring water to point of use.

C. Landscape Mat: Porous non-woven fabric with multiple layers of randomly arranged fibers, min 4.0 ounces per square yard (typical).

1. Manufacturers:

a. Mirafi 140N by Mirafi, Inc.
b. Typar 340I by DuPont.
c. Supac 5P by Phillips Fibers Corp.
d. Propex 4545 by Amoco Fabrics Co.
e. Or Equal.

D. Landscape Stone: Washed, light colored crushed granite or other approved locally available stone conforming to ASTM C33, Size 4.

(ASTM C33 – Size No. 4)

Sieve Size	% Passing by Weight
2 inch	100
1-1/2 inch	90 – 100
1 inch	20 – 55
3/4 inch	0 – 15
3/8 inch	0 – 5

PART 3 – EXECUTION

3.01 SURFACE CONDITIONS

A. Examine areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of Work. Do not proceed until unsatisfactory conditions are corrected.

3.02 PLANTING SEASONS

A. Seeding and sodding shall conform to the schedules and requirements set forth in Section 621.11 of the INDOT Specifications except as follows:

1. Erosion control seeding shall occur when required

B. Perform planting of seed or placement of sod only when weather conditions and soil conditions are acceptable.

C. Planting season limits may be changed when approved by Engineer.

3.03 PREPARATION

A. Finish grading will be performed under Section 31 22 00.

B. Do not plant seed until trees, shrubs, and other landscaping completed.

C. Scarify existing topsoil where grade is not being raised, or where topsoil is over compacted, to depth of 2 inches.

D. For topsoil with high acidity, add lime as recommended in topsoil test report.

E. Grade, rake, and roll with roller weighing not more than 100 pounds per foot or less than 25 pounds per foot.

F. Maximum variation from correct elevation is 1/2 inch 10 feet.

3.04 FERTILIZING

A. Before seeding, apply 6-24-24 fertilizer at uniform rate of 20 pounds/1000 square feet; make 2 passes at right angles. Incorporate fertilizer into soil to depth of at least 2 inches by discing, harrowing, or other approved method.

B. After completion of required interim mowings, apply 18-5-9 fertilizer at rate of 15 pounds per 1000 square feet; make 2 passes at right angles.

C. Adjust rate of application and type of fertilizer as recommended in topsoil test report.

D. Lightly water to aid dissipation of fertilizer.

3.05 SEEDING

A. Apply seed at a total rate of not less than 5 pounds/1000 square feet; make 2 passes at right angles.

B. Seeding method shall establish smooth, uniform turf.

C. Cover seed with 1/8 inches of soil by light racking.

D. Do not seed following rain, if soil has been compacted by rain, or if ground is too dry.

E. Do not seed when wind velocity exceeds 6 miles per hour.

F. Do not seed areas in excess of that which can be mulched on same day.

G. Immediately after seeding, apply mulch to flat areas and erosion control blanket to areas with greater than 3H to 1V slopes.

H. Place mulch loose to allow some sunlight to penetrate and air to circulate, but thick enough to shade ground, conserve soil moisture, and prevent erosion.

I. Butt ends and edges of erosion control blanket snugly and staple to ground surface with 6 inch staples.

J. Apply water with fine spray immediately after area has been mulched or application of erosion control blanket. Leave area thoroughly soaked at close of each working day.

3.06 MOWING STRIPS

A. Provide 2 feet wide by 6 inches deep mowing strip of landscape stone at locations shown on Drawings.

B. Prior to installing landscaping mat, spray subgrade with approved pre-emergent herbicide.

C. Install steel edging and landscaping mat and pin in place.

D. Consolidate landscape stone to achieve uniform and level surface.

3.07 PROTECTION

A. Protect turf areas by erecting temporary fences, barriers, signs, and similar protection as necessary to prevent trampling until acceptance by Owner.

B. Replace, repair, restake, or replant damaged seeding.

C. Protect slopes and embankments against erosion until Work is accepted. Repair eroded areas by refilling, reseeding, and remulching as required.

3.08 FIELD QUALITY CONTROL

A. Acceptance:

1. Notify Engineer when lawn areas are ready for final inspection.
2. Substantial completion will be granted upon conformance with following;

a. Turf reasonable free from weeds, diseases or other visible imperfections.
b. Turf displays uniform color, quality and coverage.
c. Minimum 3 mowings performed.
d. Fertilizer application performed after mowing.

3. After substantial completion, Owner will be responsible for maintenance.

3.09 MAINTENANCE

A. Maintenance shall begin immediately following installation of each portion of lawn. Continue until substantial completion.

B. Maintain lawns by watering, mowing, and repairing or replanting as may be necessary to produce uniform stand of grass until Work accepted.

C. Perform first mowing when average height of grass reaches 3 inches. Perform interim mowings, 2 minimum, as needed to maintain grass height at 2 to 2-1/2 inches. Do not remove more than 1/3 of leaf blade by mowing.

D. After completion of required interim mowings, apply 18-5-9 fertilizer as specified herein.

E. Control weed growth; apply herbicide in accordance with manufacturer's instructions.

F. Top dress or resod excessive cracks appearing upon soil shrinkage.

END OF SECTION

DIVISION 33

UTILITIES

SECTION 33 05 05
SITE UTILITIES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes Site Piping for:

1. Process piping
2. Storm sewer

1.02 REFERENCES

A. AWWA: American Waterworks Association

B. City of Bloomington, Utilities, Construction Specifications.

1.03 SYSTEM DESCRIPTION

A. Systems include yard piping between buildings or structures.

B. Systems are further described and specified in:

1. Process-Mechanical Piping Systems: Section 40 05 05
2. Plumbing Systems: Section 22 00 05

1.04 SUBMITTALS

A. Manufacturer's specifications, data sheets, and installation instructions for piping, equipment, and accessories.

B. Final Trenwa design, data sheets, installation instructions, design elevations.

C. Include other data as necessary to show compliance with these Specifications.

D. Submit in accordance with Section 01 33 00.

PART 2 - PRODUCTS

2.01 STORM SEWER

A. Comply with Section 33 42 11
B. Comply with City of Bloomington, Utilities, Construction Specifications Section 4.4

2.02 PROCESS MECHANICAL PIPING

A. Ductile Iron

1. Pipe: Comply with Section 40 05 19.
2. Joints: Comply with Section 40 05 19.
3. Coatings: Comply with Section 40 05 19.
4. Polyethylene Encasement: Comply with Section 40 05 19.

B. Stainless Steel Piping: Comply with Section 40 05 23.

C. Containment Piping: Comply with Section 40 05 31.14.

2.03 VALVES

A. Comply with Section 40 05 53 and Section 40 05 56.

2.04 BACKFILL, COVER AND BEDDING MATERIALS

A. Comply with Section 31 23 33.

2.05 CONNECTING DISSIMILAR PIPE MATERIALS

A. Provide factory fabricated connecting piece meeting same structural and joint testing standards as adjacent new piping.

2.06 BURIED INSULATION

A. Manufacturers:

1. Dow Chemical Company, Styrofoam HI 60.
2. U.C. Industries, Inc., Foamular 600.
3. Or equal.

B. Rigid, closed-cell extruded polystyrene insulation, moisture-resistant and suitable for buried installations.

2.07 CONCRETE CONTAINMENT TRENCHES

A. Precast Concrete Trench

1. Trenwa solid bottom road crossing HS20 rated.
2. Concrete lid
3. Tie plates (bolted) and SikaFlex on every joint.
4. Unistrut anchors will be embedded and provide pipe slope independent of trench.
5. Sizes and miters as noted on drawings. See 002-CPR General Note 2.
6. Conform to bedding and backfill specifications for pipe (31 23 33; 2.01, 2.02, 2.03).

PART 3 - EXECUTION

3.01 BURIED PIPING INSTALLATION

A. Comply with Section 31 23 33 and material and system specifications for piping being installed.

B. When new pipe is to be connected to existing pipe not terminating in manhole, uncover end of existing pipe to allow adjustments in line and grade before any pipe is laid.

C. Lay pipe to line and grade shown on Drawings.

D. For gravity piping, begin laying pipe from lowest point in proposed pipe line.

E. For pressure piping, lay pipe at continuous slope between invert elevations shown at building faces, unless otherwise noted.

F. Lay pipe with bell end of bell and spigot pipe pointing upgrade.

G. Lay gravity pipe uniformly to line and grade so finished pipe presents uniform bore.

H. Noticeable variations from true alignment and grade shall be considered sufficient cause for rejection of Work.

I. Record North, Easting and Elevation of all bends and fittings. Provide data to Owner and Engineer as work progresses.

J. Take precautions to prevent foreign material from entering pipe during or after laying operations. If foreign material enters pipe, remove it completely before continuing.

K. Provide watertight plugs for open ends of pipe when laying not in progress.

L. Laying of Pipe in Cold Weather:

1. Heat pipe and jointing materials to prevent freezing of joints.
2. Do not lay pipe on frozen ground.
3. Pipes with rubber gaskets or resilient type joints: Warm gasket or joint material to facilitate making proper joint.
4. With solvent cemented joint: Remove ice and snow from jointed area prior to applying of solvent cement.

M. Wrap buried ductile iron pipe with polyethylene wrap as specified in Section 40 05 19.

N. Lay pressure pipe to line and grade so horizontal and vertical joint deflection will not be more than 50% maximum deflection as recommended by manufacturer. Where greater deflections are necessary, proper fittings shall be used.

O. Thrust Restraint:

1. Provide thrust restraint on pressure pipe valves and other locations where unbalanced forces exist.
2. Restrain by one of the following means:

a. Mega-Lug by EBBA Iron, or equal.
b. Other restrained joint types as specified in Section 40 05 19.

P. Connect dissimilar pipe materials using factory fabricated connecting pieces.

Q. Plug lines and provide necessary thrust restraint until connections to internal and building systems are made.

3.02 VALVE BOX INSTALLATION

A. Provide thrust blocking with solid concrete block or concrete.

B. Center valve boxes on the valves, setting plumb.

C. Tamp earth fill around each valve box to a distance of four feet on all sides, or to the undisturbed trench face if less than four feet.

D. Tighten stuffing boxes, and fully open and close each valve to assure that all parts are in working condition.

3.03 MANHOLE AND VAULT INSTALLATION

A. Comply with Section 33 05 61 and Section 31 23 33.

B. Construct at locations and elevations shown on Drawings.

3.04 INSULATION INSTALLATION

A. Place at locations of water or drain (sanitary) and gas piping where less than 5 feet of cover exists or at locations within 2 feet from a storm sewer pipe.

1. Prior to placement of horizontal insulation, place bedding material 6 inches deep over top of pipe, level, and compact. Lightly scarify surface of cover material to depth of 1/2 inch.
2. Place horizontal insulation boards on scarified material with long side parallel to centerline of pipe.
3. Place boards in staggered arrangement to eliminate continuous joints. If 2 or more layers of insulation board are used to meet required thickness, place each layer to cover joints of layer immediately below.

B. Backfill First Lift:

1. Backfill with 6 inches of bedding material. End or side dump onto insulation board and spread so construction equipment does not operate directly on insulation.
2. Compact layer with equipment exerting contact stress of 70 to 80 pounds per square inch.

C. After first lift, compact to specified density.

3.05 FIELD QUALITY CONTROL

A. Testing:

1. Test piping systems in accordance with Section 40 05 10 and requirements of applicable systems specifications.

END OF SECTION

SECTION 33 05 61
MANHOLES, CATCH BASINS, AND INLETS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Precast concrete manholes and risers, and chemical containment structures.

1.02 REFERENCES

A. INDOT: Indiana Department of Transportation Standard Specifications Current Edition

B. ASTM: American Society for Testing and Materials

1.03 SUBMITTALS

A. Product data:

1. Manufacturer's specifications and other data needed to prove compliance with specified requirements.
2. Manufacturers recommended installation procedures.

B. Provide certification reports attesting that materials supplied meet referenced specifications.

C. Shop drawings showing all components to be installed.

D. If manufacturer’s test data is inadequate or unavailable, Engineer reserves right to require cores drilled for compressive strength tests.

E. Submit in accordance with Section 01 33 00.

F. A buoyancy calculation for each manhole and vault documenting the following buoyancy criteria is met:

1. Minimum safety factor 1.1
2. Surface friction with backfill materials shall not be included.
3. Submerged soil weight of 55 pounds per cubic foot where soil weight is used to help hold down the manhole. Only soil directly above manhole or any anti-floatation devices may be included.
4. Water table to grade.
5. No water weight to be included inside structure.
6. Weights for castings, all precast components and any manufacturer supplied fillets in bottom of manhole may be included.
7. Submit in accordance with Section 01 33 00.

1.04 QUALITY ASSURANCE

A. Manufacturer shall conform to requirements of ASTM C478.

PART 2 - PRODUCTS

2.01 PRECAST CONCRETE SECTIONS

A. Precast sections:

1. Provide reinforced precast concrete manhole, catch basin or inlet sections complying with ASTM C478.
2. No “see through” lift holes shall be allowed on precast concrete manholes and risers 48 inches in diameter or less.
3. All lift holes on structures greater than 48 inches in diameter shall be thoroughly wetted and completely filled with non-shrink mortar or epoxy grout; then smoothed and covered on the outside, with a trowelable grade butyl rubber base backplaster material to minimize leakage.
4. Provide integral anti-floatation collars (extended bases) with a minimum width of 6 inches around bottom of all manholes. Provide larger collars for manholes that calculations indicate have buoyancy safety factors less than 1.2 so that required factor of safety is achieved. Other methods of buoyancy control may also be acceptable upon Engineer’s approval.
5. Provide cone type precast as shown on Drawings.
6. Wall Thickness:

Structure/Riser Diameter	Minimum Wall Thickness
4 feet	5 inches
5 feet	6 inches
6 feet	7 inches
7 feet	8 inches
8 feet	9 inches
10 feet	11 inches

C. Joints:

1. Single off-set with rubber gaskets meeting requirements of ASTM C443.
2. Joints shall be watertight.
3. Manholes shall have an exterior joint sealer applied to each joint, meeting requirements of ASTM C-877, Type II. Manufacturers:

    a. MacWrap External Collar by Mac Wrap Construction Products Co. Inc.
    b. Cretex Wrap by Cretex Specialty Products
    c. EZ-wrap by Press Seal Gasket Corporation.

D. Pipe to Manhole Connections: All connections shall provide for a watertight seal between pipe and manhole.

1. Connect sanitary sewer pipe and flexible storm sewer pipe to manhole by means of boot-type or compression-type connector, meeting the requirements of ASTM C923.

    a. Kor-N-Seal I, by Trelleborg

b. A-Lok, by A-Lok Products, Inc.
c. Z-Lok Cast in Boots, by A-Lok products, Inc.
d. PSX Direct Drive, by Press-Seal Gasket Corporation
e. Or equal.

E. Mark each precast section with name or trademark of manufacturer and date of manufacture. Marking shall be indented into manhole section or shall be painted thereon with waterproof paint.

F. Source Quality Control:

1. Test risers and tops in accordance with ASTM C497 for compressive strength compliance by compression tests on cores drilled from 5% of lot.
2. Number of compression tests may be reduced to 1% of lot, with minimum of two cores per lot, for manhole sections fabricated on sewer pipe machine.
3. Manufacturer's core drilling machine shall conform to ASTM C497. Operator shall take test cores as directed by testing laboratory.
4. Stamp base sections, risers and tops, meeting strength requirements, with appropriate monogram.

2.02 ADJUSTING RINGS

A. Precast concrete with one line of steel reinforcements, centered in normal handling and use.

B. Mating Faces: Smooth, parallel, and free from cracks, chips, spalls, or casting irregularities.

C. Minimum thickness: 4 inches

D. Maximum thickness: 12 inches.

2.03 EXTERNAL CHIMNEY SEAL

A. External Chimney seal as manufactured by Cretex Specialty Products, or equal

2.04 FRAMES AND COVERS

A. ASTM A48, Class 30-B minimum.

B. Free from cracks, holes, swells, and cold shuts.

C. Provide all frames, gratings and covers from the same manufacturer unless approved by Engineer.

D. Provide standard finish, supplied as a total unit.

1. Sanitary Manhole Frames and Covers: Solid bolted lid with gasket seal.

a. Wording “Sanitary” in 2-inch high letters cast into cover.
b. Neenah Foundry Catalog No. R-1915-H.

2.05 INSIDE DROP BOWL

A. RELINER A4DB or equal

2.06 CHEMICAL CONTAINMENT STRUCTURES

A. 3 foot x 3 foot square concrete vault, depth as shown in 800 series drawings.

B. Buoyancy calculation required per section 1.03 F.

C. Flood tight access hatch per specification section 05 50 00.

D. All site connections to have booted connections into structure.

PART 3 - EXECUTION

3.01 SURFACE CONDITIONS

A. Examine areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of Work. Do not proceed until unsatisfactory conditions are corrected.

3.02 FIELD MEASUREMENTS

A. Make necessary measurements in the field to assure precise fit of items in accordance with the approved design.

3.03 INSTALLATION

A. Trench, backfill, and compact for work of this Section in accordance with pertinent provisions of Section 31 23 33.

3.04 BACKFILL

A. Backfill with pipe bedding and cover material to spring line of incoming pipe in accordance with Section 31 23 33.

3.05 MANHOLE BENCH (CONSTRUCTED IN FIELD)

A. Shape invert channels to be smooth and semicircular, conforming to inside of adjacent sewer sections.

B. Make changes in direction of flow with a smooth curve of as large a radius as size of manhole will permit.

C. Make changes in size and grade of channels smoothly and evenly.

D. Form invert channels directly manhole base, with concrete. On manholes with straight through pipe invert may be formed by laying full section sewer pipe through manhole and cleanly breaking out top half after surrounding concrete has hardened.

E. Smooth floor of manhole outside channels, and slope toward channels at not less than 1 inch per foot or more than 2 inches per foot.

F. Construct outside drop at sanitary manholes whenever free drop inside manhole exceeds 24 inches measured from invert of inlet pipe to top of floor of manhole outside channels.

3.06 PIPE TO MANHOLE CONNECTION

A. Support pipe entering manhole above manhole base from wall of manhole back to face of first pipe joint bell with wall of backfill concrete, brick or solid concrete block columns.

B. Connect by means of an approved flexible watertight pipe to manhole seal.

3.07 SETTING CASTINGS

A. Set at elevation shown on Drawings.

B. Adjust castings to grade with adjusting rings. Do not use more than 12 inches of adjusting rings.

C. Sealing: Seal interior and exterior of adjusting rings and castings with trowelable mastic sealing material.

D. Provide external chimney seals, with extensions as necessary, on manholes. Install seals and extensions in accordance with manufacturer's instructions.

3.08 MANHOLE OVER EXISTING PIPE

A. Construct new manhole as specified, breaking upper half of existing pipe after base of manhole is completed so as not to obstruct flow of existing pipe.

3.09 TESTING AND INSPECTING

A. Do not allow or cause any of Work of this Section to be covered up or enclosed until after it has been inspected.

B. Precast reinforced concrete manholes, inlets, catch basins, risers and tops shall be subject to rejection on account of failure to conform to any specification requirements. In addition, individual sections may be rejected because of any of the following reasons:

1. Fractures or cracks passing through shell, except for single end crack not exceeding depth of joint.
2. Defects indicating imperfect proportioning, mixing, and molding.
3. Surface defects indicating honeycombed or open texture.
4. Damaged ends where such damage would prevent making satisfactory joint.
5. Manhole steps out of line, or not properly spaced.
6. Infiltration into sanitary sewer exceeding 0.0758 gal/vert ft/hr.
7. Internal diameter of section varying more than 1% from nominal diameter.
8. Any continuous crack having surface width of 0.01 in. or more and extending for length of 12 in or more, regardless of position.

C. Manhole seals shall be approved by inspecting Engineer after application and prior to backfilling.

3.10 VACUUM TESTING MANHOLES

A. General:

1. Test manholes as recommended by manufacturer. All manholes shall be tested for leakage/air tightness.
2. Provide equipment such as pumps, gauges, regulators, hoses, pipe plugs, manhole frame plugs, necessary to perform air tests of manholes. Equipment configuration shall be such that there are no valves on or along air line between measuring point at manhole and pressure transducer or sensing device located in control unit on

surface. Amount of pressure being exerted on joint shall be readable above ground on pressure gauge.

3. Accuracy and calibration of pressure sensing/monitoring system shall have been certified by reliable testing firm within one-month period preceding use of equipment. Proof of certification shall be submitted.
4. Test sanitary manholes only.

B. Equipment:

1. Pressure meter device shall accurately show PSIG to nearest 1/10 of one pound and shall respond to and record any change in void pressure instantly.
2. Systems which incorporate bladders, hoses, or like for monitoring pressure and which have questionable accuracy will not be allowed.

C. Testing Procedure:

1. Test sanitary manholes prior to installation of chimney seals.
2. Test in accordance with ASTM C1244 and D3753.
3. Isolate manhole to be tested by temporarily plugging al pipes entering the manhole
4. Draw vacuum of 10 in. of mercury (5 PSIG or 0.03 Bar) within manhole.
5. If required vacuum pressure cannot be developed, manhole shall have failed test. Manhole being tested will also have failed if the time for the vacuum reading to drop from 10 in. of mercury to 9 in. of mercury meets or exceeds the values indicated in Table 1 or ASTM C1244.
6. Failure of manhole indicates need for sealing. Seal in accordance with manufacturer recommendations.
7. Retest until satisfactory results obtained.

END OF SECTION

SECTION 33 42 11
STORM WATER GRAVITY PIPING

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Provide sewer pipe materials and installation as shown on Drawings, specified herein, and as needed for a complete and proper installation of storm systems.

1.02 REFERENCES

A. ASTM: American Society for Testing and Materials

B. AASHTO: American Association of State Highway and Transportation Officials

C. AWWA: American Water Works Association

1.03 SUBMITTALS

A. General:

1. Submit Product Data in sufficient detail to confirm compliance with requirements of this Section. Submit Product Data and Shop Drawings in one complete submittal package. Partial submittals are unacceptable.

B. Product data:

1. Manufacturer's specifications and other data needed to prove compliance with specified requirements.
2. Manufacturers recommended installation procedures.

C. Provide certification reports attesting that materials supplied meet referenced specifications

D. Table of manufacturer’s recommended mandrel sizes for 5% deflection cases based on diameters and wall thickness of pipe provided for this project.

E. Calculations verifying pipe stiffness class, installation conditions and floatation (for depths less than 6 feet).

F. Pipe layout/installation guide from manhole to manhole by pipe diameter and pipe class or pipe stiffness rating.

G. Pipe joint certification indicating compliance with 25 ft hydrostatic head rating.

H. Submit in accordance with Section 01 33 00.

I. Results of plant tests shall be included with shipment of materials, with two additional copies of each test result to be furnished to Engineer.

1.04 QUALITY ASSURANCE

A. Pipe manufacturer shall have minimum of/five (5) years experience manufacturing pipe in accordance with ASTM AWWA Standard Specifications.

B. Plant Testing for PVC C-900 Pipe:

1. Testing shall be performed on pipe manufactured for this project for:

a. Flattening test per AWWA C-900
b. Sustained pressure test per AWWA C-900
c. Burst Pressure per AWWA C-900
d. Extrusion quality per AWWA C-900
e. Pipe diameter, wall thickness and other dimensions shall be verified as per ASTM D2122.
f. PVC cell classification meets requirements for 12454-B in accordance with ASTM D-1784

PART 2 – PRODUCTS

2.01 GRAVITY SEWER PIPE STRENGTH DESIGN

A. All sewer pipe materials provided shall be designed in accordance with the following criteria:

1. Traffic Loading = HS-20 per AASHTO, Traffic impact = 30% for depths less than 5 feet.
2. Soil loading based upon depth and unit weight of 125 pounds per cubic feet.
3. Trenching and Bedding as per details shown in plans for pipe types and per Section 31 23 33.
4. Ground water table assumed to be at the surface.
5. Saturated soil weight for bouyancy calculations = 62.5 pounds per cubic feet.
6. Safety factor for pipe buoyancy calculations =1.3.

B. Flexible pipe shall also comply with following design criteria:

1. Allowable Deflection < 3%
2. Deflection Lag Factor = 1.0 for design condition (1.5 for 1 year post construction monitoring
3. Maximum E=1000 for depths less than 25 feet to top of pipe (Lessor values may be used at manufacturer's option.)
4. Safety factor for buckling = 2.5
5. Safety factor for wall crush = 2. 0

2.02 PVC C-900 PIPE

A. PVC pipe shall be made from virgin compounds as defined in ASTM D1784 and as per AWWA C900.

B. Pipe shall have a minimum dimension ratio (DR) of 18 (150 psi rating) and conform to cast iron outside diameters as per Table 1 of AWWA C900.

C. Gaskets and Lubricants: Gaskets and lubricants intended for use with the PVC pipe and appurtenances shall be made materials that are compatible with the plastic material and with each other when used together as per AWWA C900.

2.03 UNDERGROUND PIPE TRACE WIRE

A. Type: 12-gauge AWG multiple stranded copper wire, insulated for underground installation.

B. All tracing wire splices shall be spliced with Direct Bury Splice Kit No. 09053 as manufactured by 3M, or equal.

PART 3 – EXECUTION

3.01 SURFACE CONDITIONS

A. Examine areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.02 FIELD MEASUREMENTS

A. Make necessary measurements in the field to assure precise fit of items in accordance with approved design.

3.03 INSTALLATION

A. Trenching and backfill for Work of this Section shall conform to Section 31 23 33 and pipe manufacturer's recommendations.

B. Location with respect to water supply piping:

C. Pipe laying:

1. Protect pipe during handling against shocks and free fall. Remove extraneous material from pipe interior.
2. Between manholes all gravity pipe shall be of same strength class and as shown on layout/installation guide.
3. Lay pipe by proceeding upgrade with spigot ends of bell-and-spigot pipe pointing in direction of flow.
4. Lay each pipe accurately to indicated line and grade, aligning so sewer has a uniform invert. Noticeable variations from true alignment and grade shall be considered sufficient cause for rejection of Work.
5. Continually maintain interior of pipe free from foreign material. Provide watertight plugs for open ends of pipe when laying not in progress.
6. Before making pipe joints, clean and dry all surfaces of pipe to be joined.
7. Use lubricants recommended by pipe manufacturer.
8. Place, fit, join, and adjust joints to obtain watertight seal.
9. Lay pipe to line and grade so horizontal and vertical joint deflection will not be more than 50% maximum deflection as recommended by manufacturer.
10. Laying of Pipe in Cold Weather:

    a. Heat pipe and jointing material to prevent freezing of joints, as recommended by manufacturer.
    b. Do not lay pipe on frozen ground.
    c. Pipes with rubber gaskets or resilient type joints: Warm gasket or joint material to facilitate making proper joint.

3.04 TESTING AND INSPECTING

A. Do not allow or cause any work of this Section to be covered until after it has been inspected.

B. Test and inspect sewer installation in accordance with Section 40 05 10.

1. Leakage Test

a. Low Pressure Air Test

2. Deflection Test (Flexible Pipe Only)

a. Perform not sooner than 30 days following installation.

END OF SECTION

DIVISION 40

PROCESS INTERCONNECTIONS

SECTION 40 05 05
EXPOSED PIPING INSTALLATION

PART 1 – GENERAL

1.01 SUMMARY

A. This section identifies process-mechanical piping systems to be provided, specifies unique requirements for each system identified, and references other sections where detailed requirements of piping components are specified.

B. Process-mechanical piping systems are shown on Process-Mechanical Drawings and on Civil Site Piping Drawings. Civil Site Piping Drawings may also show site utility, plumbing, fire protection, and HVAC piping systems that are specified in other sections.

C. Process-Mechanical Piping Schedule included with this section identifies process-mechanical piping systems to be provided. Schedule includes application information and specifies unique system requirements.

D. If owner accepts Alternate 1, perform all work in the Fluoride Room.

1.02 SUBMITTALS

A. Shop Drawings:

1. Layout drawings for each process-mechanical piping system drawn to scale. Identify each piping system with same flow stream identifier as shown on Drawings.

a. Double-line layout for each piping system 3-inch pipe size and larger. Minimum scale of 1/4-inch = 1 foot.
b. Single-line or double-line layout for each piping system smaller than 3-inch pipe size. Minimum scale of 1/4-inch = 1 foot.
c. For each piping system include:

1) Size for each pipe and fitting.
2) Size, type, and orientation for each valve.
3) Material, lining type, and system number for coating to be provided for each pipe and fitting.
4) Pipe class, thickness or schedule for each pipe and fitting.
5) Pipe end connections (joint type) and couplings.
6) Location and type of supports, hangers, anchors, and expansion joints.
7) Pipe couplings, saddles, sleeves, clamps, adapters, and other piping products.
8) Pipe mounted equipment and instrumentation identified by tag number assigned on Drawings.
9) Insulation to be provided.

B. Submit in accordance with Section 01 33 00.

PART 2 – PRODUCTS

2.01 PIPE AND FITTINGS

A. Provide pipe and fittings as shown on Drawings and as specified in sections identified in Process-Mechanical Piping Schedule presented at end of this section.

2.02 PIPING SUPPORT, FLEXIBILITY, THERMAL EXPANSION, ANCHORAGE, AND VIBRATION

A. Provide support system for each non-buried process-mechanical piping system in accordance with Section 40 05 07.

B. Provide anchors, restraints, and concrete blocks as required to resist hydraulic thrust and forces due to thermal expansion.

C. Piping system, including support and anchorage system, shall allow for thermal expansion and contraction due to differences in operating temperature and temperature piping is exposed to during construction. Provide piping system products to allow for and control movement of piping due to thermal expansion and contraction.

D. No attempt has been made to show all pipe supports, hangers, anchors, expansion joints, and other piping products required for piping support, thermal expansion, and anchorage. Absence of these products on Drawings does not relieve Contractor of his responsibility for providing them in accordance with these Specifications.

E. Provide joints, couplings, and expansion joints as shown on Drawings and as required for piping flexibility and vibration isolation. No attempt has been made to show all joints, couplings, expansion joints, and other piping products required for piping flexibility and vibration isolation.

2.03 OTHER PIPING PRODUCTS

A. Provide insulation for piping systems identified to be insulated in REMARKS column of Process-Mechanical Piping Schedule. Provide piping insulation in accordance with Section 40 42 13.

B. Provide products for pipe penetrations in accordance with Section 40 05 09.

C. Provide couplings, flanged coupling adapters, service saddles, and expansion joints in accordance with Section 40 05 06.

2.04 COATINGS

A. Coat exterior surfaces of non-insulated piping products with coating system numbers specified in Specifications sections identified in Part 3 of this section and in accordance with Section 09 96 00.

B. Do not coat stainless steel, copper, galvanized, plastic, or FRP piping or insulation jacketing.

PART 3 – EXECUTION

3.01 PREPARATION

A. Use implements, tools, and facilities for handling and protection of piping products to avoid damage prior to installation.

B. Inspect piping products before installation. Provide new or repair or recondition damaged piping products. Repair or reconditioning is subject to Engineer's approval. Patch damaged interior linings and exterior coatings or replace damaged product with new product. Patching is subject to Engineer's approval.

C. Clean ends of piping products before installation. Remove foreign matter and dirt from inside of piping products and keep products clean until Work has been accepted.

3.02 INSTALLATION

A. Location:

1. Install piping parallel to structure lines unless shown otherwise on Drawings.
2. Do not install piping through beams, columns, or other structural members unless shown on Drawings.
3. Locate valves in piping system in accordance with manufacturer's instructions. In horizontal piping runs, do not orient valves so operating stem is below horizontal centerline.

B. Assembly:

1. Install piping without springing or forcing in manner which would cause stress in piping, valves, or connected equipment.
2. Set pipe flanges level, plumb, and aligned. Set flanged fittings so flange is true and perpendicular to pipe axis. Set flanges so bolt holes straddle vertical centerline of pipes.
3. For flanged connections, match bolt holes and obtain uniform contact over entire flange area prior to installation of flange bolts. Tighten bolts to uniformly compress gaskets and minimize flange stress. Tighten bolts to torque recommended by gasket manufacturer. Coat nuts and bolts with anti-seize thread compound.
4. Machine off raised-face of steel flange when mating with flat-faced flange.

C. Pump, Blower and Equipment Connections:

1. Align pipe, equipment, pumps, and blowers so stresses are not transmitted to connections. Support piping independently from pumps, blowers, and equipment. Do not support piping from equipment, blowers, and pumps. Anchor piping to prevent transmission of hydraulic thrust load to pumps, blowers, and equipment.
2. Install couplings, adapters, expansion joints, flanges, and unions so pumps, equipment, valves, and in-line instruments can be removed from service without disruption to other portions of piping system.
3. Install couplings, expansion joints and other vibration isolation components to isolate piping from pump, blower, and equipment vibration.
4. For welded nozzle connections, allow for shrinkage during welding to prevent excessive stresses on pumps and equipment.
5. Provide drain piping from pump and equipment drains and overflows to floor drain system.
6. Provide control lines such as air and bubbler level system piping necessary for operation of pumps, equipment, valves, and in-line instruments.

D. Install insulating flange, insulating coupling or dielectric union at each connection between ferrous and non-ferrous metal piping.

3.03 FIELD QUALITY CONTROL

A. Inspect installed piping products for dents, kinks, abrupt changes of curvature, damage to lining, and other damage. Repair or recondition damaged products as approved by Engineer or replace damaged products with new products.

B. Inspect installed, unlined piping products for corrosion and scale on interior surfaces. Clean products to remove corrosion and scale or replace with new products.

C. Test system in accordance with Section 40 05 10 and as specified in Process-Mechanical Piping Schedule.

3.04 CLEANING

A. After installation and before testing, remove dirt, rocks, debris and other foreign matter from interior of each piping system.

B. Water flush each hydrostatically tested piping system unless specified otherwise.

1. Flushing velocities of 2.5 feet per second shall be maintained until accumulated debris has been removed.
2. Insert cone strainers at equipment connections prior to flushing. Remove cone strainers after flushing is complete.
3. Remove accumulated debris through drains not less than 2 inch in diameter or by temporarily removing pipe spools, fittings, or valves.
4. Drain piping after flushing and immediately dry piping with compressed air.

C. Blow clean each pneumatically tested piping system with compressed air unless specified otherwise.

3.05 PROCESS-MECHANICAL PIPING SCHEDULE

A. **SERVICE** column: Presents Flow Stream Identifiers for process-mechanical piping systems shown on Process-Mechanical Drawings and on Civil Drawings.

1. Civil Drawings may also show site utility, plumbing, fire protection, and HVAC piping systems which are not included in Process-Mechanical Piping Schedule. Site utility, plumbing, fire protection, and HVAC piping systems are specified in other sections.

B. **SIZE** column: Presents nominal pipe diameter(s) for each piping system shown on Process-Mechanical Drawings and continuation of piping system on Civil Drawings.

C. **PIPE MATL** column: Identifies material type to be provided for piping system. Piping material shall conform to requirements of referenced sections:

Pipe Material	Section	Abbreviation in Piping Schedule
Cement Lined Ductile Iron Piping	40 05 19	CLDI
304L Stainless Steel Piping	40 05 23	304SS
General Service Steel Piping	40 05 24	GNSTL
Polyvinyl Chloride Piping	40 05 31.13	PVC
Polyvinyl Chloride Double Containment Piping	40 05 31.14	PVC-D
Chlorinated Polyvinyl Chloride Piping	40 05 31.23	CPVC
Flexible Plastic Tubing	40 05 31.83	TUBE

D. **LOCATION** Column: Identifies installation location of piping system. Piping system components shall be suitable for condition specified.

E. **MIN/MAX TEMP** column: Presents minimum and maximum operating temperature of piping system. Piping system components shall be suitable for operating temperatures shown.

F. **MAX PRESSURE** column: Presents maximum operating pressure of piping system and type of test to be provided. Piping system components shall be suitable for maximum operating pressure shown and test pressure specified.

1. Provide hydrostatic testing in accordance with Section 40 05 10 where maximum operating pressure value is followed by "-H".
2. Provide high pressure air testing in accordance with Section 40 05 10 where maximum operating pressure value is followed by "-P".
3. Provide low pressure air testing in accordance with Section 40 05 10 where "-A" is specified.
4. Test pressure for hydrostatic and high pressure air testing shall be 1.5 times maximum operating pressure, minimum, unless specified otherwise in REMARKS column. Test pressure for low pressure air testing shall be as specified in Section 40 05 10.

G. **COLOR** column: Specifies color coding and banding to be provided for non-buried piping systems. Provide color coding, banding, and labeling in accordance with Section 10 14 10. For piping scheduled to be color-coded, but not scheduled for complete painting (such as plastic piping, stainless steel piping, or aluminum insulation jacketing) provide pipe marking tape banding to represent piping color-code. At each banding location provide following sequence:

1. 8-inch wide tape of scheduled pipe color.
2. 4-inch wide tape of scheduled band color (if pipe color-code calls for banding).
3. 8-inch wide tape of scheduled pipe color (if pipe color-code calls for banding).

H. **REMARKS** column: Provides further description of piping system and specifies additional requirements.

PROCESS-MECHANICAL PIPING SCHEDULE

Service	Size (in.)	Pipe Matl	Location	Min/Max Temp (ºF)	Max Press (psig)	Color	Remarks
220 – SETTLING BASIN 2							
HFSA	1	TUBE	Outside Exposed, Buried	30/110	40-H	Blue	Carrier pipe in a containment pipe
HFSA	4	304SS	Outside Exposed, Buried	30/110	10-H	Blue	Containment pipe. Heat trace and insulate. Blue label on containment pipe and insulation.
NAOC	1	TUBE	Outside Exposed, Buried	30/110	40-H	Yellow	Carrier pipe in a containment pipe
NAOC	4	304SS	Outside Exposed, Buried	30/110	10-H	Yellow	Containment pipe. Heat trace and insulate. Yellow label on containment pipe and insulation.
NAOH	1	TUBE	Outside Exposed, Buried	65/110	40-H	Green	Carrier pipe in a containment pipe
NAOH	4	304SS	Outside Exposed, Buried	65/110	10-H	Green	Containment pipe. Heat trace and insulate. Green label on containment pipe and insulation.
NHOH	1/2	TUBE	Outside Exposed, Buried	-21/110	40-H	Brown	Carrier pipe in a containment pipe
NHOH	3	304SS	Outside Exposed, Buried	-21/110	10-H	Brown	Containment pipe. Brown label on containment pipe.
300 – FILTER BUILDING							

PROCESS-MECHANICAL PIPING SCHEDULE

Service	Size (in.)	Pipe Matl	Location	Min/Max Temp (ºF)	Max Press (psig)	Color	Remarks
HFSA	1	TUBE	Inside Exposed	65/100	40-H	Blue	Carrier pipe in a containment pipe
HFSA	1	PVC	Inside Exposed	65/100	40-H	Yellow with Blue Band	Sch 80
HFSA	4	304SS	Inside Exposed	65/100	10-H	Blue	Containment pipe
NAOC	1	TUBE	Inside Exposed	65/100	40-H	Yellow	Carrier pipe in a containment pipe
NAOC	1	CPVC	Inside Exposed	65/100	40-H	Yellow	Uncontained pipe to feed point
NAOC	4	304SS	Inside Exposed	65/100	10-H	Yellow	Containment pipe
NAOH	1	TUBE	Inside Exposed	65/100	40-H	Green	Carrier pipe in a containment pipe
NAOH	1	304SS	Inside Exposed	65/100	40-H	Green	Uncontained pipe to feed point
NAOH	4	304SS	Inside Exposed	65/100	10-H	Green	Containment pipe
NHOH	1/2	TUBE	Inside Exposed	65/100	40-H	Brown	Carrier pipe in a containment pipe
NHOH	1/2	304SS	Inside Exposed	65/100	40-H	Brown	Uncontained pipe to feed point
NHOH	3	304SS	Inside Exposed	65/100	10-H	Brown	Containment pipe
BW	16, 30	CLDI or GNSTL	Inside Exposed	20/100	50-H	Aqua	Backwash pump suction and discharge
V	3	CLDI or GNSTL	Inside Exposed	20/100	50-A	Black	Vent for the air release valve
800 – CHEMICAL BUILDING (HFSA RELATED PIPING)							
HFSA	1, 2	PVC	Inside Exposed	65/100	40-H	Yellow with Blue Band	Sch 80
D	1, 2, 4	PVC	Inside Exposed	20/100	10-H	Black	Sch 80
OF	2, 4	PVC	Inside Exposed	20/100	10-H	Black	Sch 80
V	1, 2, 3	PVC	Inside Exposed	20/100	10-A	Black	Sch 80
800 – CHEMICAL BUILDING (NAOC RELATED PIPING)							
NAOC	1, 2, 3	CPVC	Inside Exposed	65/100	40-H	Yellow	Color noted for pipe markers
OF	2, 3	CPVC	Inside Exposed	20/100	10-H	Black	Color noted for pipe markers
V	1, 2, 3, 4	CPVC	Inside Exposed	20/100	10-A	Black	Color noted for pipe markers

PROCESS-MECHANICAL PIPING SCHEDULE

Service	Size (in.)	Pipe Matl	Location	Min/Max Temp (ºF)	Max Press (psig)	Color	Remarks
800 – CHEMICAL BUILDING (NAOH RELATED PIPING)							
NAOH	1, 2, 3	304SS	Inside Exposed	65/100	40-H	Green	Color noted for pipe markers
D	3	304SS	Inside Exposed	20/100	10-H	Black	Color noted for pipe markers
OF	2, 3	304SS	Inside Exposed	20/100	10-H	Black	Color noted for pipe markers
V	1, 2, 3	304SS	Inside Exposed	20/100	10-A	Black	Color noted for pipe markers
800 – CHEMICAL BUILDING (NHOH RELATED PIPING)							
NHOH	1/2, 1, 2, 3	304SS	Inside Exposed, Outside Exposed	-21/110	40-H	Brown	Color noted for pipe markers
V	1/2, 3	304SS	Inside Exposed, Outside Exposed	-21/110	10-A	Black	Color noted for pipe markers
900 – BACKWASH TANK							
OF	18	CLDI	Outside Exposed	-21/110	10-H	Black	Backwash Tank overflow pipe
YARD PIPING							
HFSA	1	TUBE	Outside Exposed	30/110	40-H	Blue	Carrier pipe in a containment pipe
HFSA	4	PVC-D	Outside Exposed	30/110	10-H	Yellow with Blue Band	Sch 80 containment pipe. Heat trace and insulate
NAOC	1	TUBE	Outside Exposed	30/110	40-H	Yellow	Carrier pipe in a containment pipe
NAOC	4	PVC-D	Outside Exposed	30/110	10-H	Yellow	Sch 80 containment pipe. Heat trace and insulate
NAOH	1	TUBE	Outside Exposed	65/110	40-H	Green	Carrier pipe in a containment pipe
NAOH	4	PVC-D	Outside Exposed	65/110	10-H	Yellow with Green Band	Sch 80 containment pipe. Heat trace and insulate
NHOH	1/2	TUBE	Outside Exposed	-21/110	40-H	Brown	Carrier pipe in a containment pipe
NHOH	3	PVC-D	Outside Exposed	-21/110	10-H	Yellow with Brown Band	Containment pipe

END OF SECTION

SECTION 40 05 06
COUPLINGS, ADAPTERS, AND SPECIALS FOR PROCESS PIPING

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Couplings, flanged coupling adapters, service saddles, expansion joints, and flexible couplings required for piping connections. Some products specified in this Section may not be required for this Contract. Refer to piping system Specification section(s) and Drawings to determine particular products to be provided under this Contract.

1.02 REFERENCES

A. ANSI: American National Standards Institute

B. NSF: National Sanitation Foundation / NSF International

1.03 SUBMITTALS

A. General:

1. Submit Product Data in sufficient detail to confirm compliance with requirements of this Section. Submit Product Data and Shop Drawings in one complete submittal package. Partial submittals are unacceptable.

B. Product Data:

1. Catalog cuts and product specifications for couplings and service saddles specified.
2. Catalog cuts and product specifications for couplings, flanged coupling adapters, and service saddles.

C. Submit in accordance with Section 01 33 00.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Firms experienced in manufacturing equipment of types and capacities indicated that have record of successful in-service performance.

PART 2 – PRODUCTS

2.01 GENERAL

A. All materials in contact with potable water shall be NSF 61 certified and NSF 372 lead free Certified.

2.02 COUPLINGS

A. Couplings for connecting plain-end steel or ductile iron pipe of same outside diameter:

1. Dresser Style 38.
2. Smith-Blair Product No. 411.

B. Transition couplings for connecting plain-end steel or ductile iron pipe of different outside diameter:

1. Dresser Style 162.
2. Smith-Blair Product No. 413.

C. Insulating couplings for connecting plain-end steel or ductile iron pipe and stopping flow of electrical current:

1. Dresser Style 39
2. Smith-Blair Product No. 416.

D. Restrained couplings for connecting plain-end steel, ductile, PVC, HDPE, or combinations of pipe of same outside diameter, where coupling requires restraint:

1. Smith-Blair Product No. 471
2. EBAA-Iron Series 3800

E. Restrained couplings for connecting plain-end steel pipe of same outside diameter, where coupling requires restraint:

1. Victaulic Depend-O-Lok Style 232, Type 1
2. The Ford Meter Box Co., Inc. Style FR1

F. Pressure rating shall be greater than test pressure of piping system.

G. Materials:

1. Middle Ring and Gaskets: As selected by manufacturer. Suitable for fluid service and maximum operating temperature of piping system.
2. Followers: Ductile iron or steel.
3. Bolts and Nuts: Stainless steel.

2.03 FLANGED COUPLING ADAPTERS

A. Flanged coupling adapters for connecting plain-end steel or ductile iron pipe to flanged pipe, fitting, valve, instrument, or equipment item:

1. Dresser Style 128.
2. Smith-Blair Product No. 913.

B. Pressure rating shall be greater than test pressure of piping system.

C. Materials:

1. Flange: Steel, faced and drilled to 150-pound class in conformance with ANSI B16.5.
2. Body: Steel.
3. Follower: Ductile iron or steel.
4. Gasket: As selected by manufacturer. Suitable for fluid service and maximum operating temperature of piping system.
5. Bolts and Nuts: Stainless steel.

2.04 RESTRAINED FLANGED COUPLING ADAPTERS

A. Restrained flanged coupling adapters for connecting plain-end ductile iron or steel pipe to flanged spools and fittings.

1. EBAA-Iron MegaFlange Series 2100
2. Smith-Blair Product No. 911.

B. Pressure rating shall be greater than or equal to the pressure rating of the piping system in which it used.

C. Materials:

1. Flange: Ductile iron, drilled to 125/150-pound class in conformance with ANSI B16.5. Provide flat or raised face flanges to match piping system.
2. Body: Ductile iron
3. Gasket: As selected by manufacturer. Suitable for fluid service and maximum operating temperature of piping system.
4. Bolts and Nuts: Match piping system as specified in Division 40 05 05.
5. Adapter shall be coated to match piping as specified in Division 09 96 00.

2.05 DISMANTLING JOINTS

A. Dismantling joint for valve, pump, meter, or other fitting installations with heavy duty joint restraint:

1. Style 975, by Smith Blair, Inc.
2. Or equal.

B. Pressure and Service: Same as connected piping.

C. Body: ASTM A53, ASTM A283 Gr C or carbon steel with a minimum yield of 30,000 psi.

D. Follower Flange: Ductile iron per ASTM A536, Steel section per ASTM A576GR1020HR, or carbon steel having a minimum yield stress of 30,000 psi.

E. Gasket: Recommended by the manufacturer.

F. Bolts and Nuts: Stainless steel bolts complete with washers complying with ASTM F593, AISI Type 316 and nitrided stainless nuts.

G. Type 316 stainless steel anchor studs installed in pressure-tight anchor boss for restraint. For buried or submerged applications, provide external bolting and other hardware of Type 316 stainless steel, including tie bolts, bolt plates, lugs, nuts, and washers. Provide number of studs required to restrain test pressure and service conditions. Harness shall be as designed and recommended by manufacturer.

2.06 SERVICE SADDLES

A. Service saddles for tapping pipe sizes 18 inches and smaller shall be double strap design.

1. Dresser Style 91.
2. Smith-Blair Product No. 317.

B. Service saddles for tapping pipe sizes larger than 18 inches shall be triple strap design.

1. Smith-Blair Product No. 366.

C. Materials:

1. Body: Malleable iron or ductile iron.
2. Straps: 304 Stainless Steel.
3. Nuts and Washers: 304 Stainless Steel.
4. Gasket: As selected by manufacturer. Suitable for fluid service and maximum operating temperature of piping system.

2.07 RUBBER EXPANSION JOINTS

A. Rubber expansion joints rubber designed to absorb all-directional movements and reduce noise and vibration manufactured by:

1. General Rubber.
2. Garlock.
3. Mercer.
4. Proco Products.
5. Or equal.

B. Rubber Expansion Joints:

1. Cover, body, seamless tube, and integral full-faced flanges. Standard 125-pound flange drilling.
2. Materials and construction shall be suitable for fluid service, maximum operating temperature, maximum operating pressure, and test pressure of piping system. Unless otherwise recommended by manufacturer, elastomers shall be:

a. Pure gum rubber for grit slurry lines or other abrasive services.
b. Buna-N for primary sludge, primary scum, secondary scum, or other services where oils or grease may be present.
c. EPDM for all other services.

3. Single arch.

a. Filled for wastewater, sludge and other fluids with suspended solids.
b. Unfilled for air, clean water and other fluids without suspended solids.

4. Split carbon steel, coated in accordance with Section 09 96 00, retaining rings.
5. Provide control unit for each expansion joint:

a. Gusset plates, washers, bolts, and elastomeric bushings.
b. No metal-to-metal contact to eliminate transmission of noise and vibration.
c. Size control units for maximum operating pressure and test pressure of piping system.
d. Control unit hardware shall be stainless steel.

6. Minimum movement capability for single, unfilled arch joints:

Joint Size (inch)	Axial Compression (inch)	Axial Extension (inch)	Lateral Deflection (inch)
≤ 6	7/16	1/4	1/2
8 to 18	11/16	3/8	1/2

Joint Size (inch)	Axial Compression (inch)	Axial Extension (inch)	Lateral Deflection (inch)
20 to 24	13/16	7/16	1/2
26 to 40	15/16	1/2	1/2
≥ 42	1-1/16	9/16	1/2

7. Minimum movement capability for single, filled arch joints shall be at least 50 percent of movement specified above for unfilled arch joints.

2.08 ANCHORS

A. Provide anchors including, but not limited to, tie rods, lugs, harness assemblies, flanged spool pieces, friction collars and hardware for each coupling and flanged coupling adapters to restrain pipe where required to prevent pipe movement out of each coupling or flanged coupling adapter.

B. Design each anchor to sustain force developed by test pressure of piping system.

C. Anchorage with welded attachments to ductile iron piping is unacceptable.

2.09 COATINGS

A. Coatings for couplings, flanged coupling adapters, and service saddles shall be same material as coatings for connected pipe.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install couplings, adapters, and specials for process piping in accordance with manufacturer's written instructions. Provide flanged coupling adapters as shown on the Drawings, restrained flange adapters are not an acceptable equal to flanged spool sections in rigid piping systems.

B. Provide expansion joints where indicated on Drawings and elsewhere as determined by Contractor for adequate expansion compensation and vibration isolation of piping systems.

3.02 EXPANSION JOINT SUPPORTS

A. Provide supports in accordance with pipe hangars, supports, and anchors in accordance with Section 40 05 07.

B. Fixed Supports:

1. Provide a fixed support for each expansion joint. Fixed support shall restrain pipe to prevent movement of fixed end of the expansion joint.
2. Fixed support shall be located on the same end of pipe as the “restraining ring” is welded.
3. Design each support to sustain force developed by test pressure of piping system.
4. Fixed supports with welded attachments to stainless steel piping are unacceptable.

C. Adjustable Supports:

1. Provide adjustable supports for each expansion joint. Adjustable support shall allow axial movement of pipe into the expansion joint.
2. Adjustable support shall be located on the opposite end of the pipe as the welded

"restraining ring."

3. Design each support to sustain force developed by test pressure of piping system.
4. Adjustable supports with welded attachments to stainless steel piping are unacceptable.

END OF SECTION

SECTION 40 05 07
PIPE HANGERS AND SUPPORTS

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. System of pipe supports and anchors with necessary inserts, bolts, nuts, restraining and hanger rods, washers, and other accessories.

1.02 REFERENCES

A. MSS: Manufacturers Standardization Society

B. ASTM: American Society for Testing and Materials

C. ANSI: American National Standards Institute

1.03 SYSTEM DESCRIPTION

A. Design Requirements:

1. Design, detail, and installation of pipe support system shall be the responsibility of Contractor unless detailed on the Drawings.
2. Pipe support system components shall withstand dead loads imposed by weight of pipes filled with water plus insulation, plus live loads due to thermal expansion, vibration, internal test pressures, and have minimum safety factor of 5.
3. Absence of pipe supports and details on Drawings shall not relieve Contractor of responsibility for providing them throughout plant.
4. Supply design loading criteria to precast concrete manufacturer for piping supported from precast members.

1.04 SUBMITTALS

A. General:

1. Submit Product Data in sufficient detail to confirm compliance with requirements of this Section. Submit Product Data and Shop Drawings in one complete submittal package. Partial submittals are unacceptable.

B. Product Data:

1. Catalog cuts and product specifications for pipe hangers, supports, and anchors specified.

C. Shop Drawings:

1. Pipe supporting system, including manufacturer's product data, dimensions, sizes, types, location, maximum loadings, thrust anchorage, and installation instructions.
2. Shop Drawing shall be stamped by a Professional Structural Engineer registered in the State of Indiana.

D. Submit in accordance with Section 01 33 00.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipe hangers, supports, and anchors to their final locations in protective wrappings, containers, and other protection that will exclude dirt and moisture and prevent damage from construction operations. Remove protection only after equipment is made safe from such hazards.

B. Store pipe hangers, supports, and anchors in clean, dry location.

C. Fiberglass components shall be stored on a flat, level surface protected from UV light (sunlight).

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. B-Line.

B. Grinnell.

C. Carpenter-Paterson.

D. Unistrut.

E. Superstrut.

F. Champion Fiberglass

2.02 GENERAL

A. MSS types indicated are typical of types and quality of standard pipe supports and hangers to be employed. Special support and hanger details are shown to cover locations where standard catalog supports are inapplicable.

B. Provide factory fabricated piping hangers and supports, clamps, hanger rod attachments, building attachments, saddles, shields, thrust anchorage, and other miscellaneous products of MSS SP69 type indicated or shop fabricated supports; comply with MSS SP58 and manufacturer's published product information. Where MSS type not indicated, provide proper selection for installation requirements and comply with MSS SP69, MSS SP89 and manufacturer's published product information.

2.03 MATERIALS

A. Refer to Space Environment and Hazardous Ratings Schedule on Drawings for determination of the Exposure type of each space in which materials are to be installed. Refer to Material Schedule on Drawings for materials to be utilized within each Exposure type.

B. Where galvanized supports are used, structural shapes, framing, hangers, and supports shall be hot dipped galvanized and saddles, hangers, shields, hanger rods and hardware may be electroplated galvanized.

C. Fiberglass components:

1. Shall be pultruded or injection molded from fire-resistant vinyl ester resins. Polyester and vinyl ester resins utilized will have a fire-retardant rating of 25 or less when tested in accordance with ASTM E-84 and exhibit low smoke generation.

2. Installed allowable operating temperature range shall be -40 to 140F.
3. Glass-reinforced channels shall be constructed with 70% glass and 30% resin. Channels shall utilize UV-stabilized resins and incorporate UV-resistant surfacing veil into the laminate. Surfacing veils shall be applied to all exterior surfaces to improve weatherability and inhibit ultraviolet degradation.
4. Glass-reinforced pipe hangers and clamps shall be injection molded from 40% long glass fiber polyurethane resin and shall incorporate dark grey pigments to improve weatherability and inhibit ultraviolet degradation.
5. Non-metallic fasteners shall be manufactured from long glass fiber-reinforced polyurethane.
6. Fiberglass threaded rod shall be manufactured from pultruded vinyl ester resin with rod couplers of injected molded polyurethane resin.

2.04 HORIZONTAL PIPING HANGERS AND SUPPORTS

A. General:

1. Unless otherwise shown or specified, hangers for 2 1/2 inches and smaller pipe shall be split-ring, adjustable swivel, clevis or roller type, hangers for 3 inch pipe or greater shall be clevis or roller type.
2. Hangers for use with spring supports shall be split-ring or clamp type.
3. Hangers for fiberglass reinforced pipe shall be saddle type.
4. Each hanger shall be designed to permit at least 1/2 inch vertical adjustment after installation.

B. Adjustable Swivel Split Ring Hanger: MSS Type 6.

C. Adjustable Clevis Hanger: MSS Type 1.

D. Adjustable Band Hanger: MSS Type 7.

E. Adjustable Swivel-Band Hanger: MSS Type 10.

F. Clamp: MSS Type 4.

G. Single Roll Support: MSS Type 41, including axle roller and threaded sockets.

H. Adjustable Roller Hanger: MSS Type 43, including axle roller and clevis.

I. Roll/Stand: MSS Type 44, including roller, stand, and axle.

J. Adjustable Roller/Base: MSS Type 46, including roller, adjustable base, and stand.

K. Steel Brackets: Welded structural steel shapes complying with following:

1. Light Duty: MSS Type 31.
2. Medium Duty: MSS Type 32.
3. Heavy Duty: MSS Type 33.

L. Adjustable Saddle Support:

1. MSS Type 38, including saddle, pipe and reducer.
2. Fabricate base support from steel pipe and include cast iron flange or welded steel plate. Use of threaded rod for pedestal support stanchions is not acceptable.

M. Stanchion Saddle Support:

1. MSS Type 37, including saddle and U-bolt.
2. Fabricate base support from steel pipe and include cast iron flange or welded steel plate. Use of threaded rod for pedestal support stanchions is not acceptable.

N. Strap or wire hangers are not acceptable.

2.05 VERTICAL PIPING CLAMPS

A. 2-Bolt Riser Clamp: MSS Type 8.

B. 4-Bolt Riser Clamp: MSS Type 42, include pipe spacers at inner bolt holes.

2.06 HANGER RODS AND ATTACHMENTS

A. Hanger Rods:

1. ASTM A36, threaded both ends or continuous thread.
2. Rods shall conform to following sizes.

Pipe Size (inches)	Minimum Rod Diameter (inches)
Up to 2	3/8
2 1/2 and 3	1/2
4	5/8
6 to 8	3/4
10 to 12	7/8
14 to 18	1
20 and Up	1-1/4
Trapeze Hangers	As Required

B. Turnbuckles: MSS Type 13.

C. Weldless Eye Nut: MSS Type 17.

D. Eye Socket: MSS Type 16.

E. Clevis: MSS Type 14.

2.07 BUILDING ATTACHMENTS

A. Individual Concrete Inserts:

1. MSS Type 18.
2. MSS Type 19.
3. Minimum Safe Load: 1,100 pounds.

B. Top Beam C-Clamp: MSS Type 19.

C. C-Clamps: MSS Type 23.

D. Single-Side Clamp: MSS Type 25.

E. Top I-Beam Clamp: MSS Type 25.

F. Side Beam Clamp: MSS Type 20.

G. Concrete Anchors:

1. Provide in accordance with Section 05 50 00.
2. Minimum Safety Factor: 5.

2.08 SADDLES AND SHIELDS

A. Protection Saddles: MSS Type 39.

B. Protection Shields: MSS Type 40.

C. Wood Insulation Saddle:

1. Elcen Metal Products Company.
2. Or equal.

2.09 FRAMING SYSTEMS

A. Metal Systems:

1. Shop-Fabricated Anchors and Supports:

a. Steel Plates, Shapes, and Bars: ASTM A36.
b. Restraining Rods: ASTM A307.

B. Fiberglass Systems:

1. Provide as a system including all necessary non-metallic components including fasteners, hangers, pipe clamps, channel splice plates, brackets, beam clamps, etc.

C. Concrete: Minimum 28 day compressive strength of concrete – 3,000 pounds per square inch.

PART 3 – EXECUTION

3.01 GENERAL

A. Proceed with installation of hangers, supports, and anchors after required building structural work is complete and concrete support structure has reached 28-day compressive strength as 3,000 pounds per square inch.

B. Install hangers, supports, clamps, and attachments from building structure. Comply with MSS SP-69. Group parallel runs of horizontal piping to be supported together on trapeze type hangers where possible.

C. Install supports to provide indicated pipe slopes and maximum pipe deflections allowed by ANSI B31.1 are not exceeded.

D. Except as otherwise indicated for exposed continuous pipe runs, install hangers and supports of same type and style as installed for adjacent similar piping.

E. Do not support piping from other piping.

F. Prevent contact between dissimilar metals. Where concrete or metal pipe support is used,

place 1/8 inch thick Teflon, neoprene rubber or plastic strip under piping at point of bearing. Cut to fit entire area of contact between pipe and support.

G. Prevent electrolysis in support of copper tubing by use of hangers and supports that are copper plated, plastic coated or by other recognized industry methods. Electrician's tape not acceptable isolation method.

H. Apply anti-seize compound to nuts and bolts.

3.02 INSTALLATION OF BUILDING ATTACHMENTS

A. Support piping from structural framing, unless otherwise noted.

B. Concrete Inserts:

1. Locate inserts so total load on insert does not exceed manufacturer's recommended maximum load. Location of inserts shall be approved by Engineer.
2. Where necessary to anchor supports to hardened concrete or completed masonry, use concrete anchors.

C. Attach to structural steel with beam clamps.

3.03 THRUST ANCHORS AND GUIDES

A. Thrust Anchors:

1. For suspended piping, center thrust anchors as closely as possible between expansion joints and between elbows and expansion joints. Anchors shall hold pipe securely and be sufficiently rigid to force expansion and contraction movement to take place at expansion joints or elbows and preclude separation of joints.
2. Provide thrust anchors as required to resist thrust due to changes in diameter or direction or dead ending pipe lines. Anchorage shall be required wherever bending stresses exceed allowable for pipe. Wall pipes may be used as thrust anchors.

B. Pipe guides shall be provided adjacent to sliding expansion joints in accordance with recommendations of National Association of Expansion Joint Manufacturers.

3.04 PIPE SUPPORT

A. Spacing:

Type of Pipe (inches)	Maximum Pipe Support Spacing (feet)
Steel	
10 and larger	22
8	19
6	17
5	16
4	14
3 1/2	13
3	12
2 1/2	11
2	10
1 1/2	9
1	7

Type of Pipe (inches)	Maximum Pipe Support Spacing (feet)
3/4	6
1/2	5
Copper	
4	12
3 1/2	11
3	10
2 1/2	9
2	8
1 1/2	8
1 1/4	7
1	5
3/4	5
1/2	5
Plastic (Schedule 80 at 100 degrees Fahrenheit, F)	
8	9-1/2
6	9
4	7-1/2
3	7
2	6
1 1/2	5-1/2
1	5
3/4	4-1/2
1/2	4-1/2
(For plumbing or chemical applications, plastic piping shall be supported at maximum of 4 ft-0 in. spacing.)	
Stainless Steel	
1 and smaller	6
1 1/2 through 4	8
6	8
8 and 10	10
12	10
14	12
16	12
18 and larger	14
Cast Iron and Ductile Iron	
1 and smaller	6
1 1/4 through 2 1/2	8
3 and 4	10
6	12
8	12
10 and 12	14
14	16
16 and 18	16
20	18
24 and larger	18
(For cast iron soil pipe plumbing applications, support as 5 ft-0 in. spacing.)	

B. Where piping of various sizes is to be supported together, space supports for smallest pipe size or install intermediate supports for smaller diameter pipe.

C. Provide minimum of 2 pipe supports for each pipe run.

D. Where piping connects to equipment, support by pipe support and not by equipment, unless

approved by equipment manufacturer.

E. Unless otherwise shown or authorized by Engineer, place piping running parallel to walls approximately 1 1/2 inches out from face of wall and at least 3 inches below ceiling.

F. Pedestal pipe supports shall be adjustable with stanchion, saddle, and anchoring flange. Use of threaded rod for pedestal support stanchions is not acceptable.

G. Piping passing through sleeves or openings in interior wall sleeves shall be carried by supports or hangers. Do not rest on wall.

H. Support piping in manner preventing undue strain on valve, fitting or equipment. Provide pipe supports at changes in direction or elevation, adjacent to flexible couplings, adjacent to non-rigid joints, and where otherwise shown. Do not install pipe supports and hangers in equipment access areas.

I. Install supports to allow controlled movement of piping systems, permit freedom of movement between pipe anchors, and facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

J. Piping shall be free to move when expands or contracts, except where fixed anchors are indicated. Where specified hanger rod swing length cannot be provided or where pipe movement based on expansion of 1 inch per 100 feet for each 100 degrees F change in temperature exceed 1/2 inch, provide approved roller supports.

K. Piping 6 inches and larger supported by trapeze hangers shall be supported with rollers.

L. Stacked horizontal runs of piping along walls may be supported by metal framing systems. Metal framing systems shall be attached to concrete insert channels.

M. Coat hangers, clamps, protective shields, metal framing support components, and hanger accessories in accordance with Section 09 96 00.

3.05 GALLERY AND TUNNEL PIPING

A. Support piping by framing system. Where possible, extend each insert channel continuously over gallery or tunnel ceiling and down both walls to floor.

3.06 INSULATED PIPING

A. Attach clamps, including spacers (if any), to piping with clamps projecting through insulation; do not exceed allowable pipe stresses.

B. Where low compressive strength insulation or vapor barriers are indicated on cold or chilled water piping, install coated protective shields. For pipe 8 inches and larger, install wood insulation saddles.

C. Where insulation without vapor barrier is indicated, install protection saddles on piping 2 inches and larger.

END OF SECTION

SECTION 40 05 09
PIPE SLEEVES AND SEALS

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Modular mechanical seals.
2. High density polyethylene (HDPE) sleeves.
3. Fire Barriers.

1.02 SUBMITTALS

A. General:

1. Submit Product Data in sufficient detail to confirm compliance with requirements of this Section. Submit Product Data and Shop Drawings in one complete submittal package. Partial submittals are unacceptable.

B. Product Data:

1. Catalog cuts and product specifications for sleeves and seals specified.

C. Submit in accordance with Section 01 33 00.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. GPT Industries, LINK-SEAL.

B. Advance Products & Systems (APS), Innerlynx.

2.02 MODULAR MECHANICAL SEALS

A. Modular, mechanical type, consisting of inter-locking synthetic rubber links shaped to continuously fill annular space between pipe and opening.

B. Seal Element: Ethylene propylene diene monomer (EPDM). Provide low-durometer EPDM elements for thin or soft walled pipes of HDPE, PVC, tubing, or others with a wall thickness less than 3/8-inches as recommended by manufacturer.

C. Pressure Plates: Composite.

D. Bolts and Nuts: 316 stainless steel.

2.03 FIRE RATED MODULAR MECHANICAL SEALS (LINK SEAL)

A. Modular, mechanical type, consisting of inter-locking synthetic rubber links shaped to continuously fill annular space between pipe and opening.

B. Seal Element: Silicone.

C. Pressure Plates: Zinc plated carbon steel.

D. Bolts and Nuts: Zinc plated carbon steel.

E. UL approved for 3-hour fire wall penetrations.

2.04 HDPE SLEEVES

A. Material: HDPE.

B. Integrally molded water stop / anchor at least 4-inches larger than outside diameter of sleeve.

C. Textured surface to increase concrete bond strength.

D. Designed for use with modular mechanical seals.

2.05 FIRE STOP COLLARS

A. Manufacturer:

1. Hilti
2. 3M – Fire Barrier – Ultra PPD Plastic Pipe Device.
3. Or Equal.

B. Metal collar with heat expanding intumescent material designed to expand to fill the void of failed plastic piping.

C. UL classified for 2 or 3-hour fire wall penetrations as indicated on the drawings.

D. For floor or wall assembly.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install sleeves and seals in accordance with manufacturer's written instructions.

END OF SECTION

SECTION 40 05 10
TESTING PIPING SYSTEMS

PART 1 – GENERAL

1.01 SUMMARY

A. Hydrostatic pressure testing, low pressure air testing, and high pressure air testing of piping systems.

B. Systems to be tested, type of test to be performed, and test pressure shall be as specified in other sections of Specifications.

1.02 SUBMITTALS

A. Test report for each piping system tested. Include following:

1. Date of test.
2. Description and identification of piping system tested.
3. Type of test performed.
4. Test fluid.
5. Test pressure.
6. Type and location of leaks detected.
7. Corrective action taken to repair leaks.
8. Results of retesting.

B. Submit in accordance with Section 01 33 00.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 GENERAL

A. Test in presence of Engineer.

B. Owner will provide on-site source of water for testing specified herein.

C. Provide pumps and piping required to bring water to point of use.

D. Provide air supply.

E. Provide test pressure equipment, meters, pressure gauges, and other equipment, materials, and facilities necessary to perform specified tests.

F. Provide bulkheads, flanges, valves, bracing, blocking, or other temporary sectionalizing devices that may be required.

G. Remove temporary devices after tests complete.

H. Perform tests on exposed piping after completely installed, including supports, hangers, and anchors.

I. Perform tests on piping before insulation installed.

J. Perform tests on piping that is clean and free of dirt, sand or other foreign material.

K. Plug pipe outlets with test plugs. Brace each plug securely to prevent blowouts.

L. Add test fluid slowly.

M. Include regulator set to avoid overpressurizing and damaging piping.

N. Perform pressure testing in accordance with local, state, and federal requirements.

O. Correct leaks or defects and retest at no additional cost to Owner.

3.02 HYDROSTATIC PRESSURE TESTING – NON-HDPE PIPING

A. Perform hydrostatic pressure testing for piping systems identified in other sections. Test pressure shall be as specified in other sections.

B. Open vents at high points to purge air pockets while piping system is filling. Venting may also be provided by loosening flanges or with equipment vents.

C. Testing:

1. After section of piping to be tested has been filled with water, apply test pressure by means of force pump of such design and capacity that required pressure can be applied and maintained without interruption for duration of test.
2. Measure test pressure by means of tested and properly calibrated pressure gauge acceptable to Engineer.
3. Maintain test pressure for sufficient length of time to permit Engineer to observe piping under test but not less than 2 hours.

D. Piping systems shall show no visual evidence of weeping or leaking. If leakage is evident, make appropriate repairs and retest.

3.03 HYDROSTATIC PRESSURE TESTING – HDPE AND LDPE PIPING

A. Perform hydrostatic pressure testing for piping systems identified in other sections. Test pressure shall be as specified in other sections.

B. Open vents at high points to purge air pockets while piping system is filling. Venting may also be provided by loosening flanges or with equipment vents.

C. Testing:

1. After section of piping to be tested has been filled with water, apply test pressure by means of force pump of such design and capacity that required pressure can be applied and maintained without interruption for duration of test.
2. Measure test pressure by means of tested and properly calibrated pressure gauge acceptable to Engineer.
3. Maximum test pressure is temperature dependent. Test fluid and test section temperatures should be less than 80ºF. At temperatures above 80ºF, reduced test pressure is required. Sunlight heating of exposed pipe especially black pipe can result in high pipe temperature. Before applying test pressure, allow time for the test fluid and the test section to temperature equalize.
4. Maximum Test Pressure – The maximum allowable leak test pressure and leak test time including initial expansion, and time at leak test pressure shall be in accordance with the

following equation:

$$P_{(T)} = \frac{2 \times HDS \times F_t \times H_T}{(DR-1)}$$

$P_{(T)}$ = Leak Test Pressure (psi) for Leak Test Time, T
T = Leak Test Time (hours)
HDS = Material hydrostatic design stress for water at 73ºF (psi)
F_t = Material temperature reduction factor
H_T = Leak test duration factor for leak test time, T
DR = Pipe dimension ratio

Leak Test Duration Factor, "HT"

Leak Test Pressure $P_{(T)}$ (psi)	Leak Test Time T (hours)	Leak Test Duration Factor $H_{(T)}$
$P_{(8)}$	< 8	1.5
$P_{(48)}$	< 48	1.25
$P_{(120)}$	< 120	1.00

Material Hydrostatic Design Stress

Material Designation	HDS for Water at 73 F (psi)
PE2606 (PE2406)	630
PE2708	800
PE3608 (PE3408)	800
PE3710 & PE4710	1,000

Various materials can have different elevated temperature performance. Consult pipe manufacturer for the applicable temperature reduction factor, "Ft".

Example: maximum leak test pressure for a DR 11 PE4710 pipe for a 24 hour leak test where the pipe temperature is 125ºF:

$$P_{(T)} = \frac{2 \times HDS \times F_t \times H_T}{(DR-1)} = P_{(24)} = \frac{2 \times 1{,}000 \times 0.70 \times 1.25}{(11-1)} = 175\ psi$$

D. Pressurize pipeline to 10 psi above test pressure, add water hourly to restore pressure as pipe stretches during this expansion phase for three to four hours.

E. After expansion phase reduce pipe pressure by 10 psi to test the specified test pressure and hold for two hours. Pipe pressure at the end of the two-hour test period shall be within 5% of the test pressure, if not make appropriate repairs and retest.

F. Piping systems shall show no visual evidence of weeping or leaking. If leakage is evident, make appropriate repairs and retest.

3.04 LOW PRESSURE AIR TESTING

A. General:

1. Perform low pressure air testing for gravity sewer and drainage piping systems identified in other sections.
2. Test pipes between adjacent manholes. Test time for air pressure to drop 1.0 psi.

a. For pipes 4 in. through 36 in. dia comply with Table 40 05 10.

b. Pipe over 36 in. dia shall not be tested by the low pressure air method.
c. Ignore length of laterals.

B. Preparation:

1. Isolate pipe section to be tested by plugging each end with air tight plugs. Plug ends of branches, laterals and wyes which are to be included in test section.
2. Brace plugs to prevent slippage and blowout due to internal pressure.
3. One plug shall have inlet tap or other provision for connecting air supply.
4. Air control equipment shall consist of valves and pressure gauges to control rate at which air flows into test section and gauges to monitor air pressure inside pipe.

C. Testing:

1. If pipe to be tested is submerged in water, determine height of water above spring line of pipe at each end of test section and compute average. For each foot of water above pipe's spring line, increase test pressure by 0.43 psi.
2. Add air slowly to test section until pressure inside pipe is raised to 4.0 psi greater than average back pressure of water that may be over pipe
3. After pressure of 4.0 psi obtained, control supply of air so internal pressure maintained between 3.5 and 4.0 psi (above average water back pressure) for minimum of 2 minutes to allow temperature of air to come into equilibrium with temperature of pipe.
4. Determine rate of air lost by time pressure drop method.

a. After temperature stabilized for 2 minute period, disconnect air supply. Allow pressure to decrease to 3.6 psi. At this pressure, start stopwatch to determine time required for pressure to drop 1.0 psi. Time required for loss of 1.0 psi is then compared to Table 40 05 10.
b. If time is equal to or greater than time indicated in table, test shall be acceptable.
c. If time is less than time indicated in table, make appropriate repairs and retest.

3.05 HIGH PRESSURE AIR TESTING

A. Not for use with PVC or other brittle piping which may shatter during testing.

B. Perform high pressure air testing for piping systems as specified in other sections. Test pressure shall be as specified in other sections.

C. Perform preliminary test at not greater than 25 psi. Examine for leakage at joints with soap solution and visual detection of soap bubbles. Correct visible leaks.

D. Perform final test at test pressure specified. Pressure in system shall be gradually increased in small increments until test pressure reached. Test pressure shall be maintained for minimum of 10 minutes and additional time necessary to conduct soap bubble test examination of each joint for leakage.

E. Piping system shall show no evidence of leakage. If leakage is evident, make appropriate repairs and retest.

TABLE 40 05 10
LOW PRESSURE AIR TEST

Test time required for loss of air pressure of
1.0 psi for size and length of pipe indicated.

A	B	C	D	E	**F**
Pipe **Dia (in.)**	Time/Ft **Up To Length In Column C (sec)**	Length Time In Column B Applies **(ft)**	Test Time **For Length Between Columns C & E (min:sec)**	Length **Time In Column F Applies (ft)**	Time/Ft **Over Length In Column E (sec)**
4	0.18	636	1:54	1,432	0.08
6	0.40	424	2:50	955	0.18
8	0.71	318	3:47	716	0.32
10	1.11	255	4:43	573	0.49
12	1.60	212	5:40	477	0.71
15	2.50	170	7:05	382	1.11
18	3.62	141	8:30	318	1.61
21	4.92	121	9:55	273	2.19
24	6.42	106	11:20	239	2.85
27	8.14	94	12:45	212	3.62
30	10.00	85	14:10	191	4.44
33	12.14	77	15:35	174	5.40
36	14.37	71	17:00	159	6.39

END OF SECTION

SECTION 40 05 19
DUCTILE IRON PROCESS PIPE

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Detailed requirements for various ductile iron piping products. Some products specified in this Section may not be required for this Contract. Refer to piping system Specification section(s) and Drawings to determine particular ductile iron piping products to be provided under this Contract.

1.02 REFERENCES

A. AWWA: American Water Works Association

B. ANSI: American National Standards Institute

C. ASTM: American Society for Testing and Materials

D. AWS: American Welding Society

E. NSF: National Sanitation Foundation / NSF International

1.03 SUBMITTALS

A. General:

1. Submit Product Data in sufficient detail to confirm compliance with requirements of this Section. Submit Product Data and Shop Drawings in one complete submittal package. Partial submittals are unacceptable.

B. Product Data:

1. Catalog cuts and product specifications for ductile iron piping specified.
2. Manufacturer's specifications, catalog cuts, and literature for the following:

a. Pipe.
b. Inside linings.
c. Restrained push-on joints.
d. Mechanical joints.
e. Flange joints.
f. Grooved joints.
g. Standard fittings.
h. Special fittings.
i. Wall pipe and floor pipe.

C. Shop Drawings:

1. Installation and assembly drawings and specifically prepared technical data for ductile iron piping.
2. Submit outside coating system for buried, interior, exterior, and submerged piping

locations. Include submittal information in accordance with Section 09 96 00.
3. Submit all product data and coating system information specified above in one complete submittal.
4. Shop drawings showing layout for ductile iron piping systems shall be submitted in accordance with and transmitted under appropriate piping system Specification section.
5. Submit in accordance with Section 01 33 00.

D. Lining Reports:

1. Submit layout drawing showing location of each pipe spool and fitting identification number.
2. Submit notarized certification report for each pipe spool and fitting for approval prior to shipment.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Firms experienced in manufacturing materials of types and capacities indicated that have record of successful in-service performance.

B. Single-Source Responsibility: Obtain ductile iron piping from single supplier with responsibility for entire system.

PART 2 – PRODUCTS

2.01 GENERAL

A. All materials in contact with potable water shall be NSF 61 certified and NSF 372 lead free Certified.

2.02 MANUFACTURERS

A. American Cast Iron Pipe Company.

B. U.S. Pipe and Foundry Company.

C. McWane Ductile - Clow Water Systems Co. (Less than 48-inch pipe)

2.03 PIPE

A. Liquid and air service pipe: AWWA C151, ductile iron.

B. Minimum Thickness/Pressure Class:

1. Buried Piping: Restrained push-on joint pipe and mechanical joint pipe, Pressure Class 250 unless specified otherwise in Section 40 05 05**.**
2. Flanged joint pipe: Special Thickness Class 53.
3. Grooved joint pipe: Special Thickness Class 53.

2.04 INSIDE LINING

A. Pipe and fittings shall be provided unlined or with inside lining as specified in Section 40 05 05.

B. Cement lining shall be in accordance with AWWA C104.

2.05 JOINTS

A. Joint Type:

1. Liquid and air services in buried locations shall be mechanical or push-on joint unless otherwise noted or specified in system Specification section.

   a. Provide restrained mechanical joints or restrained push-on joints for piping systems with a maximum operating pressure greater than 5 pounds per square inch.

2. Liquid and air service in locations other than buried shall be flanged or grooved end joint at Contractor's option unless a specific joint type is noted on the Drawings or specified elsewhere.

B. Mechanical and Push-On Joints:

1. AWWA C111.
2. Gasket material:

   a. Suitable for service and maximum operating temperature of piping system as specified in Section 40 05 05.
   b. Selected by pipe manufacturer.

3. Restrained Mechanical Joints:

   a. Incorporate restraint into follower gland with individually actuated wedges.
   b. Full mechanical joint deflection during assembly and after burial.
   c. Ductile iron components.
   d. Series 1100 Megalug as manufactured by EBAA Iron, Inc.

4. Restrained Push-On Joints:

   a. Retainer Ring Type:

      1) American Cast Iron Pipe Company, Flex-Ring and Lok-Ring.
      2) U.S. Pipe and Foundry Company, TR-Flex, HDSS, or HP LOK.
      3) McWane-Clow, TR-Flex.

5. Restrained joints shall be mechanical locking type to provide positive restraint from joint separation without use of restraining rods, straps, or clamps.
6. Minimum pressure rating of restrained joints: 250 pounds per square inch.
7. For all buried applications use Cor-Blue T-bolts or equal, which have a ceramic filled, baked on fluorocarbon resin developed to handle highly corrosive conditions. Cor-Blue or equal T-Bolts and nuts shall comply with current version of ANSI/AWWA C111/A21.11.

C. Flanged Joints:

1. Flanged pipe for liquid and air service shall be in accordance with AWWA C115.
2. Fabrication of flanged pipe, including assembly of flange on pipe shall be performed by pipe manufacturer in accordance with AWWA C115. Assembly of flange on pipe outside of manufacturer's shop is unacceptable.
3. Flange material for flanged pipe shall be ductile iron. Flanged pipe with gray iron flanges is not acceptable.
4. Gasket material shall be suitable for service and maximum operating temperature of piping

system as specified in Section 40 05 05. Torque requirement of gaskets shall be less than torque rating of flange, bolt, and nuts.

5. Gaskets shall be ring or full face, 1/8-inch thick, and conform to dimensions shown in Appendices to AWWA C110 and AWWA C115.
6. Nuts and bolts:

    a. Size, length, and number as shown in AWWA C110 and AWWA C115.
    b. Materials:

        1) Refer to Space Environment and Hazardous Ratings Schedule on Drawings for determination of the Exposure type of each space in which materials are to be installed. Refer to Material Schedule on Drawings for materials to be utilized within each Exposure type.
        2) Carbon steel fasteners shall be ASTM A307, Grade B.
        3) Stainless steel fasteners shall be Type 316. Provide bolt insulating sleeves to protect against dissimilar materials.

    c. Dimensions: ANSI B18.2.1, heavy hex.

2.06 FITTINGS

A. Pressure rating shall be 250 pounds per square inch, minimum.

B. Standard fittings for liquid and air service:

1. Restrained push-on and restrained mechanical joint fittings:

    a. Ductile iron.
    b. AWWA C110 or AWWA C153.

2. Flanged joint fittings:

    a. Ductile iron.
    b. AWWA C110.
    c. Flange dimensions in accordance with AWWA C115.

C. Special fittings for liquid and air service, not included in AWWA standards, shall be manufacturer's standard, based on AWWA design principles, and in compliance with applicable requirements of AWWA standards.

D. Wall Pipe and Floor Pipe:

1. Ductile iron.
2. Wall thickness of body equal to or greater than wall thickness of connecting pipe.
3. Flanges set flush with face of concrete shall be tapped for stud bolts.
4. Collar dimensions as shown on Drawings.
5. Collar cast integral with pipe or fabricated by welded attachment of collar to pipe.
6. Fabricated wall pipe and floor pipe shall be as follows:

    a. Rated for dead end thrust due to 250 pounds per square inch internal pressure.
    b. Steel collar welded continuously around pipe on both sides of collar.
    c. Weld in pipe manufacturer's shop by qualified welder.
    d. Electrodes: AWS A5.15, Class ENiFe-CI or AWS 5.6, Class ECuAl-2.

E. Miscellaneous Fittings:

1. Provide miscellaneous fittings, such as cutting in sleeves, tapping sleeves, caps, plugs, and other fittings, as required for a complete system.
2. Manufacturer of miscellaneous fittings shall be same manufacturer as pipe.
3. Miscellaneous fittings shall be suitable for service.

2.07 COATINGS

A. Provide buried piping with 1 mil thick asphaltic coating in accordance with applicable AWWA and ANSI standards.

B. Surface preparation, priming, and finish coating of non-buried piping shall be compatible and in accordance with Section 09 96 00.

C. Finish color for interior and exterior piping shall be as specified in Section 40 05 05.

D. Coating for piping embedded in concrete is not required.

PART 3 – EXECUTION

3.01 INSTALLATION

A. In accordance with Section 40 05 05.

B. Buried Piping: In accordance with Section 33 05 05.

C. Pipes to be cut in the field shall be gauged and within acceptable tolerances to ensure fit of connections.

3.02 JOINT ASSEMBLY

A. Restrained push-on, mechanical, and grooved joint in accordance with manufacturer's written instructions.

B. Flanged joint in accordance with Section 40 05 05, flanged pipe manufacturer's written instructions, and gasket manufacturer's written instructions.

3.03 TAPPING

A. Do not tap polyethylene-lined or glass-lined pipe.

B. Taps for cement-lined and unlined pipe shall be in accordance with pipe manufacturer's instructions.

C. Provide service saddles for tap sizes greater than 1-inch. Service saddles are not required for tap sizes 1-inch and smaller.

3.04 IDENTIFICATION

A. Provide pipe identification in accordance with Section 10 14 10.

END OF SECTION

SECTION 40 05 23
STAINLESS STEEL PROCESS PIPE

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Detailed requirements for various 304L and 316L stainless steel pipe and fittings. Some products specified in this Section may not be required for this Project. Refer to piping system Specification section(s) and Drawings to determine stainless steel piping products to be provided under this Contract.

1.02 REFERENCES

A. ASME: American Society of Mechanical Engineers.

B. ASTM: American Society of Testing and Materials.

C. ANSI: American National Standards Institute.

1.03 SUBMITTALS

A. General:

1. Submit Product Data in sufficient detail to confirm compliance with requirements of this Section. Submit Product Data and Shop Drawings in one complete submittal package. Partial submittals are unacceptable.

B. Product Data:

1. Catalog cuts and product specifications for piping system specified.
2. Submit for pipe, fittings, flanges, face rings, and bolting.
3. Submit proposed gasket material for each service. Submit documentation confirming gasket material selection is appropriate for fluid carried in system.
4. Coating system for carbon steel surfaces. Include coating system submittal information specified in Section 09 96 00.

C. Shop Drawings:

1. Shop Drawings showing layout for stainless steel piping shall be submitted in accordance with and transmitted under appropriate piping system specification sections.

D. Submit in accordance with Section 01 33 00.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Firms experienced in manufacturing equipment of types and capacities indicated that have record of successful in-service performance.

B. Welding Qualifications:

1. Contractor shall be responsible for qualifying welders as required by ANSI B31.3 and

ASME Boiler and Pressure Vessel Code, Section IX.

C. Contractor shall maintain record of welding procedures used and welders or welding operators assigned to this Project and their symbols. Records shall show date and results of procedure and performance qualifications. Records shall be certified by Contractor and kept at job site and shall be available to Owner or Engineer on request for duration of Project.

D. Single-Source Responsibility: Obtain stainless steel products from single manufacturer with responsibility for entire system.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver piping system components to their final locations in protective wrappings, containers, and other protection that will exclude dirt and moisture and prevent damage from construction operations. Remove protection only after equipment is made safe from such hazards.

B. Shipping:

1. Sections with field welded ends shall have wooden plug securely installed at each end to prevent pipes from being bent out of round.
2. Flanged connections shall have plywood blind wired over end and through bolt holes to hold flange against face ring or clip-on type flange protectors.
3. Ship protected from damage and contact with carbon steel.
4. Tarp sections during shipment to avoid contact with road dust and salt spray.

C. Storage:

1. Store stainless steel products in clean, dry location.
2. Store protected from damage and contact with carbon steel.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Felker Brothers Corporation

B. Or equal.

2.02 GENERAL

A. Grade of stainless steel (304 or 316) shall be as indicated in Section 40 05 05 or elsewhere.

B. All piping, fittings and miscellaneous components installed on welded piping systems shall be provided in low carbon (L) variant of specified stainless steel alloy.

C. When cast materials are used, systems specified for:

1. 304 stainless steel shall be cast from CF-8 materials.
2. 304L stainless steel shall be cast from CF-3 materials.
3. 316 stainless steel shall be cast from CF-8M materials.
4. 316L stainless steel shall be cast from CF-3M materials.

D. At Contractor’s option, thicker materials than specified are acceptable.

E. At Contractor’s option, 316 stainless steel will be accepted in lieu of 304 stainless steel.

2.03 PIPE

A. Unless indicated otherwise, provide piping as follows:

1. 1/2-inch to 3/4-inch:

a. ASTM A312.
b. Dimensions: Conform to ANSI B36.19.
c. Schedule 10 for socket welded piping, Schedule 40 for socket welded piping utilizing Class 3000 fittings, Schedule 80 for threaded.
d. Fittings: Unless indicated otherwise in Section 40 05 05 or elsewhere for specific service, use the following:

1) 150-lb fittings meeting pressure/temperature requirements of MSS-SP-114 Class 150 fittings (300-psi CWP)
2) Threaded end connections shall conform to ASME B1.20.1.
3) Dimensions: Conform to MSS-SP-114.
4) ASTM A351, cast stainless steel.

2. 1-inch to 2-inch:

a. ASTM A312.
b. Dimensions: Conform to ANSI B36.19.
c. Schedule 10 for socket welded piping, Schedule 40 for threaded and for socket welded piping utilizing Class 3000 fittings.
d. Fittings: Unless indicated otherwise in Section 40 05 05 or elsewhere for specific service, use the following:

1) 150-lb fittings meeting pressure/temperature requirements of MSS-SP-114 Class 150 fittings (300-psi CWP)
2) Threaded end connections conforming to ASME B1.20.1.
3) Dimensions: Conform to MSS-SP-114.
4) ASTM A351, cast stainless steel.

3. 2-1/2-inch:

a. ASTM A312.
b. Dimensions: Conform to ANSI B36.19.
c. Schedule 10 for butt welded piping.
d. Fittings: Unless indicated otherwise in Section 40 05 05 or elsewhere for specific service, use the following:

1) Butt Weld Fittings:
2) ASTM A403, Class WP.
3) Dimensions: Conform to ANSI B16.9, Buttwelded.
4) Elbows shall be long radius unless otherwise indicated on Drawings.
5) Wall Thickness: match connecting pipe.

4. 3-inch to 24-inch:

a. ASTM A312 or ASTM A778.
b. Dimensions: Conform to ANSI B36.19.
c. Schedule 10 for butt welded piping.
d. Fittings: Unless indicated otherwise in Section 40 05 05 or elsewhere for specific service, use the following:

1) Butt Weld Fittings:
2) ASTM A403 or ASTM A774, Class WP.
3) Dimensions: Conform to ANSI B16.9, Buttwelded.
4) Elbows shall be long radius unless otherwise indicated on Drawings.
5) Mitered fittings are not permitted unless approved by Engineer.
6) Wall Thickness: match connecting pipe.

2.04 FITTINGS

A. Class 150 Cast Threaded Fittings:

1. Fittings shall be 150-lb fittings meeting pressure/temperature requirements of MSS-SP-114 Class 150 fittings (300-psi CWP)
2. Threaded end connections conforming to ASME B1.20.1.
3. Dimensions: Conform to MSS-SP-114.
4. ASTM A351, cast stainless steel.

B. Class 150 Cast Socket Welded Fittings:

1. Meeting pressure/temperature requirements of MSS-SP-114 Class 150 fittings (300-psi CWP).
2. Socket welded end connections shall be bored to match mating pipe Outside Diameter.
3. Dimensions: Conform to MSS-SP-114. ASTM A351, cast stainless steel.

C. Forged Class 3000 Fittings:

1. Forged stainless steel materials conforming to ASME A182.
2. All fittings shall be socket welded fittings.
3. Dimensions: Conform to ASME B16.11.

D. Butt Weld Fittings:

1. ASTM A403, Class WP when ASTM A312 pipe materials provided.
2. ASTM A774, Class WP when ASTM A778 pipe materials provided.
3. Dimensions: Conform to ANSI B16.9, Buttwelded.
4. Elbows shall be long radius unless otherwise indicated on Drawings.
5. Mitered fittings are not permitted unless approved by Engineer.
6. Wall Thickness: match connecting pipe.

2.05 JOINTS

A. Threaded Joints:

1. Size: ½-inch to 2-inch.
2. Non-flanged equipment connections and valves shall be threaded, all other connections are Contractors choice of threaded or socket welded.
3. Thread Sealant: Teflon tape or Teflon paste.

B. Socket Welded Joints:

1. Size: ½-inch to 2-inch.
2. Socket welded joints shall be performed in the shop in accordance with Shop Fabrication paragraph or in the field in accordance with Field Welded Joints paragraph.

C. Butt Welded Joints:

1. Size: 2-1/2-inch and Larger.
2. Butt welded joints shall be performed in the shop in accordance with Shop Fabrication paragraph or in the field in accordance with Field Welded Joints paragraph.

D. Flanged Joints:

1. Flange:

a. Unless specifically indicated on Drawings or Remarks of Process-Mechanical Piping Schedule of Section 40 05 05, type of flange to be used in Contractor's choice from the list below:

1) 304L stainless steel, 316L stainless steel, hot dipped galvanized steel, coated ductile iron back-up (lap joint) type.
2) Weld-neck style matching specified pipe material.
3) Slip-on flanges matching specified pipe material.

b. Flanges shall be raised face except where attaching to flat faced equipment or valves, then flat faced flanges shall be provided.
c. Faced and drilled to 150 or 300 pound class in conformance with ANSI B16.5.

2. Face Ring: Type 304L or 316L (match material type of pipe) stainless steel angle ring or flat plate. Flat plate thickness to suit pipe wall thickness and welding procedure to avoid warpage.
3. Bolting: ASTM F593-02 Type 316 stainless steel bolts, nuts and washers. Provide anti-galling compound on all mating threads of nuts and bolts.
4. Gaskets: Material and facing as recommended as suitable for service by gasket Manufacturer.

2.06 FLANGE ISOLATION KITS

A. Manufacturers:

1. Pipeline Seal and Insulator, Inc.
2. Or equal.

B. Flange Isolation Kit:

1. Provide at all locations where stainless steel piping contacts ductile iron, carbon steel, cast iron, or copper piping to prevent galvanic reaction created from dissimilar metals.
2. Isolating and Sealing Gasket:

a. Provide one full faced isolating and sealing gasket, 1/8" thick, G-10 retainer containing precision tapered groove to accommodate controlled compression of a Teflon or Viton quad-ring sealing element.
b. Sealing element placement shall accommodate either flat, raised face, or RTJ flanges.
c. Quad-ring seal shall be pressure energized.
d. G-10 retainer shall have 550 volts/mil dielectric strength and minimum 50,000 psi compressive strength.
e. Full faced flange isolating gasket shall be 1/8-inch less in inner diameter than the inner diameter of flange in which it is installed.

3. Full Length Bolt Isolating Sleeves:

a. Provide one full length G-10 sleeve (extending halfway into both steel washers) for

each flange bolt.

b. G-10 shall be 1/32-inch-thick tube with 400 volts/mil dielectric strength and water absorption of 0.10 percent or less.

2.07 SHOP FABRICATION

A. Dimensions:

1. Piping dimensions of fabricated sections shall conform to dimensions for manufactured pipe in ANSI B36.19.
2. For purpose of shop fabrication, dimensions shown on Drawings shall be considered approximate only. Field verification is responsibility of Contractor. Where possible, use field welds in each direction with adequate allowance for trim and fit, but not less than 2-inch in each direction. Loose flanged shall be provided for fit up at equipment connections.

B. Branch Connections:

1. Nozzle welds may be used in lieu of buttwelded reducing tees when permitted by ANSI B31.3. Buttwelded tees shall be used when branch is same size or one pipe size smaller than header. Nozzle welds shall be reinforced in conformance with ANSI B31.3.
2. Threaded or welded full couplings (O-lets) may be used for branch connections of 1-inch or smaller pipe size. Coupling shall comply with Fittings Paragraph of this Section.

C. Shop Welded Joints:

1. Preparation: Equipment used in welding preparation shall be covered or faced to prevent mild steel contamination of stainless steel. Items shall be marked “STAINLESS STEEL”, and shall be used for no other purpose.
2. Cleaning: Clean metal to be fused of lubricants, grease, paint, filings, and cuttings. Cleaning with alcohol or acetone. Do not use chlorinated solvents.
3. MIG and TIG Welding: Metal Inert Gas (MIG) welding may be used with automatic or semi-automatic machine welding. Tungsten Inert Gas (TIG) welding shall be used for manual welding of pressure joints. Apply shielding gas protection to underside of weld. Filler metal rods shall be AWS A5.9 Type ER308L or ER316L.
4. SMA Welding: Shielded Metal Arc (SMA) welding may be used at noncritical non-pressure connections and for joining stainless to carbon steel. Welding electrodes shall be stored in dry atmosphere to avoid moisture pick-up. Filler metal rods shall be AWS A5.4 Type E308L or E316L.
5. Dissimilar Metals: Do not weld carbon steel directly to stainless steel piping. Weld “poison pads” of equal thickness and same material of pipe to pipe and attach carbon steel to poison pad. SMA welding may be used to attach carbon steel to stainless pad. Filler metal rods shall be AWS A5.4 Type E309, or ASW A5.9 Type ER309 if TIG welding is used.
6. Shielding Gas: Use welding grade argon or helium-argon mixture.
7. Penetration: Buttweld joints shall have 100 percent penetration.
8. Tack Welding: Make tack welds with same grade of filler metal as finished weld. Tack welds shall be small enough to be absorbed into following weld beads and have slag and oxides removed prior to finishing weld or shall be completely removed.
9. Weld Finish: Inside of weld shall be smooth and free from projections and depressions. Grind with iron free grinding wheels labeled “STAINLESS STEEL” used for nothing else. Use 160 grit grinding wheels. Remove scale, oxides, and discolorations from pipes and welds. Products and procedures shall be as recommended by manufacturer.

2.08 COATING

A. Surface preparation, priming, and finish coating of carbon steel surfaces shall be compatible

and in accordance with Section 09 96 00.

B. Stainless steel components shall not be coated.

C. Surface Treatment of Stainless Steel Components:

1. Electro-chemically clean or acid passivate all welds in stainless steel subassemblies.
2. After passivation, thoroughly rinse weldments with clean water and allow to air dry.
3. Heat tint or carbon steel contamination shall not be evident. If contamination is evident, clean by method specified above, rinse and recheck.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install piping systems in accordance with manufacturer's written instructions.

B. Install in accordance with appropriate piping system Specification section.

C. Non-flanged equipment or skid connections shall be provided a union upstream of connection point between isolation valve and equipment.

D. Interconnections between stainless steel piping systems and copper, steel, or iron piping systems shall be made with a flanged connection, utilizing a Flange Isolation Kit.

3.02 IDENTIFICATION

A. Identification: pipe identification shall be in accordance with Section 10 14 10.

3.03 FIELD WELDED JOINTS

A. Branched connections:

1. Nozzle welds may be used in lieu of buttwelded reducing tees when permitted by ANSI B31.3. Use buttwelded tees when branch is same size or one pipe size smaller than header. Reinforced nozzle welds in conformance with ANSI B31.3.
2. Threaded full couplings may be used for branch connections of 1-inch or smaller pipe size. Couplings shall comply with Paragraph 2.03.A.

B. Joint Preparation:

1. Equipment used in welding preparation shall be covered or faced to prevent mild steel contamination of stainless steel.
2. Prepare buttwelded joints in conformance ANSI A16.25.
3. Cleaning: Clean metal to be fused of lubricants, grease, paint, filings, and cuttings. Cleaning with alcohol or acetone. Do not use chlorinated solvents.

C. Welding:

1. Protect weld area from wind or draft while welding with gas back-up.
2. Preheat weld area if work piece temperature is less than 60 degrees Fahrenheit (F).
3. TIG Welding: Use Tungsten Inert Gas (TIG) welding for welding of critical pressure pipe joints. Apply shielding gas protection to underside of weld. Filler metal rods shall be AWS A5.9 Type ER316L.
4. SMA Welding: Shielded Metal Arc (SMA) welding may be used at noncritical pressure pipe

joints and for joining stainless steel to carbon steel. Welding electrodes shall be stored in dry atmosphere to avoid moisture pick-up. Filler metal rods shall be AWS A5.4 Type E316L.

5. Dissimilar Metals: Carbon steel shall not be welded directly to stainless steel piping. Weld “poison pads” of equal thickness and same material of pipe to pipe and attach carbon steel to poison pad. SMA welding may be used to attach carbon steel to stainless pad. Filler metal rods shall be AWS A5.4 Type E309, or ASW A5.9 Type ER309 if TIG welding is used.
6. Shielding Gas: Use welding grade argon or helium-argon mixture.
7. Penetration: Buttweld joints shall have 100 percent penetration.
8. Tack Welding: Make tack welds with same grade of filler metal as finished weld. Tack welds shall be small enough to be absorbed into following weld beads and have slag and oxides removed prior to finishing weld or be completely removed.
9. Weld Finish: Inside of weld shall be smooth and free from projections and depressions. Grind with iron free grinding wheels labeled “STAINLESS STEEL” used for nothing else. Use 160 grit grinding wheels. Remove scale, oxides, and discolorations from pipes and welds. Products and procedures shall be as recommended by manufacturer.

3.04 FIELD QUALITY CONTROL

A. Any appearance of rusting from embedded iron on exterior surfaces of installed piping systems prior to issuance of Substantial Completion for associated system shall be corrected by Contractor by means of pickling affected surface with an appropriate solution, scrubbing with stainless steel brushes, and rinsing clean with deionized / distilled water.

3.05 WALL PIPES, WALL SLEEVES, AND SEALS FOR WALL PENETRATIONS

A. Support wall pipe by form work to prevent contact with reinforcing steel.

B. Install wall pipe in accordance with Section 03 30 00.

END OF SECTION

SECTION 40 05 24
STEEL PROCESS PIPE

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Detailed requirements for various steel piping products: Some products specified in this Section may not be required for this Contract. Refer to piping system Specification section(s) and Drawings to determine particular steel piping products to be provided under this Contract.

1.02 REFERENCES

A. ANSI: American National Standards Institute

B. ASTM: American Society for Testing and Materials

C. AWS: American Welding Society

1.03 SUBMITTALS

A. General:

1. Submit Product Data in sufficient detail to confirm compliance with requirements of this Section. Submit Product Data and Shop Drawings in one complete submittal package. Partial submittals are unacceptable.

B. Product Data:

1. Submit for pipe, fittings, flanges, bolting and gaskets.

C. Shop Drawings:

1. Shop Drawings showing layout for steel piping systems shall be submitted in accordance with and transmitted under appropriate piping system specification sections.
2. Provide layout drawings for all piping systems.

D. Submit in accordance with Section 01 33 00.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Firms experienced in manufacturing equipment of types and capacities indicated that have record of successful in-service performance.

B. Piping systems shall be installed and cleaned in accordance with applicable section of the following:

1. ASME B31.1, Process Piping

C. Welders Qualifications:

1. Quality and certify welding procedures, welders and operators in accordance with ANSI

B31.3, Paragraph 127.5, for shop and project site welding of piping work.

PART 2 – PRODUCTS

2.01 PIPE

A. Unless indicated otherwise, provide piping as follows:

1. 2 ½-inch and Larger:

a. Carbon steel, black, seamless or electric resistance welded, ASTM A53, Grade B.
b. Schedule 40

2.02 JOINTS

A. 2-1/2-inch and larger: Butt-welded joints, except provide flanges where shown on Drawings or where required to connect to flanged equipment and piping components

2.03 FITTINGS

A. Fabrication tolerances shall be in accordance with the latest edition of Pipe Fabrication Institute Standard ES-3.

B. Forged Class 3000 Fittings:

1. Forged carbon steel material.
2. All fittings shall be socket welded fittings.
3. Dimensions: Conform to ASME B16.11.

C. Welded Joints:

1. Welded fittings shall have minimum thickness of piping system served.
2. Conform welding to latest editions of Section IX, ASME Boiler and Pressure Vessel Code and ANSI codes as Follows:

a. ANSI B31.3.

D. Flanges:

1. Class 150 Slip-on Flanges. Exceptions for weld neck flanges may be made, Contractor shall review locations with Engineer for approval prior to installation.
2. Thickness and drilling shall conform to ANSI B16.5 unless otherwise specified.
3. Raised face type.

E. Gaskets:

1. Gasket material shall be suitable for service and maximum operating temperature of piping system as specified in piping system specification section. Torque requirement of gaskets shall be less than torque rating of flange, bolt, and nuts.
2. Gaskets shall be ring or full face, 1/8-in. thick.

2.04 COATINGS

A. Preparation, priming, and finish coating of non-buried piping shall be compatible and in accordance with Section 09 96 00.

B. All piping to be insulated shall be prime coated and have first coat applied prior to installation of insulation.

C. Finish color for piping shall be as specified for the piping system in Section 40 05 05.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install all piping in accordance with manufacturer's installation instructions and referenced ASTM B31 standards.

B. Threaded end pipe shall be tapered and cut clean as per ANSI B1.20.1. Joints shall be drawn tight after applying thread sealant to male pipe end.

C. All pipe ends shall have sharp edges and burrs removed.

D. Flange boltholes shall straddle major centerlines of piping.

E. Weld-neck flanges shall be bored to match mating pipe or fitting.

F. All coated piping shall be handled with care to prevent damage to the coating.

G. Adequate care shall be taken during storage, handling, and installation to keep inside surfaces free of foreign material.

H. Locating piping runs, except as otherwise indicated, vertically and horizontally (pitched to drain) and avoid diagonal runs wherever possible. Orient horizontal runs parallel with walls and column lines. Locate runs as shown or described by diagrams or details.

I. Hold piping close to walls, overhead construction, columns and other structural and permanent-enclosure elements of building; limit clearance to 1/2" where furring is shown for enclosure or concealment of piping, but allow for insulation thickness, if any. When possible, locate insulated piping for 1.0" clearance outside insulation.

J. Welding:

1. All welding shall conform to applicable AWS and ASME codes and guidelines.
2. Welds shall be made by the shielded electric arc processes with full penetration of pipe thicknesses.
3. Preheat and postheat treatment of welded joints shall be in accordance with applicable ASME Codes.
4. Examine welds in accordance with applicable ASME Codes.

3.02 ADJUSTMENT AND CLEANING

A. Clean exterior surfaces of installed piping systems of superfluous materials and prepare for application of specified coatings (if any). Flush out piping systems with clean water before proceeding with required tests. Inspect each run of each system for completion of joints, supports and accessory items.

3.03 PIPING TESTS

A. Test piping system in accordance with Section 40 05 10 and ANSI B31.

3.04 IDENTIFICATION

A. Identification: pipe identification shall be in accordance with Section 10 14 10.

END OF SECTION

SECTION 40 05 31.13
POLYVINYL CHLORIDE PROCESS PIPE

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Detailed requirements for various PVC piping products. Some products specified in this Section may not be required for this Contract. Refer to piping system Specification section(s) and Drawings to determine particular PVC piping products to be provided under this Contract.

1.02 REFERENCES

A. ASTM: American Society for Testing and Materials

B. ANSI: American National Standards Institute

1.03 SUBMITTALS

A. General:

1. Submit Product Data in sufficient detail to confirm compliance with requirements of this Section. Submit Product Data and Shop Drawings in one complete submittal package. Partial submittals are unacceptable.

B. Product Data:

1. Catalog cuts and product specifications for PVC components specified.
2. Submit product data for pipe, fittings, flanges, gaskets, and bolting.
3. Submit proposed gasket material for each service. Submit document confirming gasket material selection is appropriate for fluid carried in system.
4. Submit product data for solvent cement. Submit documentation confirming solvent cement material selection is appropriate for fluid carried in system.

C. Shop Drawings:

1. Submit layout drawings for PVC piping systems in accordance with and transmitted under appropriate piping system Specification(s) section.

D. Submit in accordance with Section 01 33 00.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Firms experienced in manufacturing equipment of types and capacities indicated that have record of successful in-service performance.

B. Single-Source Responsibility: Obtain PVC piping components from single manufacturer.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Spears.

B. Or Equal.

2.02 PVC MATERIAL

A. Type 1, Grade 1 conforming to ASTM D1784.

2.03 PIPE

A. Schedule 80 PVC conforming to ASTM D1785.

B. Provide schedule 80 PVC conforming to ASTM D1785 where identified as Carrier in the Process-Mechanical Piping Schedule or identified as Schedule 80 PVC.

2.04 FITTINGS

A. Schedule 40 or 80 PVC to match piping system.

1. ASTM D2464 for threaded joint type.
2. ASTM D2467 for socket joint type.

2.05 JOINTS

A. Provide socket type at all locations except unions, valves, and equipment with threaded or flanged end connections.

B. Threaded connections are not acceptable for nominal piping size greater than 2 inches.

C. Do not provide threaded joints for piping systems identified on Drawings or in other sections to be provided without threaded joints.

2.06 FLANGES

A. One Piece – socket configuration, PVC, flat faced, conforming to ANSI B16.5 150-pound bolt-hole drilling pattern.

B. Van Stone Style – two-piece design with rotating flange ring, PVC, flat faced, conforming to ANSI B16.5 150-pound bolt-hole drilling pattern.

2.07 GASKETS

A. Full-face, 1/8-inch thick flat type.

B. When mating flange has raised face, use flat ring gasket and provide filler gasket between outside diameter of raised face and flange outside diameter to protect flange from bolting moment.

C. Material compatible with fluid carried in system.

2.08 BOLTING

A. Type 316 Stainless Steel, ASTM A193, Grade B8M hex head bolts and ASTM A194, Grade 8M hex head nuts.

B. Bolts shall conform to ANSI B.1.20.1.

C. Provide washers same material as bolts.

2.09 SOLVENT CEMENT

A. Join socket connections with PVC solvent cement conforming to ASTM D2564.

B. For piping systems containing acids, bases, salts, or hypochlorites provide chemically resistant solvent cement Weld-On 724 CPVC, E-Z Weld 230 Chemical Resistant or equal. Otherwise, as recommended by pipe and fitting manufacturer to assure compatibility fluid in piping system.

2.10 THREAD LUBRICANT

A. Teflon tape.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install PVC components in accordance with manufacturer's written instructions.

B. Install products as shown on Drawings, and as specified in applicable piping system Specification section(s).

3.02 IDENTIFICATION

A. Identification: pipe identification shall be in accordance with Section 10 14 10.

END OF SECTION

SECTION 40 05 31.14
POLYVINYL CHLORIDE DOUBLE CONTAINMENT PROCESS PIPE

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Detailed requirements for various double containment PVC piping products. Some products specified in this Section may not be required for this Contract. Refer to piping system Specification section(s) and Drawings to determine particular products to be provided under this Contract.
2. If owner accepts Alternate 1, perform all work in the Fluoride Room.

1.02 REFERENCES

A. ASTM: American Society for Testing and Materials

B. ANSI: American National Standards Institute

1.03 SYSTEM DESCRIPTION

A. Provide double containment piping systems where specified on drawings and/or specification Section 40 05 05 – Exposed Piping Installation.

B. Double containment system shall be a floating carrier design constructed from conventional pipe and fittings meeting applicable ASTM requirements for all standard configurations of secondary containment.

C. Complete containment piping system shall include; carrier pipe, containment pipe, centralizer brackets, valves and valve boxes, plus double containment configurations including elbows, tees, closure and termination fittings.

D. Double containment system shall be sized based on specified primary carrier system per manufacturer's recommendations.

E. Provide drains at all low points in piping and vents at all high points. Vents shall be routed along wall and ceiling and connected to common tank vent or vented outside or vented through the roof.

F. Materials shall be compatible with the following chemicals:

1. Aqua Ammonia: 5 – 19.5%
2. Hydrofluorosilicic Acid: 23%
3. Sodium Hydroxide: 50%
4. Sodium Hypochlorite: 12.5 – 15.6%

1.04 SUBMITTALS

A. General:

1. Submit Product Data in sufficient detail to confirm compliance with requirements of this Section. Submit Product Data and Shop Drawings in one complete submittal package.

Partial submittals are unacceptable.

B. Product Data:

1. Catalog cuts and product specifications for components specified.
2. Submit product data for pipe, fittings, flanges, gaskets, and bolting.
3. Submit proposed gasket material for each service. Submit document confirming gasket material selection is appropriate for fluid carried in system.
4. Submit product data for solvent cement. Submit documentation confirming solvent cement material selection is appropriate for fluid carried in system.

C. Shop Drawings:

1. Installation and assembly drawings and specifically prepared technical data for double contained PVC components.
2. Submit layout for double contained PVC piping systems in accordance with and transmitted under appropriate piping system Specification section.

D. Submit in accordance with Section 01 33 00.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Firms experienced in manufacturing equipment of types and capacities indicated that have record of successful in-service performance.

B. Single-Source Responsibility: Obtain PVC double containment components from single manufacturer with responsibility for entire system.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver PVC double containment piping system components to their final locations in protective wrappings, containers, and other protection that will exclude dirt and moisture and prevent damage from construction operations. Remove protection only after equipment is made safe from such hazards.

B. Ship protected from damage. Tarp sections during shipment to avoid contact with road dust and salt spray.

C. Store PVC double containment piping system components in clean, dry location covered by a tarp to avoid sunlight and UV light.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Spears Manufacturing Company.

B. Asahi-American.

2.02 PVC MATERIAL

A. Type 1, Grade 1 conforming to ASTM D1784.

2.03 PIPING

A. Carrier and containment piping shall conform to ASTM D1785. Carrier pipe and containment pipe material shall as specified in the Schedule in Section 40 05 05.

B. Pipe shall be rated for 150 pounds per square inch at 73 degrees Fahrenheit (F).

C. Containment piping system shall be rated for 10 pounds per square inch. Piping shall be air-vented to prohibit pressurization in excess of 10 pounds per square inch.

D. Provide PVC drain valves at lowest points in system for both carrier and containment pipes.

E. Slope piping in direction shown on Drawings.

2.04 FITTINGS

A. Fittings shall be Double Containment configurations.

B. Schedule 40 or 80 PVC to match piping system.

1. ASTM D2464 for threaded joint type.
2. ASTM D2467 for socket joint type.

C. Fittings shall be rated for 150 pounds per square inch at 73 degrees F.

D. Centralizer Brackets:

1. Primary carrier system shall be supported by polypropylene centralizer brackets.
2. Brackets shall hold carrier piping centrally located within containment piping.
3. Slip-on design.
4. Allows free movement of components during expansion and contraction.
5. Design with annular space suitable for drainage and/or for routing leak detection cables.
6. Held in place by clean room adhesive.
7. Space centralizers as recommended by containment pipe manufacturer.

E. Containment Fittings:

1. Same configuration as internal carrier pipe fittings.
2. Designed with dimensions that bring the pipe stop of the carrier fitting flush to the face of the socket of the containment fitting.
3. On each pipe run, the carrier pipe cut length shall be equal to the face-to-face distance between containment fittings.

F. Termination Fittings:

1. Used for starting or stopping the containment portion of a system.
2. Shall consist of a reducer coupling to accept containment pipe that is pre-fabricated to an internal extender coupling for connection to existing carrier system, thereby terminating the secondary containment portion of the system.
3. Provide drain at lowest point of termination if low point in containment system. Field route PVC drain pipe, size as recommended by containment pipe supplier, along wall down to within 4-inches of floor. Coordinate drain route with Engineer.

G. Closure Fittings:

1. Special coupling configuration used for joining two containment lines that meet.
2. Typically used at the end of a system where the final termination fitting must connect to a

fixed point in the system.

H. Valve Boxes:

1. Provide “tee-style” valve boxes for valves within double contained system.
2. Provide threaded cap for access to valve handle.

I. Expansion Joints:

1. Designed for accommodate linear thermal expansion and contraction using an O-ring sealed internal piston.

J. Sensor Saddles

1. Sensor saddles for installation at low points in containment piping to provide instrument access detect fluid leaks from carrier piping or high points as an air relief connection.
2. Clamp-On style with O-ring seal for containment piping up to 6-inch.
3. Glue-On style for containment piping larger than 6-inch.
4. 3/4" NPT connection.

2.05 FLANGES

A. PVC, 1-piece socket type, flat faced, conforming to ANSI B16.5 150 pound bolt-hole drilling pattern.

B. Van Stone Style – two-piece design with rotating flange ring, PVC, flat faced, conforming to ANSI B16.5 150-pound bolt-hole drilling pattern.

2.06 JOINTS

A. Provide socket type at all locations except unions, valves, and equipment with threaded or flanged end connections.

B. Threaded connections are not acceptable for nominal piping size larger than 2 inches.

C. Do not provide threaded joints for piping systems identified on Drawings or in other sections to be provided without threaded joints.

2.07 GASKETS

A. Full-face, 1/8-inch thick flat type.

B. When mating flange has raised face, use flat ring gasket and provide filler gasket between outside diameter of raised face and flange outside diameter to protect flange from bolting moment.

C. Material compatible with fluid carried in system.

2.08 BOLTING

A. Type 316 Stainless Steel, ASTM A193, Grade B8M hex head bolts and ASTM A194, Grade 8M hex head nuts.

B. Bolts shall conform to ANSI B.1.20.1.

C. Provide washers same material as bolts.

2.09 SOLVENT CEMENT

A. Join socket connections with PVC solvent cement conforming to ASTM D2564.

B. As recommended by pipe and fitting manufacturer to assure compatibility with media in pipe system.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install components in accordance with manufacturer's written instructions.

B. Install products as shown on Drawings, and as specified in applicable piping system Specification section(s).

C. Provide drain piping, size as recommended by containment pipe supplier, field routed along wall down to within 4 inches of floor at all low points in system. Coordinate route with Engineer.

3.02 IDENTIFICATION

A. Identification: pipe identification shall be in accordance with Section 10 14 10.

END OF SECTION

SECTION 40 05 31.23
CHLORINATED POLYVINYL CHLORIDE PIPING

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Detailed requirements for various CPVC piping products. Some products specified in this Section may not be required for this Contract. Refer to piping system Specification section(s) and Drawings to determine CPVC piping products to be provided under this Contract.

1.02 REFERENCES

A. ANSI: American National Standards Institute.

B. ASTM: American Society of Testing and Materials.

C. NSF: National Sanitation Foundation

1.03 SUBMITTALS

A. General:

1. Submit Product Data in sufficient detail to confirm compliance with requirements of this Section. Submit Product Data and Shop Drawings in one complete submittal package. Partial submittals are unacceptable.

B. Product Data:

1. Catalog cuts and product specifications for CPVC piping components specified.
2. Submit product data for pipe, fittings, flanges, gaskets, and bolting.
3. Submit proposed gasket material for each service. Submit documentation confirming gasket material selection is appropriate for fluid carried in system.
4. Submit product data for solvent cement. Submit documentation confirming solvent cement material selection is appropriate for fluid carried in system.

C. Shop Drawings:

1. Submit layout drawings for CPVC piping systems in accordance with and transmitted under appropriate piping system Specification(s) section.

D. All materials in contact potable water shall be NSF/ANSI 61 certified.

E. Submit in accordance with Section 01 33 00.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Firms experienced in manufacturing equipment of types and capacities indicated that have record of successful in-service performance.

B. Single-Source Responsibility: Obtain CPVC piping components from single manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver CPVC piping systems components to their final locations in protective wrappings, containers, and other protection that will exclude dirt and moisture and prevent damage from construction operations. Remove protection only after equipment is made safe from such hazards.

B. Ship protected from damage. Tarp sections during shipment to avoid contact with road dust and salt spray.

C. Store CPVC piping components in clean, dry locations.

D. Tarp sections during storage to avoid sunlight and UV light.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Spears.

B. Or Equal.

2.02 CPVC MATERIAL

A. Class 23447.B conforming to ASTM D1784.

B. Pipe and fitting materials shall be specially formulated with sufficient UV screeners to provide for long-term outdoor exposure with no deleterious effects.

2.03 PIPE

A. Schedule 80 CPVC conforming to ASTM F441.

B. Pipe shall be rated for minimum of 150-pounds per square inch at 73 degrees Fahrenheit (F).

2.04 FITTINGS

A. Schedule 80 CPVC.

1. ASTM F437 for threaded joint type.
2. ASTM F439 for socket joint type.

B. Fittings shall be rated for 150-pounds per square inch at 73 degrees Fahrenheit (F).

2.05 JOINTS

A. Provide socket type at all locations except unions, valves, and equipment with threaded or flanged end connections.

B. Threaded connections are not acceptable for nominal piping size greater than 2 inches or for buried piping. If permitted by Engineer, threaded joints may be used in lieu of solvent welded joints in exposed interior locations where required to facilitate assembly. Use of threaded joints shall be held to a minimum.

C. Do not provide threaded joints for piping systems identified on Drawings or in other sections to

be provided without threaded joints.

2.06 UNIONS

A. Unions shall be O-ring seal type having interchangeable components with two union valves for maximum system versatility.

B. Unions intended for joining dissimilar materials shall be the transition type, which utilize components of the two dissimilar materials, joined with an elastomeric seal to absorb the thermal expansion coefficient differential. Seal material shall be compatible with fluid carried in system.

2.07 FLANGES

A. CPVC, 1-piece socket type, flat faced, conforming to ANSI B16.5 150-pound bolt-hole drilling pattern.

B. Van Stone Style – two-piece design with rotating flange ring, CPVC, flat faced, conforming to ANSI B16.5 150-pound bolt-hole drilling pattern.

2.08 GASKETS

A. Full-face, 1/8-inch thick flat type.

B. When mating flange has raised face, use flat ring gasket and provide filler gasket between outside diameter of raised face and flange outside diameter to protect flange from bolting moment.

C. Material compatible with fluid carried in system.

2.09 BOLTING

A. Type 316 Stainless Steel, ASTM A193, Grade B8M hex head bolts and ASTM A194, Grade 8M hex head nuts.

B. Bolts shall conform to ANSI B.1.20.1.

C. Provide washers same material as bolts.

2.10 SOLVENT CEMENT

A. Join socket connections with CPVC solvent cement conforming to ASTM F493.

B. For piping systems containing acids, bases, salts, or hypochlorites provide chemically resistant solvent cement Weld-On 724 CPVC, E-Z Weld 230 Chemical Resistant or equal. Otherwise, as recommended by pipe and fitting manufacturer to assure compatibility fluid in piping system.

2.11 THREAD LUBRICANT

A. Teflon tape.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install CPVC piping systems in accordance with manufacturer's written instructions.

B. Install products as shown on Drawings, and as specified in applicable piping system Specification section(s).

3.02 IDENTIFICATION

A. Identification: pipe identification shall be in accordance with Section 10 14 10.

END OF SECTION

SECTION 40 05 31.83
FLEXIBLE PLASTIC TUBING

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes various flexible tubing materials.

1.02 DESIGN REQUIREMENTS

A. Tubing shall be compatible with following chemicals:

1. Linear Low Density Polyethylene Tubing and Braided PVC Tubing:

a. Aqua Ammonia: 5 – 19.5%
b. Hydrofluorosilicic Acid: 23%
c. Sodium Hydroxide: 50%
d. Sodium Hypochlorite: 12.5 – 15.6%

B. Tubing shall comply with the NSF (National Sanitation Foundation) requirements for the control of equipment that comes into contact with either potable water or products that support the production of potable water; and shall be listed as approved under NSF-61.

C. Provide tubing sizes as specified in the Process-Mechanical Piping Schedule in Section 40 05 05.

D. Tubing shall be suitable for pressures and temperatures specified in the Process-Mechanical Piping Schedule in Section 40 05 05.

E. If owner accepts Alternate 1, perform all work in the Fluoride Room.

1.03 SUBMITTALS

A. General:

1. Submit Product Data in sufficient detail to confirm compliance with requirements of this Section. Submit Product Data and Shop Drawings in one complete submittal package. Partial submittals are unacceptable.

B. Product Data:

1. Catalog cuts and product specifications for tubing specified.

C. Submit in accordance with Section 01 33 00.

1.04 DELIVERY, STORAGE, AND HANDLING

A. All components shipped to the job site shall be properly protected from the elements so that no damage or deterioration occurs from the time of delivery to the time when the installation is complete and materials are placed into operation.

B. Manufacturer shall define the requirements to properly protect the components shipped to the job site, during storage, and during installation.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Freelin-Wade.

B. United States Plastic Corp.

C. Saint-Gobain.

D. Hudson Extrusion.

E. Or Equal.

2.02 LINEAR LOW DENSITY POLYETHYLENE TUBING

A. Materials:

1. Opaque, solid color low density polyethylene tubing.
2. Provide in opaque colors as indicated on the Schedule in Section 40 05 05.
3. Smooth interior wall.
4. Non-toxic food grade materials.

B. Physical Properties:

1. Temperature range: -40 to 150 F.
2. Vacuum Rating: 28” Hg.
3. Dimensions and pressure ratings:

Outer Diameter	Inner Diameter	Working Pressure @ 75 F (PSI)	Working Pressure @ 150 F (PSI)	Minimum Bend Radius
1/8”	0.062”	305	120	0.5”
5/32”	0.106”	175	70	1”
1/4"	0.170”	200	80	1.25”
5/16”	0.187”	230	90	1.5”
3/8”	0.25”	190	75	2”
1/2"	0.375”	135	55	2.5”
5/8”	0.500”	100	40	3”

C. Fittings:

1. Dual ferrule compression fittings by Parker, or equal.
2. Materials shall be suitable for media conveyed.
3. Provide connecting adapters as required to match connection type of equipment served.

2.03 BRAIDED PVC TUBING

A. Materials:

1. Clear PVC with braided reinforcement.
2. Smooth interior wall.
3. Non-toxic food grade materials.

B. Physical Properties:

1. Temperature range: -30 to 150 F.
2. Vacuum Rating: 18” Hg.
3. Dimensions and pressure ratings:

Outer Diameter	Inner Diameter	Working Pressure @ 75 F (PSI)	Working Pressure @ 150 F (PSI)	Bend Radius
0.438”	1/4"	250	125	1”
0.594”	3/8”	225	110	1.25”
0.75”	1/2"	200	100	2.25”
1.025”	3/4"	150	75	3.25”
1.312”	1”	125	60	5”
1.656”	1-1/4”	100	50	6.5”
1.937”	1-1/2”	100	50	8.5”
2.5”	2”	75	35	10”

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install tubing in accordance with manufacturer's written instructions.

END OF SECTION

SECTION 40 05 53
PROCESS VALVES

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Plug Valves
2. Butterfly Valves.
3. Check Valves.
4. Ball Valves.
5. Miscellaneous Valves.
6. Valve Accessories.

B. Some products specified in this Section may not be required for this Contract. Refer to piping system Specification section(s) and Drawings to determine particular products to be provided under this Contract.

C. If owner accepts Alternate 1, perform all work in the Fluoride Room.

1.02 DEFINITIONS

A. psi – pounds per square inch

B. w.c. – water column

C. FOG – fats-oils-grease

D. Deg F – Degree Fahrenheit

E. CWP – cold working pressure

F. SWP – steam working pressure

G. NPT – National Pipe Thread

1.03 REFERENCES

A. ANSI: American National Standards Institute

B. ASTM: American Society for Testing and Materials

C. ASME: American Society of Mechanical Engineers

D. AWWA: American Water Works Association

E. ISO: International Organization for Standardization

F. MSS: Manufacturers Standardization Society

G. NEMA: National Electrical Manufacture’s Association

H. NSF: National Sanitation Foundation

1.04 SUBMITTALS

A. Product Data and Shop Drawings:

1. Submit in accordance with Section 01 33 00 in sufficient detail to confirm compliance with the Drawings and this Section.
2. Submittal shall, at a minimum, include the items listed below.

a. Manufacturer's product data for each type of valve.
b. Motor data. Submit in accordance with Section 26 05 84.
c. Coating systems. Submit in accordance with Section 09 96 00.
d. Valve schedule. Identify all valves by type number, pipeline, location, joint type, manufacturer, and model or catalog number.

B. Instructional Services Documentation:

1. Submit in accordance with Section 01 79 30.

C. Operation and Maintenance (O&M) Data:

1. Submit in accordance with Section 01 78 23.

1.05 QUALITY ASSURANCE

A. Manufacturer shall be responsible for all components identified for each valve type, accessory, and actuator specified in this Section.

1.06 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. All equipment and parts shipped to the job site shall be properly protected from the elements so that no damage or deterioration occurs from the time of delivery to the time when the installation is complete and the units are placed into operation.

B. Manufacturer shall define the requirements to properly protect the equipment and parts shipped to the job site.

PART 2 – PRODUCTS

2.01 GENERAL

A. All materials in contact with potable water shall be NSF 61 certified and NSF 372 lead free Certified.

B. All valves shall be complete with all necessary operating hand wheels, chain wheels, extension stems, worm and gear operators, operating nuts, chains, wrenches, and other accessories that are required for proper completion of Work included under this section.

C. Valves installed in insulated piping systems shall be furnished with extended stem as required to allow operation of valve without damage to, or interference with, insulation system.

D. Unless otherwise shown, valves shall be same size as adjoining pipe.

E. All units shall have name of manufacturer and size of valve cast on body or bonnet or shown on permanently attached plate in raised letters.

F. Service for all items specified herein are shown on Drawings or in Specifications. Note, this is a general specification; some types listed herein may not be part of the Work.

2.02 PLUG VALVES

A. Type V005: Eccentric Plug Valve

1. Manufacturers:

a. DeZurik.
b. Henry Pratt.
c. Val-Matic.

2. Non-lubricated, resilient seated eccentric plug valve in compliance with AWWA C517-09.
3. Drip-tight shut-off up to full pressure rating of valve with pressure in either direction.
4. Provide grease zerk fittings in upper bonnet and lower body bearing for sludge applications.
5. Provide 100 percent full port valve for thickened sludge services. Port area shall be 100 percent of the connection pipe area.
6. Pressure rating for valves 12-inch and smaller: 175-psig.
7. Pressure rating for valves 14-inch and larger: 150-psig.
8. Cast iron body, ASTM A126, Grade B.
9. Bonnet shall be ASTM A126 Grade B cast iron or nickel aluminum bronze alloy C95500.
10. Buna-N, V packing, U-cup, or O-ring seals.
11. Nickel seats.
12. Balanced plug coated with NBR. Valves for digester gas service shall be provided with 316 stainless steel plugs.
13. Flanged ends, 125-pound ANSI Standards.
14. Mechanical joint ends for buried piping.
15. Stainless steel bearings.
16. Valves 4-inch and smaller, maximum operating pressure 25 psig and less: lever actuator.
17. Valves 4-inch and smaller, maximum operating pressure greater than 25 psig: gear actuator.
18. Valves 6-inch and larger: gear actuator.

2.03 BUTTERFLY VALVES

A. Type V105: Cast Iron Butterfly Valve

1. Manufacturers:

a. Dezurik.
b. Henry Pratt.
c. Val-Matic.

2. Provide sizes indicated on Drawings.
3. Conforms to or exceeds the latest revision of AWWA Standard C504 for Class 150B.
4. Body: ASTM A126, Class B cast iron.
5. Disc: Contoured ASTM A48, Class 40C or ASTM A126 Class B cast iron or ASTM A536, Grade 65-45-12 ductile iron.
6. Shaft: Type 304 stainless steel with self-lubricating, polytetrafluoroethylene (PTFE) sleeve type bearings.
7. Disc edge, Type 316 stainless steel.
8. Seat: ethylene propylene diene monomer (EPDM).

a. 3-inch through 20-inch shall be molded in and vulcanized to the valve body. The seat

shall contain an integral shaft seal protecting the valve bearings and packing from any line debris.

b. 24-inch and larger shall be retained within a dovetail groove in the valve body and locked in place by an epoxy compound edge. Compression between the seat and disc edge shall be adjustable from both the upstream and downstream side of the valve disc and the seat shall be field replaceable without disassembly of the disc and shaft.

9. Packing: Adjustable, EPDM.
10. 125-lb flanged ends faced and drilled in accordance with ANSI B16.1 standard.

2.04 CHECK VALVES

A. Type V204: Air Cushioned Swing Check Valve

1. Manufacturers:

a. DeZurik, APCO Model CVS-6000/6000A.

2. 2-in through 66-inch
3. Swing check with outside lever, weight, and air cushion chamber.
4. External air cushion chamber to dampen valve closure. Closing speed adjustable.
5. Suitable for flow direction horizontal or vertical up.
6. External adjustable counterweight to initiate valve closure.
7. Ductile iron body, disc, and cover.
8. Stainless steel hinge shaft.
9. Flanged ends meeting 125-lb ANSI standards.
10. 250 psi cold working pressure rating.
11. Stainless steel body seat, resilient Buna-N seat on disc.

B. Type V230: Wafer Check Valve

1. Manufacturers:

a. Val-Matic, Dual Disc Check.
b. Or equal.

2. 2-in through 66-inch
3. Dual disc, wafer style check valve with torsion spring induced closure.
4. ANSI B16.1 150# class.
5. One piece, 316 stainless steel body.
6. 316 stainless steel disc, trim, and spring.
7. Viton seals designed for positive shut-off at all pressures.

C. Type V255: PVC Ball Check Valve

1. Manufacturers:

a. Spears Manufacturing.
b. Hayward Industrial Products, Inc.
c. Or equal.

2. Ball check valve.
3. Provide sizes as indicated on Drawings.
4. PVC construction, ASTM D1784.
5. Valve shall be true union type.

6. Provide with socket weld joints.
7. Viton seats and seals.
8. O-rings shall be EPDM. For Sodium Hypochlorite and Hydrofluorosilicic Acid applications, O-rings shall be Viton**.**
9. All valve unions and nuts shall have Buttress threads.
10. Valve shall be suitable for installation in the vertical or horizontal position.
11. Rated for 150-psi at 73 deg F.

2.05 BALL VALVES

A. Type V330: Stainless Steel, Threaded, Vented Ball Valve

1. Manufacturers:

a. Apollo.
b. Nibco.
c. Watts.
d. Or equal.

2. 2-inch and smaller.
3. Provide sizes as indicated on Drawings.
4. Stainless steel body and ball.
5. Vented ball.
6. Blowout proof stem.
7. Reinforced Teflon seats and seals.
8. Full port design.
9. Threaded ends.
10. Hand lever actuator.
11. Rated at 1,000-lb WOG minimum, 250-psi SWP.

B. Type V336: Stainless Steel Ball Valve

1. Manufacturers:

a. Apollo, Figure 76-100.
b. Nibco, Figure T-580-S6-R-66.
c. Nibco, Figure K-590-S6-R-66.
d. Or Equal.

2. 1/4-inch to 3-inch for water service on stainless steel piping systems.
3. Comply with MSS-SP-110.
4. Conventional port, two-piece stainless steel body for threaded valves.
5. Conventional port, three-piece stainless steel body for socket weld valves.
6. Stainless steel ball and stem.
7. Reinforced TFE Seats.
8. 1,000 psi CWP.

C. Type V355: PVC, Socket-Weld Ball Valve

1. Manufacturers:

a. Spears Manufacturing.
b. Nibco.
c. Hayward Industrial Products, Inc.
d. Or equal.

2. 3-inch and smaller.
3. Provide sizes as indicated on Drawings.
4. PVC construction, ASTM D1784.
5. Valve shall be true union type.
6. Provide with socket weld joints.
7. Full-port.
8. PTFE ball seats.
9. O-rings shall be Viton for Sodium Hypochlorite and Hydrofluorosilicic Acid and EPDM for other services.
10. All valve unions and nuts shall have Buttress threads.
11. Rated for 150-psi at 73 deg F.
12. Unless indicated otherwise, provide with double-stop polypropylene handle operator.

D. Type V356: PVC, Socket-Weld Vented Ball

1. Manufacturers:

    a. Spears Manufacturing.
    b. Nibco.
    c. Hayward Industrial Products, Inc.
    d. Or equal.

2. 3-inch and smaller.
3. Provide sizes as indicated on Drawings.
4. PVC construction, ASTM D1784.
5. Valve shall be true union type.
6. Provide with socket weld joints.
7. Full-port.
8. Vented Ball.
9. PTFE ball seats.
10. O-rings shall be Viton (FKM) for Sodium Hypochlorite and Hydrofluorosilicic Acid service and EPDM for others.
11. All valve unions and nuts shall have Buttress threads.
12. Rated for 150-psi at 73 deg F.
13. Unless indicated otherwise, provide with double-stop polypropylene handle operator.

E. Type V361: CPVC, Socket-Weld Vented Ball Valve

1. Manufacturers:

    a. Spears.
    b. Nibco
    c. Or equal.

2. 3-inch and smaller.
3. Provide sizes as indicated on Drawings.
4. CPVC construction, ASTM D1784.
5. Vented ball.
6. Full-port.
7. Valve shall be true union type.
8. Provide with socket weld joints.
9. PTFE ball seats.
10. O-rings shall be Viton (FKM) for Sodium Hypochlorite and Hydrofluorosilicic Acid service and EPDM for others.
11. All valve unions and nuts shall have Buttress threads.
12. Rated for 150-psi at 73 deg F.

13. Unless indicated otherwise, provide with double-stop polypropylene handle operator.

2.06 MISCELLANEOUS VALVES

A. Type V915: Air Release Valve

1. Manufacturers:

a. Val-matic, Model 49A
b. Apco, Series 450
c. ARI Flow Control Accessories Ltd.
d. Or equal.

2. Automatic air release style valve utilizing a float that drives closure of vent orifice as chamber fills with liquid.
3. Meeting requirements of AWWA C512
4. Bolted cover for internal access.
5. Cast iron body.
6. Stainless steel internals: linkage, stem, float, and fasteners.
7. BUNA-N or EPDM elastomers.
8. 2” NPT bottom inlet.
9. 1” NPT outlet.
10. 150 psi working pressure.
11. Factory primed in accordance with Section 09 96 00. Finish coating by Contractor to match piping system in accordance with Section 09 96 00.

2.07 ACCESSORIES

A. Valve Actuators:

1. Open by turning counter-clockwise.
2. Valves with centerline 5-feet 6-inch or less above operating floor: Handwheel for gear-actuated valves, lever for lever-actuated valves. Shall require no more than 40-pound effort to unseat valve.
3. Valves 4-inch and larger, unless otherwise noted on drawings, with centerline greater than 5-feet 6-inch above operating floor: Chainwheel.
4. Valves 4-inch and smaller and 6-inch butterfly valves, maximum operating pressure 25 psig and less: Lever.
5. Valves 4-inch and smaller, maximum operating pressure greater than 25 psig: Gear.
6. Valves 6-inch and larger: Gear.

B. Tee Wrenches:

1. Provide for buried and submerged valves.
2. Provide wrenches of varying lengths as needed so that when in operation the handle is 36-40 inches above the operating floor for each valve application.
3. Provide dual Type 316 stainless steel wall hooks, one on each branch of tee, for hanging each wrench. Anchors and hardware shall be type 316 stainless steel. Coordinate location of tee wrench wall hooks with Owner.
4. Provide wrench compatible with connection to 2-inch nut.

C. Chain Wheels and Chain Levers:

1. Provide chain wheels with guides and chain having coil proof design.
2. Provide chain levers with chain having coil proof design.

3. Ductile iron chain wheels, chain levers, and chain guides.
4. Stainless steel chain.
5. Chain size as recommended by valve manufacturer.
6. Extend chains to within 4-feet of operating floor.
7. Provide chain hooks and tieback anchors for chains. Install so chain does not interfere with personnel traffic.

D. Buried and Submerged Valves:

1. Provide seals on shafts and gaskets on valve and actuator covers to prevent water entry.
2. Provide totally enclosed actuator mounting brackets with gasket seals.

E. Valve Boxes:

1. Provide for buried valves.
2. Three-piece screw type, cast iron box and cover.
3. Valve box diameter 5 ¼-inch, length as required for installation.
4. Provide extension stem as required for installation and 2-inch operating nut located within 6-inches from top of cover.

F. Floor Boxes:

1. Provide for valves as shown on Drawings.
2. Cast iron box and cover.
3. Provide valves with extension stems, complete with operating nuts, as required to locate top of operating nuts 2-inches below top of floor box cover.
4. Provide floor box cover wrench.

G. Extension Stems for Submerged Valves or Valves Below Operating Floor or Walkway:

1. Provide for valves as shown on Drawings.
2. Provide with intermediate stem guides with maximum spacing not exceeding 10 feet or L/R not exceeding 200.
3. Stem guides, stem, and couplings: Type 316 stainless steel.
4. Provide stem ends with transition pieces to connect to valve actuator and operator above.

H. Operator (Floor) Stand:

1. Ductile iron or Type 316 stainless steel floor mounted operator stand to operate extended stem valves with handwheel or handcrank actuator as noted on Drawings.
2. Provide bevel gear operator with clear plastic stem cover.
3. Floorstand and handwheel shall be cast iron.
4. Provide valve position indicator.
5. Provide rising stem, unless otherwise noted on Drawings.

I. Locking Devices:

1. Provide for valves as shown on Drawings.
2. Locking device shall be integral to the valve/operator and shall accept a normal padlock. Locking devices using chains and cables are not acceptable.
3. Provide two padlocks (one duty and one spare) for each pad-lockable valve.
4. Provide one key for each pad-lockable valve.
5. All padlocks provided shall be compatible with all keys provided. Different keys for each padlock are not acceptable.

J. Worm and Gear Actuators:

1. Totally enclosed design.
2. Sized for valve operation under valve rated pressure with pull of 40-pounds on handwheel or chain wheel.
3. Self-locking to prevent valve position creep.
4. Hardened alloy steel worm.
5. Reduction gearing runs in lubricant.
6. Orient operators to avoid interference with adjacent piping, equipment, and structures.
7. Include valve position indication.

2.08 ELECTRIC ACTUATORS

A. General

1. Actuators shall be sized and furnished by valve manufacturer.

B. EA-1:

1. Manufacturers:

a. Beck.
b. Rotork, IQ/IQM series.
c. Limitorque, QX/MX series.
d. EIM, TEC2000 series.
e. AUMA, SA/SAR-UW series.

2. Design Requirements:

a. Self-contained, totally enclosed with motor, integral reversing starters, local controls, reduction gearing, limit switch gearing, limit switches, control power transformer, torque switches, declutch lever, auxiliary handwheel, and local position indication.
b. Torque output no less than 1.5 times the required operating torque.
c. Removable from valve without taking valve out of service.
d. Designed for mounting and running in any position.
e. Suitable for indoor or outdoor service with ambient temperatures from -40 to 140 F. Provide enclosure heater as required.
f. Actuators for open/close service shall be rated for 60 starts per hour.
g. Actuators for modulating service shall be rated for 1,200 starts per hour.
h. Enclosure:

1) Rating shall be as specified in the Actuated Valve Schedule at the end of this section.
2) Cast iron construction.
3) Type 316 stainless steel external fasteners

3. Motors (Beck):

a. Induction type.
b. Insulation: Class H.
c. Totally enclosed, non-ventilated.
d. 120 volt, 1 phase, 60 Hz.
e. Motor shall be non-coasting, suitable for high duty cycle conditions, and shall be self-locking and self-releasing without the use of a separate brake winding, mechanical brake, or worm gear mechanism.

f. The motor shall be capable of up to 60 starts/stops per minute or a temporary stall condition without overheating.
g. Triacs shall be utilized for solid-state switching. Torque capacity of the operators shall be sufficient to operate the valves with a maximum pressure differential indicated in the Valve Schedule with a safety factor of at least 1.5.
h. Maximum current draw of motors shall be 3.1 amperes in a fully stalled condition.
i. Motors shall reach synchronous speed on start-up in 1.5 AC power cycles, and shall also reach dead stop from full synchronous speed in 1.5 cycles. Motor shall not overheat or fail when in continuous stall condition for 72 hours.
j. No electrical or thermal overload protection shall be required for protection of a stalled or cycling operator.

4. Motors (Rotork, Limitorque, EIM, and AUMA):

a. 460 Volt, 3-phase, 60 Hz power supply. 1 Hp maximum without Engineer approval.
b. High starting torque; low stall torque, low inertia, designed and built by actuator manufacturer.
c. Embed thermistor in each winding for thermal protection.
d. Class F insulation with a duty rating of at least 15 minutes at 40 F ambient temperature.
e. Plug and socket electrical disconnect. Allow removal of motor without loss of lubricant.
f. Provide hardware to allow correct rotation required for valve regardless of power supply connection sequence.

5. Terminal Compartment:

a. Separate from the inner electrical components of the actuator with a watertight double seal.
b. Provide three threaded cable entries (Rotork, Limitorque, EIM, and AUMA). Provide two threaded cable entries (Beck).
c. Provide stud type terminals embedded in a terminal block of high tracking-resistance compound.
d. Shroud three phase power terminals from control terminals with an insulating cover.

6. Gear Train:

a. Grease filled, O-ring sealed in cast or ductile iron gear case.
b. Suitable for operation in any orientation.
c. Hardened, machine cut steel gears and precision machined alloy bronze worm gear (Rotork, Limitorque, EIM, and AUMA).
d. Heat treated steel and ductile iron (Beck).
e. Provide reduction gearing as required.

7. Manual Operation:

a. Handwheel rim pull shall be a maximum of 40 pounds.
b. Handwheel shall not rotate during motor operation, unless it is safe with a spoke-free design.
c. Safety interlock feature to prevent motor operating when manual override engaged (Rotork, Limitorque, EIM, and AUMA).
d. Actuator shall have a lockable handswitch to prevent user from running motor from handswitch (Beck).
e. Utilize actuator worm gear to maintain self-locking gearing and facilitate change over from motor to manual operation when the actuator is under load (Rotork, Limitorque, EIM, and AUMA).
f. Actuator shall utilize a self locking mechanism capable of holding double the rating of the actuator torque to prevent back driving (Beck).

g. Failure of the motorized gearing shall not prevent manual operation.

8. Position and Torque Calibration:

    a. Sensing provided by absolute encoder using hall effect sensors. Incremental encoders requiring batteries to retain settings on power loss are not acceptable. Settings shall be stored in non-volatile memory.
    b. Torque and travel adjustment:

        1) Position setting range of 1 to 500 turns with a resolution of 2.81 degrees and accuracy of 5 degrees of actuator output.
        2) Torque setting range of 40 to 100 percent of rated torque.

    c. Actuator shall be provided with adjustable torque switches responsive to load encountered in either direction of travel (Rotork, Limitorque, EIM, and AUMA).
    d. Torque switch bypass for torque sensing system to inhibit torque switch trip during unseating or during starting in mid-travel against high inertial loads (Rotork, Limitorque, EIM, and AUMA).
    e. Limit switches:

        1) Adjustable to trip at any point between full open and full close.
        2) Do not allow set position to be lost if over travel occurs in either manual or electric modes of operation.
        3) Provide two independent and full adjustable rotary type position limit switches with 15 amp DPDT contacts for remote open/close position indication.

    f. Torque and position settings shall be configurable without the need to remove any cover from the actuator via Bluetooth communication (Rotork, Limitorque, EIM, and AUMA).

9. Provide continuous mechanical dial position indication in step at all times with actual position whether operated by the actuator motor or handwheel.
10. Controls:

    a. Microprocessor based with mechanically and electronically interlocked reversing contactors for open/close duty and solid-state contactors for modulating duty (Rotork, Limitorque, EIM, and AUMA).
    b. Provide pad-lockable Local/Off/Remote selector switch and Open/Stop/Close pushbuttons mounted on the face of the actuator with red and green indicating lights for open/close and amber fault light.
    c. Open/Close Service: Actuator shall accept separate signals to open and close.
    d. Actuators shall be provided with monitoring relays to remotely indicate:

        1) Common fault.
        2) Local/Off/Remote switch position.
        3) Open limit switch reached.
        4) Close limit switch reached.

    e. DC power supply integral with operator and powered from 110-volt AC internal transformer. Positioner board to provide repeatable accuracy of 0.25 percent of span and have separate trim pots for zero, span, and deadband adjustment (Rotork, Limitorque, EIM, and AUMA).
    f. Network controls:

        1) When indicated in schedules, actuators shall include a digital control module to

allow remote control via a 2-wire non-proprietary field bus protocol.

2) Equip digital control module with serial communication ports to all actuation by the Process Control Network linked by a 2-wire local area network utilizing Modbus function code.
3) Arrange in a self-healing ring configuration with multi-drop taps to each actuator.

2.09 COATINGS

A. Provide in accordance with Section 09 96 00 unless specified otherwise in this Section.

B. Manufacturer is responsible for surface preparation, prime coat, and second coat of equipment in the factory prior to shipment unless otherwise noted.

C. Manufacturer is responsible for the surface preparation and all motor coatings in the factory prior to shipment.

D. Contractor shall provide final third finish coat for equipment in the field and be responsible for touchup and any additional specified coatings.

E. Final color of exposed equipment and motors shall be selected by Owner.

F. Stainless steel, bronze, and nonmetallic surfaces shall not be coated.

G. Coat machined or bearing surfaces and holes with protective grease.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install valves in accordance with manufacturer's written recommendations and approved submittals. Plug valves installed in horizontal pipelines in applications with suspended solids, slurries, etc. shall be installed on their side so the plug rotates to the top of the pipeline when open.

B. Bolt holes of flanged valves shall straddle the vertical centerline of the pipe run. Before installing flanged valves, the flanged faces shall be thoroughly cleaned. After cleaning, insert gasket and bolts, and tighten the nuts progressively and uniformly. If flanges leak under pressure, loosen or remove the nuts and bolts, reseat or replace the gasket, retighten and/or reinstall the nuts and bolts, and retest the joints.

C. Actuator orientation and positioning, or rotation of various component heads on actuator may be required to be adjusted in the field after or during installation. Contractor shall coordinate with Engineer in positioning actuator to allow best access to controls and manual operator. Field adjustments shall be made at no additional cost to Owner.

D. Electrical connections to actuators shall be located beneath the actuator.

E. Provide equipment identification marker complete with equipment name and tag number in accordance with Section 10 14 10. Coordinate field location with Engineer.

3.02 FIELD QUALITY CONTROL

A. Tests:

1. Pressure test valves at same time connected piping is tested.

2. Repair leaking joints.
3. Protect parts of valves and actuators that could be damaged by test.

B. Manufacturer’s Field Services:

1. Supplier's or manufacturer's representative for actuated valves specified herein shall be present at jobsite or classroom designated by Owner for workdays indicated, travel time excluded, for assistance during plant construction, plant startup, and training of Owner's personnel for plant operation. Include separate trips for:

   a. 1 workday for Installation Services per actuator type.
   b. 1 workday for Instructional Services per actuator type.
   c. 1 workday for Post Startup Services.

2. Supplier or manufacturer shall direct services to system and equipment operation, maintenance, troubleshooting, and equipment and system-related areas other than wastewater treatment process. See Section 01 61 00.
3. In addition to the services specified above, provide manufacturer’s services as required to successfully complete systems demonstration as specified in Section 01 79 10.

SCHEDULE 1: ACTUATED VALVE SCHEDULE

Tag No.	Valve Type	Valve Size (inch)	Service	Actuator Type	Operating Mode	Failure Mode	Position Switches / Transmitter	NEMA Rating	Comments
NAOC-V-1	V361	3	NAOC	EA-1	O/C	LAST POSITION	N/A	7	
NAOC-V-2	V361	3	NAOC	EA-1	O/C	LAST POSITION	N/A	7	
NAOC-V-3	V361	3	NAOC	EA-1	O/C	LAST POSITION	N/A	7	
NAOC-V-4	V361	1	NAOC	EA-1	O/C	LAST POSITION	N/A	7	
NAOC-V-5	V361	1	NAOC	EA-1	O/C	LAST POSITION	N/A	7	
NAOC-V-6	V361	1	NAOC	EA-1	O/C	LAST POSITION	N/A	7	
NAOC-V-7	V361	1	NAOC	EA-1	O/C	LAST POSITION	N/A	7	
NAOC-V-8	V361	1	NAOC	EA-1	O/C	LAST POSITION	N/A	7	
NAOC-V-9	V361	2	NAOC	EA-1	O/C	LAST POSITION	N/A	7	
NAOC-V-10	V361	2	NAOC	EA-1	O/C	LAST POSITION	N/A	7	
NAOC-V-11A	V361	1	NAOC	EA-1	O/C	LAST POSITION	N/A	7	
NAOC-V-11B	V361	1	NAOC	EA-1	O/C	LAST POSITION	N/A	7	
NAOC-V-12A	V361	1	NAOC	EA-1	O/C	LAST POSITION	N/A	7	
NAOC-V-12B	V361	1	NAOC	EA-1	O/C	LAST POSITION	N/A	7	

NHOH-V-1A	V330	1/2	NHOH	EA-1	O/C	LAST POSITION	N/A	7	
NHOH-V-1B	V330	1/2	NHOH	EA-1	O/C	LAST POSITION	N/A	7	
NAOH-ZS-1	V336	2	NAOH	MANUAL	N/A	N/A	NAOH-ZSO-1 NAOH-ZSC-1	7	
NAOH-ZS-2	V336	2	NAOH	MANUAL	N/A	N/A	NAOH-ZSO-2 NAOH-ZSC-2	7	
NAOH-V-1A	V336	1	NAOH	EA-1	O/C	LAST POSITION	N/A	7	
NAOH-V-1B	V336	1	NAOH	EA-1	O/C	LAST POSITION	N/A	7	
HFSA-V-1A	V355	1	HFSA	EA-1	O/C	LAST POSITION	N/A	7	
HFSA-V-1B	V355	1	HFSA	EA-1	O/C	LAST POSITION	N/A	7	
FLTR-V-321	V105	30	BW	EA-1	O/C	LAST POSITION	N/A	4X	
FLTR-V-26	V105	30	BW	EA-1	O/C	OPEN	N/A	4X	

END OF SECTION

SECTION 40 41 13
PROCESS PIPING HEAT TRACING

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes self-regulating pipe heat tracing systems and control equipment.

1. HTP-1
2. HTP-2

1.02 SYSTEM DESCRIPTION

A. Design Requirements:

1. Piping heat tracing supplier shall provide complete design of pipe heat tracing system, including:

a. Analysis and calculations signed and sealed by the qualified professional engineer responsible for their preparation.
b. Definition of:

1) Required length of circuits.
2) Quantity of circuits.
3) Number and type of fittings and fixtures.
4) Define design heating load and required heating cable output.
5) Include and application derate of heat trace capacity when installed on plastic piping.
6) Total electrical load at each required power connection.

2. Provide pipe tracing cable system capable of maintaining pipe contents at temperature specified in the Schedule(s) at the end of this section when outside ambient temperature is -21°F with 25 miles per hour wind.
3. Limit individual lengths of heat tracing circuits such that maximum single circuit capacity is 30 amps when starting the circuit. Provide multiple 30-amp circuits as required at individual heat tracing locations.
4. See Piping Heat Tracing Schedule for temperature requirements.
5. Heating calculations shall include a minimum safety factor of 10%.

B. Provide complete pipe electric heat tracing systems consisting of a self-regulating heating cable, connection kits, accessories, and controls.

1.03 SUBMITTALS

A. Product Data:

1. Heating cable data sheet.
2. Connection kits and accessories data sheet.
3. Controller data sheet.
4. Controller wiring diagram.
5. Include rated capacities, operating characteristics, and furnished specialties and accessories.

B. Shop Drawings:

1. Schedule indicating heating capacity, length of cable, and electrical power requirement for each electric heating cable required and quantity of circuits for each controller.
2. Heat loss calculations for each pipe including pipe and insulation characteristics, heat loss, and watts per foot supplied by the heating cable.
3. Heat Trace Circuit Layout Drawings, including:

    a. Location/identification of area to be traced.
    b. Heater circuit number.
    c. Electrical load.
    d. Heater catalog numbers.
    e. Heater termination points.
    f. Start-up temperature.
    g. Location of all components.
    h. Material list and quantities of all components.
    i. Heating cable layout.

4. Heat Trace Isometric, including the following:

    a. Location of line.
    b. Piping line numbers.
    c. Valves, pumps, flanges, fittings, and instruments.
    d. Heat loss and heater output.
    e. Electrical load.
    f. Heater catalog number.
    g. Heater termination points.
    h. Design parameters.
    i. Insulation type and thickness.
    j. Position of all components.
    k. Material schedule listing all components and quantities used.
    l. Panel ID number.

5. Pipe Freeze Protection Detail Drawings: Project-specific Detail Drawings, including details showing the following:

    a. Installation and positioning of all components.
    b. Proper amounts of tracing for valves, pumps, flanges, fittings, instruments, etc.
    c. Junction box layouts.

6. Control Panel Drawings: Drawings for each control panel shall include the following:

    a. Physical arrangement and structural detail drawings.
    b. Complete power and control wiring diagrams showing all internal wiring connections for electrical and instrument components in each control panel. All wires, terminals, and devices shall be numbered and tagged in accordance with system elementary diagrams.

7. System Wiring Diagram: Project-specific Drawings (if applicable) including:

    a. Interconnect of all major components.
    b. Assignment of circuiting.
    c. Connection of circuit wiring in terminal blocks.
    d. Connection of sensor wiring.
    e. Connection of external alarm wiring.

8. Controller Setpoint Schedule (if applicable) showing the following:

    a. Circuit addresses.
    b. Circuit set points,

c. Circuit alarms and settings.

C. Test Results:

1. Submit megger testing results for each heat trace cable as specified in Part 3.

D. Submit in accordance with Section 01 33 00.

E. Operation and Maintenance (O&M) Data:

1. Operating instructions and maintenance data for materials and products for inclusion in O&M Manual.
2. Manufacturer's written instructions for periodic tests of submersible centrifugal equipment in service.
3. Submit in accordance with Section 01 78 23.

F. Submit Instructional Services information in accordance with Section 01 79 30.

1.04 QUALITY ASSURANCE

A. Certification - System (Heating Cable and Connection Kits): c-UL-us Listed, CSA Certified, or FM Approved for freeze protection of metallic and non-metallic piping associated with HVAC, Plumbing, and Fire Suppression systems.

1.05 WARRANTY

A. Manufacturer shall repair or replace heat tracing products listed below that fail in materials or workmanship within specified warranty period, when such goods are properly installed, operated, and maintained in accordance with product documentation.

1. Heating cables, connection kits, and accessories.
2. Thermostats, controllers, panels, contactors, sensors, and accessories.

B. Warranty Period: Two years from date of Substantial Completion.

C. Manufacturer's Extended Warranty: Provide Owner an extended product warranty for heat tracing products described below.

1. Contractor must complete and forward to Owner the Installation, Inspection, or Commissioning Record(s), and complete manufacturer's online warranty registration form within 30 days from date of installation, otherwise only standard limited warranty applies. Any loss of manufacturer warranty duration defined below shall become the Contractor’s burden to maintain specified warranty duration.
2. Heating Cable Warranty Period: 10 years from date of installation.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in original, unopened containers or packages with intact and legible manufacturers' labels.

B. Store heating cable in clean, dry location with a temperature range of 0 to 140 deg F (-18 to 60 deg C).

C. Protect heating cable ends from moisture ingress until final termination of the heating cable is complete.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. RAYCHEM by nVent.

B. Or equal.

2.02 HEATING CABLE

A. Heating Element: Pair of parallel No. 16 AWG, nickel-coated, stranded copper bus wires embedded in crosslinked conductive polymer core, which varies heat output in response to temperature along its length. Terminate with waterproof, factory-assembled, non-heating leads with connectors at one end, and seal the opposite end with a watertight end seal. Cable shall be capable of crossing over itself without overheating.

B. Electrical Insulating Jacket: Flame-retardant modified polyolefin.

C. Ground Braid: Tinned-copper braid. Minimum 70 percent for ground path and mechanical ruggedness.

D. Outer Jacket Requirements.

1. For aboveground freeze protection of water lines where fuel oil or aqueous chemicals are not present, use a modified polyolefin with ultraviolet inhibitor.
2. For below-grade applications, scum or grease lines, or where fuel oil and aqueous chemicals are present, use fluoropolymer with ultraviolet inhibitor.

E. Maximum Operating Temperature (Power On): 154 deg F for 3 W/ft., 5 W/ft., and 8 W/ft cable and 150 deg F for 12 W/ft cable.

F. Maximum Exposure Temperature (Power Off): 185 deg F.

G. Heat output/foot/°F shall remain constant, independent of length.

H. Capable of being cut to any length in field.

I. Self-regulating heat output with lower heat output upon rise in cable temperature.

J. Provide manufacturer’s standard power connections, end seals, splice, and tee kit components.

K. Provide proper fittings and appurtenances for field connection of system to conduit and wiring without need for procurement of special fittings or wiring devices.

2.03 ACCESSORIES

A. Securing Tape

1. Provide manufacturer’s standard tape for securing heat trace cable to pipe.

a. Aluminum foil coated tape for plastic piping, installed for continuous (longitudinal) covering of the heating cable.
b. Glass or polyester cloth tape for metallic piping
c. Tape used for stainless steel piping systems shall be formatted for proper adhesion to stainless steel materials.

B. End Seals

1. NEMA 4X, IP66, non-metallic construction, and UV resistant.
2. Lighted High Profile Style:

    a. Extended body type, mounted to pipe surface with access cap extended through pipe insulation system with thickness up to 4 inches.
    b. Threaded cap allowing access to wire ends for testing.
    c. Reusable sealing boot.
    d. Cold applied, no heat required for installation.
    e. LED indicator which energizes when voltage applied to circuit.
    f. Light module shall be replaceable.
    g. All electronics shall be fully encapsulated.

C. Power Termination, Tee, and Splice Connections

1. NEMA 4X, IP67, non-metallic construction, and UV resistant.
2. High Profile Style:

    a. Extended body type, mounted to pipe surface with access cap extended through pipe insulation system with thickness up to 4 inches.
    b. Removable, gasketed access cover attached with stainless steel screws.
    c. Cold applied, no heat required for installation.

2.04 CONTROLS

A. Single circuit local digital controller: (Type HTC1)

1. Control self-regulating heating cable via an energy-saving, programmable single-circuit controller to provide adjustable maintained temperatures in the range of -40 to 140 deg F.
2. Provide one controller for each heat-tracing circuit, as indicated on Piping Heat Tracing Schedule(s).
3. Controller shall include self-test function to verify heating cable integrity at least once every 24 hours.
4. Controller Capabilities:

    a. Supply Voltage: 100 to 277 V ac.
    b. Enclosure: NEMA 4X FRP or 304 stainless steel enclosure with clear window for reading display. Provide FRP enclosures for interior locations and stainless steel for exterior locations.
    c. Operating Temperature Range: -40 to 140 deg F.
    d. Touch screen display.
    e. Control Algorithms: Selectable between On/Off and PASC (proportional ambient sensing control).

5. Password lockout feature to prevent unauthorized programming changes.

    a. Memory: Nonvolatile, restored after power loss.
    b. Temperature: degrees Fahrenheit or degrees Celsius.

6. Alarm conditions:

    a. Low/high temperature.
    b. Low/high current.
    c. Low/high voltage.
    d. Low/high resistance.
    e. Ground fault alarm and trip.

7. Temperature Sensor Inputs:

    a. Quantity: Three.
    b. Provide intrinsically safe barriers on RTD inputs when located in a hazardous environment.
    c. Compatible with:

        1) 100 ohm, platinum, 3-wire RTD.
        2) 100 ohm, nickel iron, 2-wire RTD.
        3) 100 ohm, nickel, 2-wire RTD.

8. Double pole relay output for remote notification of any alarm condition.
9. Communications:

    a. RJ-45 port for Ethernet communications via Modbus/TCP.
    b. 2-wire RS 485 Serial communications via Modbus RTU.
    c. Each heat trace control and monitoring unit shall have a unique address.

10. Digital touch screen display with the following:

    a. Actual temperature.
    b. Control temperature.
    c. Heat trace current.
    d. Heat trace voltage.
    e. Power.
    f. Alarm status.

B. Multi-Circuit Controller: (Type HTC2)

1. Control self-regulating heating cable via an energy-saving, programmable multi-circuit controller to provide adjustable maintained temperatures in the range of -40 to 140 deg F.
2. Panel to consist of six individual controllers, each providing a single heat trace circuit, as indicated on heat tracing schedule(s).
3. Controller to include self-test function to verify heat-tracing integrity at least once every 24 hours.
4. Controller Capabilities:

    a. Supply Voltage: 100 to 277 V ac.
    b. Enclosure: NEMA 12 (painted steel, indoor installation)
    c. Operating Temperature Range: - 40 to 140 deg F.
    d. Touch screen display.
    e. Control Algorithms: On/Off and proportional ambient sensing control.
    f. The system shall use 3-wire 100-ohm platinum Resistance Temperature Detectors (RTDs), or temperatures derived from 4-20 mA sources for temperature sensing.
    g. The system shall allow multiple RTD temperature inputs per heat tracing circuit for monitoring, control and fault indication. Each sensor shall be configurable for control, monitoring or high temperature cut-out or combinations thereof.

5. Password lockout feature to prevent unauthorized programming changes.

    a. Memory: Nonvolatile, restored after power loss.
    b. Temperature: degrees Fahrenheit or degrees Celsius.

6. Alarm conditions:

    a. Low/high temperature.
    b. Low/high current.

c. Low/high voltage.
d. Low/high resistance.
e. Ground fault alarm and trip.

7. Double pole relay output for remote notification of alarm condition.
8. Communications:

a. RJ-45 port for Ethernet communications via Modbus/TCP.
b. 2-wire RS 485 Serial communications via Modbus RTU.
c. Each heat trace control and monitoring unit shall have a unique address.

9. Digital touch screen display with the following:

a. Actual temperature.
b. Control temperature.
c. Heat trace current.
d. Heat trace voltage.
e. Power.
f. Alarm status.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions under which pipe tracing cables to be installed and notify Engineer, in writing, of conditions detrimental to proper and timely completion of Work.

1. Prior to installation of heating cable system, verify that all piping that will be heat traced has passed all hydrostatic/pressure test and is signed off by all applicable local inspectors.
2. Ensure surfaces and pipes in contact with electric heating cables are free of burrs and sharp protrusions.
3. Ensure ambient temperature is within allowable range for installation of tape attachment system.

3.02 INSTALLATION

A. Install in accordance with manufacturer's written instructions and as follows:

1. Support heating cables at no more than 1’-0” intervals.
2. For freeze protection systems, install heating cable along bottom quadrant of piping.
3. All cables installed on pipe elbows shall be routed along the outer radius of the fitting.
4. Minimize use of spiral wrapped heating cables. Where single straight cable has inadequate heating capacity, provide two parallel cables.
5. Instrument, vent, and drain branches shall be wrapped with heating cable in addition to protected pipeline.
6. Valves shall be wrapped with heating cable to protect entire valve body. Provide adequate slack to allow removal of heating cable from valve as required to allow removal of valve or valve internals without disconnection of heating cable.
7. Wrap pipe flanges and pipe supports with additional heating cable as recommended by manufacturer.
8. Install pipe surface temperature sensors 180° from heating cable in a single cable installation and no less than 90° away from any cable in a multi-cable installation. Entire length of sensor shall remain be in contact with pipe surface.
9. Orientate all sensor heads, junction fittings, controllers, and end-of-line terminations in a vertical orientation when installed on horizontal piping.
10. All pipe mounted junction boxes, sensor bodies, and other wire termination components shall be securely fastened to piping with stainless steel pipe adjustable pipe straps.

11. Install all ambient air temperature sensors shielded from direct exposure to sunlight or other heat sources.

B. Protect all heating cable ends from moisture ingress until cable is terminated with end seals.

C. Coordinate circuit connection points and voltages with Drawings.

D. All heating cables shall be meggered per manufacturer's requirements:

1. Heating cable insulation resistance must exceed 20 megohms at a minimum of 500 vdc.
2. All results must meet manufacturer's specification. Cables will be considered defective if they do not pass tests and inspections in accordance with manufacturer's testing requirements.
3. Remove and replace damaged heating cables.
4. Submit test report summarizing results.
5. The following field megger readings shall be taken on each heating cable:

    a. When received at Project site before installation.
    b. After installation, but before insulation is installed.
    c. After insulation is installed.
    d. At final commissioning prior to being energized.

E. Coordinate the following with pipe insulation work of Section 40 42 13:

1. All termination components and sensor that extend through the insulation system shall have jacketing trimmed to a tight fit around penetration and the full perimeter of penetration closed with sealant.
2. Where low profile style end of line terminations installed, provide removable portion of insulation to allow access for testing. Apply manufacturer furnished label to insulation surface at access point.

F. Apply "electrically traced" signs to outside of thermal insulation every ten feet, alternating sides of pipe.

G. Provide Class B Ground Fault Circuit Interrupting (GFCI) protection for each heat trace line.

Section 40 41 13
Piping Heat Tracing Controller Schedule

Heat Trace Controller	Type	Location	Circuit Quantity	Control Mode	Power Supply Voltage	Hazardous Rating
HTP-1	HTC2	Structure 800 Interior	6	Ambient	208V	NR
HTP-2	HTC1	Structure 300 Outside Exposed	1	Ambient	208V	NR

1. NR – Not Rated, installed in a nonhazardous environment.
2. Hazardous rating Temperature Class shall be suitable for T3 (200°C, 392°F) materials.

Section 40 41 13 Piping Heat Tracing Schedule								
Heat Trace Circuit	Heat Trace Controller	Service	Location	Nominal Pipe Diameter	Pipe Material	Pipe Length (ft)	Temperature to Maintain	Hazardous Rating
NAOH-HTC-8	HTP-2	NAOH	Str 220 Outside Exposed	4-inch	304SS	240	65F	NR
NAOC-HTC-1	HTP-1	NAOC	Yard Outside Exposed	4-inch	PVC	75	30F	NR
NAOC-HTC-2	HTP-1	NAOC	Yard Outside Exposed	4-inch	PVC	355	30F	NR
NAOC-HTC-3	HTP-1	NAOC	Yard Outside Exposed	4-inch	PVC	355	30F	NR
NAOH-HTC-4	HTP-1	NAOH	Yard Outside Exposed	4-inch	PVC	75	65F	NR
NAOH-HTC-5	HTP-1	NAOH	Yard Outside Exposed	4-inch	PVC	115	65F	NR
HFSA-HTC-6	HTP-1	HFSA	Yard Outside Exposed	4-inch	PVC	355	30F	NR
FILL-HTC-7	HTP-1	NAOH, NAOC, HFSA	Outside Exposed	2-inch and 3-inch	PVC	6	65F	NR

1. See Section 40 05 05 for Pipe Material abbreviations and specification references.
2. See Section 40 42 13 for insulation requirements.
3. All lengths identified are approximations provided for convenience only. All quantity estimates shall be based on Drawings and all design calculation shall be based on Contractor's piping shop drawings.
4. NR – Not Rated, installed in a nonhazardous environment.
5. Hazardous rating Temperature Class shall be suitable for T3 (200°C, 392°F) materials.
6. For Heat Trace Circuit FILL-HTC-7 provide RTD temperature sensor for ambient sensing, Raychem #RTD-200 or equal. Mount sensor outside of Structure 800.
7. For Heat Trace Circuit FILL-HTC-7 provide low profile end seal light, Raychem #E-150 or equal.

END OF SECTION

SECTION 40 42 13
MECHANICAL INSULATION

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. Drawings and General Requirements of contract including General and Supplementary Conditions and Division 1 specification sections apply to work of this Section.

B. Extent of mechanical insulation specified in this section includes Piping and Ductwork Systems (where indicated).

1.02 REFERENCES

A. ANSI: American National Standards Institute

B. ASTM: American Society for Testing and Materials

1.03 QUALITY ASSURANCE

A. Installation shall meet the requirements International Building Code.

B. Manufacturer - Subject to compliance with requirements, provide products of one of the following:

1. Armstrong World Industries, Inc.
2. Certainteed Corp.
3. Knauf Fiberglass
4. Manville Corp.
5. Owens-Corning Fiberglass Corp.
6. Pittsburg Corning Corp.
7. Rubatex Corp.

C. Installer - A firm with at least 3 years successful installation experience on projects with mechanical insulation similar to that required for this project.

D. Flame/Smoke Ratings - Provide composite mechanical insulation (insulation, jackets, coverings, sealers, mastics and adhesives) with flame-spread rating of 25 or less, and smoke-developed rating of 50 or less, as tested by ANSI/ASTM E 84 (NFPA 255) method.

1.04 SUBMITTALS

A. Product Data - Submit manufacturer's specifications and installation instructions for each type of mechanical insulation. Submit schedule showing manufacturer's product number, thickness, and furnished accessories for each mechanical system requiring insulation in accordance with Section 01 33 00.

B. Submit manufacturer’s recycled content percentage or certification for supplied products.

C. Maintenance Data - Submit maintenance data and replacement material lists for each type of mechanical insulation in accordance with Section 01 33 00.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver insulation, coverings, cements, adhesives, and coatings to site in containers with manufacturer's stamp or level, affixed showing fire hazard ratings of products.

B. Protect insulation against dirt, water, and chemical and mechanical damage. Do not install damaged insulation; remove from project site.

PART 2 - PRODUCTS

2.01 FIBERGLASS PIPE INSULATION MATERIALS

A. Fiberglass Pipe Insulation: Knauf 1000° Pipe Insulation, Johns Manville Micro-lok, or equal. Preformed insulation designed for nominal pipe sizes indicated on the drawings.

B. Meeting requirements of ASTM C547, ASTM C585, and ASTM C795.

C. Rigid, molded, noncombustible construction.

D. Maximum k = 0.23 Btu in./hr sq ft °F at 75°F.

E. Minimum 3.5 pound per cubic foot density.

F. Jacketing as specified for intended use.

2.02 FLEXIBLE UNICELLULAR INSULATION MATERIALS

A. Manufacturer:

1. Armacell, AP Armaflex.
2. Or Equal.

B. Flexible, closed-cell elastomeric insulation.

C. Provide in properly sized preformed shapes for pipe systems. Pipe systems shall be self-seal type.

D. Meeting the requirements of ASTM C534.

E. Shall be manufactured without the use of CFC’s, HFC’s, or HCFC’s and shall be formaldehyde free, low VOC’s, fiber free, dust free, and resistant to mold and mildew.

F. Flame spread index less than 25 and smoke-developed index of less than 50 when tested in accordance with ATSM E84.

G. Maximum thermal conductivity of 0.27-Btu-in./h-ft2-˚F at 75˚F mean temperature when tested in accordance with ASTM C177 or C518.

H. Maximum water vapor transmission of 0.08-perm-inches when tested in accordance with ASTM E96, Procedure A.

2.03 CELLULAR GLASS INSULATION MATERIALS

A. Manufacturers:

1. FOAMGLAS, Pittsburgh Corning Corporation.
2. Or equal.

B. Cellular Glass Insulation: ASTM C552, density 7.0 to 9.5 pcf, maximum ASTM E96 permeability = 0.005 perm in., maximum k = 0.32 Btu in./hr sq ft °F at 75°F, to 850°F (427°C).

1. CGP-1, Cellular Glass Pipe Insulation: Type II, Class 2.

2.04 POLYISOCYANURATE INSULATION MATERIALS

A. Manufacturers:

1. Trymer.
2. Dyplast Products.
3. Or equal.

B. Polyisocyanurate Insulation: Product meets the requirements of ASTM C591, type IV.

C. Thermal conductivity of 0.19 btu-in/hr-ft2-°F or lower at 75°F mean temperature.

D. Minimum 4 lb/ft3 density.

E. Flame spread/smoke developed performance tested via method ASTM E-84, UL 723, or NFPA 255 of 25/50 or better at thicknesses of 1.0 inches or less.

F. Heat traced piping systems shall be provided oversized as required for installation of heat tracing.

2.05 JACKETING MATERIALS

A. Aluminum Piping Jacket Materials:

1. JRA, 0.016-in. aluminum, ASTM B209, with Pittsburgh seam, butt joint strips, matching fitting covers, stucco embossed finish and weather mastic.

B. Colored PVC Piping Jacket Materials:

1. Heavy-duty UV resistant PVC jacketing, ASTM D1784, 30 mil thickness, solid color, Johns Manville Zeston 300 PVC, or equal.
2. Color to be as selected by Owner or Engineer.

PART 3 - EXECUTION

3.01 SYSTEM INSULATION

A. For all Exterior and Buried Piping systems identified on Drawings, Section 40 05 05, or herein, to be heat traced and/or insulated and jacketed:

1. Insulate exterior above grade heat traced piping system with the following types and thicknesses of insulation:

a. Insulation: Cellular Glass Insulation, 2-in. thickness for 2-in and larger pipes, 1-1/2-in thickness for 1-1/2-in and smaller pipes. Jacketing: Aluminum, stucco embossed.

2. Insulate exterior below grade piping system with the following types and thicknesses of insulation:

    a. Insulation: Cellular Glass, 2-in. thickness for 2-in and larger pipes, 1-1/2-in thickness for 1-1/2-in and smaller pipes. Jacketing: PITTWRAP, or equal.

3.02 INSTALLATION OF INSULATION

A. Install insulation products in accordance with manufacturer's written instructions.

B. Install insulation on pipe systems subsequent to testing and acceptance of tests.

C. Install insulation materials with smooth and even surfaces. Insulate each continuous run of piping with full-length units of insulation, with single cut piece to complete run. Do not use cut pieces or scraps abutting each other.

D. Clean and dry pipe surfaces prior to insulating. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered.

E. Maintain integrity of vapor-barrier jackets on pipe insulation, and protect to prevent puncture or other damage.

F. Cover valves, fittings and similar items in each piping system with equivalent thickness and composition of insulation as applied to adjoining pipe run. Install factory molded, precut or job fabricated units (at Installer's option) except where specific form or type is indicated.

G. Extend piping insulation without interruption through walls, floors, and similar piping penetrations, except where otherwise indicated.

H. Install protective metal shields and insulated inserts wherever needed to prevent compression of insulation.

3.03 PROTECTION AND REPLACEMENT

A. Replace damaged insulation which cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.

B. Insulation Installer shall advise Contractor of required protection for insulation work during remainder of construction period, to avoid damage and deterioration.

END OF SECTION

SECTION 40 61 13
PROCESS CONTROL SYSTEM (PCS) GENERAL PROVISIONS

PART 1 – GENERAL

1.01 SUMMARY

A. Section covers general provisions and requirements for all work necessary for engineering, furnishing, installing, adjusting, testing, documenting, programming, and starting-up the complete process control system.

B. Unless otherwise noted, the System Integrator shall assume responsibility for specification sections:

1. Process Control System – Configuration Services	Section 40 61 20.
2. Process Control System – Testing	Section 40 61 21.
3. Process Control System – Training	Section 40 61 26.
4. Process Control System – O&M Data	Section 40 61 30.
5. Process Control System I/O Listing	Section 40 61 93.
6. Process Control Descriptions	Section 40 61 96.
7. Operator Interface Terminals	Section 40 62 63.
8. Programmable Logic Controllers (PLC)	Section 40 63 43.
9. Control Panels	Section 40 67 15.
10. Control Panel-Mounted Uninterruptible Power Supply (UPS)	Section 40 67 63.
11. Flow Measurement	Section 40 71 00.
12. Level Measurement	Section 40 72 00.
13. Pressure, Strain, and Force Measurement	Section 40 73 00.
14. Panel Mounted Instruments	Section 40 78 00.

1.02 REFERENCES AND ABBREVIATIONS

A. References:

1. ANSI: American National Standards Institute
2. CSA: Canadian Standards Association
3. EN: European Standards (generic)
4. FM: Factory Mutual
5. IEC: International Electrotechnical Commission
6. IEEE: Institute of Electrical and Electronics Engineers
7. ISA: International Society of Automation
8. NEC: National Electrical Code
9. NEIS: National Electrical Installation Standards
10. NEMA: National Electrical Manufacturers Association
11. NIST: National Institute of Standards and Technology
12. NRTL: Nationally Recognized Testing Laboratory
13. NFPA: National Fire Protection Agency
14. OSHA: Occupational Safety and Health Administration
15. UL: Underwriters Laboratory

B. Abbreviations:

1. HMI: Human/Machine Interface
2. I&C: Instrumentation and Controls
3. I/O: Input / Output
4. LOS: Line of Sight
5. PC: Personal Computer

6. PCN: Process Control Network
7. PCS: Process Control System
8. PLC: Programmable Logic Controller
9. OIU: Operator Interface Unit
10. SCADA : Supervisory Control and Data Acquisition
11. UPS: Uninterruptible Power Supply

1.03 DEFINITIONS

A. Process Control System: a complete, integrated system of PLCs, computers, instruments, devices, wireless and wired process control networks, software, application engineering, and ancillary equipment for monitoring and control of process systems.

B. Process Control Network: a complete, integrated and secured communication network consisting of equipment and cabling providing communication between components of the Process Control System.

C. System Integrator: an organization whose principal function is to design, program, configure, manufacture, install, and service the PCS. Who, under the direction of the Contractor, shall assume complete responsibility for: detail design, manufacture, installation, configuration, technically advising on and certifying correctness of installation, testing and adjusting, documenting and starting-up, and training of the complete PCS.

1.04 SUBMITTALS

A. In addition to the requirements of Section 01 33 00, the following information shall be provided in tabbed, booklet format covering all Project work.

B. Shop Drawings:

1. General:

a. Drawings shall include ancillary devices such as terminal strips, relays, fuses, utility lights and receptacles, fans, heaters, etc.
b. Typical drawings for multiple circuits or systems are not acceptable.

2. Panel Layout Drawings - Drawings shall show all panel mounted devices to scale and dimensioned and shall include legend.

a. Include cross-reference to a bill of material for components used.
b. Component designations shall match those used on elementary schematic diagrams and physical component labeling required per Section 40 67 15.
c. Prepare in general accordance with NFPA 79, Annex D.

3. Elementary Schematic Diagrams – Ladder type circuit diagrams prepared to facilitate the understanding of the system function for maintenance and fault detection.

a. Control devices shall be shown between vertical lines that represent control power wiring, with the left line representing control circuits common and right representing operating coils common except where permitted by Clause 9 of NFPA 79.
b. Control devices shall be shown on numbered horizontal lines (rungs) between the vertical lines.
c. Drawings shall include a cross referencing scheme used in conjunction with each relay, output device, limit switch, and other devices so that any contact related to a device can be readily located on the drawing.

d. Component designations shall be included for all devices, with the same designations used on panel layout drawings.
e. Each panel terminal within a terminal strip shall be numbered; when multiple terminal strips exist each shall be given a unique identification. Terminal strip identification shall be included on panel layout drawings.
f. All wires shall be numbered; wire numbers shall be applied to labels in accordance with Section 40 67 15. Wiring and devices external to panel shall be clearly identified.
g. Control devices shall utilize the symbology depicted in NFPA 79 and IEEE315.
h. Switch symbols shall be shown with utilities turned off and devices in their normal starting condition. Include control settings on the diagrams when available.

4. Panel Interconnection Diagrams – Wiring interconnection diagrams prepared to show all signal and power wiring for external connections to control panels provided for the project. Wire and cable tags information shall be provided to Contractor in an electronic format for use in physical wire and cable tagging.

    a. Drawings prepared on a per control panel basis.
    b. Show interconnecting wiring between field devices and control panel.
    c. Interconnecting wiring shall include wire and cable tag numbers.
    d. Field device information shall include device tag and description, signal description, signal electrical characteristics, and range.
    e. Control panel information shall include terminal strip identification and terminal number.
    f. Drawings shall indicate source of control signal power.
    g. Prepare drawings in accordance with requirements of NFPA 79.

5. PLC equipment layout drawings including processing equipment, I/O components, power supplies, and peripheral devices.
6. PCS equipment layout drawings including detailed enclosure layouts for servers, switches and communications systems with overall dimensions and equipment bill of materials.
7. Software user manuals for all applications, including operating system, describing programming methods and procedures, utilities, diagnostics, documentation, and system support functions. Documentation covering all custom software or programming proposed or required for this Project**.**
8. Electrical power, UPS, Grounding, and DC Power Schematics for all equipment.
9. Heat calculations for all enclosures.
10. UPS sizing calculations.
11. Test reports.

C. List of special tools (including software) required for instrument calibration, startup, checking, testing, parts replacement, troubleshooting, and maintenance of all components of the Process Control System. Identify any special tools specially designed or adapted for use on parts of this system.

D. Product Data:

1. Catalog Information - Provide catalog information and descriptive literature on all equipment associated with the PCS.
2. Product Data (Specification) Sheets – Provide product data sheets for each component provided under this Section. The purpose of the data sheets is to supplement the generalized catalog information provided by citing all specific features for each specific component (e.g., scale range, materials of construction, special options included). Product Data Sheets shall follow General ISA S20 format.

E. Test Outline and Procedure Submittal

1. A detailed description of each specified test procedure and demonstration shall be submitted for approval. The decision of Engineer upon the acceptability of the procedure shall be final.
2. It is required that this be a two-step submittal: outlines first followed, upon receipt of Engineer's approval, by specific test descriptions.
3. Test descriptions shall be in sufficient detail to fully describe the specific tests to be conducted to demonstrate conformance with these Specifications.
4. Provide detailed step-by-step in-factory and field test procedure in accordance with Section 40 61 21. Include proposed test documentation and sign-off sheets and punch list forms.
5. Identify complete inventory of equipment to be tested at factory including make, model, and serial number. Label each piece of equipment.

F. Operation and Maintenance (O&M) Data:

1. Process Control System - Submit in accordance with Section 40 61 30.
2. Fully document copy of all application programs including PLC, PC and Server-based applications. See Section 40 61 30 for requirements
3. Network, server and workstation setup instructions. See Section 40 61 30 for requirements.

G. Record Drawings: Submit in accordance with Section 40 61 30.

1.05 QUALITY ASSURANCE

A. Contractor shall engage the services of a qualified System Integrator for the purposes of furnishing the Process Control System, providing technical assistance on the installation of System, and certifying the correctness of said installation.

B. Equipment shall be of the latest and most modern design at the time of the Notice to Proceed.

C. All software and firmware used in this project shall be the latest version that is compatible with each other at the time of the Notice to Proceed.

D. Like items of equipment shall be end products of single manufacturer to achieve standardization for maintenance, spare parts, operation, and service.

E. Coordination - In order to ensure timely performance of the contract and the System's conformance with specifications, coordination meeting(s) shall be held during the course of the project.

1. Within 45 days of date of contract commencement, submit progress meeting schedule, submittal schedule, and activity schedule for final coordination by Owner/Engineer, Contractor, and Systems Integrator.
2. Progress meetings shall be held at the project site and designated by Owner with Owner, Engineer's, Contractor's, Application Engineer, and System Integrator's representatives in attendance.
3. Purpose of progress meetings is to obtain Owner/Engineer's clarification on intent of contract documents during submittal preparation and prior to OIT/HMI and PLC software configuration. Progress meeting(s) shall cover following:

a. Review of functional descriptions describing equipment operation.
b. Owner/Engineer selection of options.
c. Owner/Engineer review documentation.

4. Prepare and submit startup schedule, coordinated with overall Construction Schedule including the following:

    a. Factory acceptance test(s).
    b. Review of wiring sign-off forms by Owner/Engineer.
    c. I/O checkout by System Integrator.
    d. Plant startup.
    e. Training.
    f. Post-startup services.

1.06 SYSTEM INTEGRATOR RESPONSIBILITY

A. System Integrator shall inspect Equipment provided under this Section prior to shipment to Project sites.

B. System Integrator shall coordinate work with Contractor to ensure that:

    1. All components provided are properly installed.
    2. All components provided are properly configured.
    3. The proper type, size, and number of control wires with conduits are provided.
    4. Proper electric power circuits are provided for all components and systems.

C. System Integrator shall be responsible for coordination of voltage levels and signal types for signals connected to Process Control System. Provide relays, signal isolators, termination or pull-up resistors, signal conditioners or other devices as required for proper interfacing and operation of non-compatible devices.

D. System Integrator shall supply all HMI, OIT and PLC software fully configured for the project requirements.

E. System Integrator shall be responsible for establishing proper communication of all control system equipment as shown on drawings and specified. System Integrator shall test and document communications as part of testing specified in Section 40 61 21.

F. System Integrator shall be responsible for the operational testing of the HMI, OIT and PLC software programs.

G. System Integrator shall coordinate Process Control Network addressing schemes with Owner and Application Engineer and incorporate agreed upon scheme for all equipment on the PCS including vendor supplied equipment.

H. All field located conduits, wiring and cables shall be provided in accordance with Division 26 – Electrical. Exceptions to this are copper Ethernet cable which shall be provided in accordance with Division 40.

I. Modifications to existing control equipment.

    1. System integrator shall conduct on site evaluation of existing control panel PLC configurations.
    2. Provide equipment necessary to affect changes to existing control equipment as shown on drawings and specified.
    3. Provide interposing relays and current-to-current isolation relays only as required to affect signal interfacing with non-compatible devices.
    4. Modify documents of existing control equipment to reflect new as-built conditions and submit revised drawings per Section 01 33 00.

J. Contractor shall furnish Owner with copy of all configured PLC application programs after on-site acceptance test.

1.07 APPLICATION ENGINEERING SERVICES

A. Application Engineering Services shall be provided by System Integrator.

B. Application Engineering Services shall include the following:

1. Develop written loop descriptions from the Process Control Descriptions of Section 40 61 96. These loop descriptions will define the proposed operation and control of the plant equipment and treatment systems affected by the work on this project.
2. Develop sample human machine interface (HMI) graphic screen layouts.
3. Organize and lead one workshop with minimum duration of 4 hours with Owner at the project site to review and discuss:

    a. Loop descriptions for operation and control of systems affected by the work on this project.
    b. Sample HMI graphic screen layouts.
    c. HMI navigation alternatives and approaches.
    d. Trending requirements.
    e. Alarm and event requirements.
    f. HMI Security requirements.

4. Prepare draft meeting notes of workshop(s) including any mutually agreed-upon changes to the loop descriptions and the sample HMI graphics presented.
5. Develop PLC and HMI application software associated with the project in accordance with Section 40 61 20. Application software will be based on the standards established with the Owner during the pre-programming phase of the project.
6. Install and test PLC and HMI application software developed by Application Engineer. Modify tested software to incorporate changes agreed to between the Owner and Application Engineer.
7. Develop the alarm notification feature of the HMI software to alert Owner personnel of alarm conditions.
8. Develop standard trends and set up custom trend features.
9. Prepare an operation and maintenance manual for the new PLC and HMI application software. The manual will serve as the basis for training provided by Application Engineer.
10. Provide one day of on-site training of Owner's personnel in the use of the HMI and PLC application software configurations provided.
11. Deliverables:

    a. One electronic copy of PLC and HMI program documentation on flash drive or other media acceptable to Owner.
    b. Three hardcopy and one electronic copy of O&M Manual prepared for this project. O&M manual electronic copy will be MSWord with supporting material in PDF.

1.08 WORK FOR HIRE

A. Any and all configuration, programming, setup or other software functions (Software) performed on all intelligent devices provided as part of this Project is to be considered "Work for Hire" under the 1976 Copyright Act as amended (Title 17 of the United States Code). The Software shall be owned by Owner and shall be turned over to Owner fully documented as the work is completed.

B. Owner intends only to obtain the Software for its own use.

C. Owner will not prevent the Software supplier from reuse of the Software concepts and ideas for other projects. Any reuse of the Software concepts and ideas generated under this Project is solely the responsibility of the Software supplier. The Software supplier shall defend, indemnify and hold harmless Owner from all claims, damages and expenses (including reasonable litigation costs), arising out of any use, misuse or misapplication of Software concepts and ideas.

1.09 WARRANTY

A. System Integrator shall warranty the Process Control System for a period of one year from the date of substantial completion.

PART 2 – PRODUCTS

2.01 SYSTEM INTEGRATORS

A. Wessler Engineering. Indianapolis, IN.

2.02 SYSTEM INTEGRATOR EXPERIENCE REQUIREMENT

A. The System Integrator shall have the following organizational and individual experience, knowledge, and capability:

1. Be regularly engaged in the design, installation, and servicing of water treatment plant process controls systems.
2. Have previously executed a minimum of five water treatment plant PCS projects of similar size and complexity to this Project using the PLC and HMI platforms included in this project.
3. Have previously successfully executed wireless and wired networked projects of comparable size and complexity to this project.
4. The person(s) performing the required field work shall have a minimum of five-year experience on similar PLC-based systems.
5. Provide an on-site control systems engineer for commissioning, functional testing, start-up, and training of the Process Control System. The individual shall have authored and commissioned control logic for no fewer than three projects of similar or greater complexity,and shall have a demonstrated proficiency in authoring logic in PLC Function Block Language.
6. Upon request of Owner and in addition to other specified requirements, Contractor shall provide a minimum of five System Integrator references to confirm compliance with these requirements.

2.03 EQUIPMENT, SYSTEMS, AND SERVICES

A. Equipment, systems, and services provided under this Section shall conform to the following requirements.

1. UL 508 - Standards for Safety, Industrial Control Equipment.
2. NEMA ICS 1 - General Standards for Industrial Control and Systems.
3. NEMA ICS 2 - Standards for Industrial Control Devices, Controllers and Assemblies.
4. NEMA ICS 3 - Industrial Systems.
5. NEMA ICS 6 - Enclosures for Industrial Controls and Systems.
6. NEMA ICS 250 - Enclosures for Electrical Equipment.
7. NFPA 79 - Electrical Standard for Industrial Machinery
8. UL 698A Intrinsic Safe Circuits.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Contractor shall install and wire Process Control System equipment in accordance with System Integrator's and instrument manufacturer's written instructions and approved submittals.

B. PCS components shall be grounded in accordance with NEC requirements.

C. The System Integrator shall supervise final power and signal connections by Contractor to all equipment provided or interfacing with the Process Control System.

D. Instrumentation transmitters, displays, and other indicators shall be orientated such that they are easily readable and accessible from operating locations.

E. System Integrator shall field calibrate and completely configure equipment and instruments at time of startup on loop-by-loop basis and make adjustments necessary to place equipment in satisfactory operation.

3.02 FIELD QUALITY CONTROL

A. Protection during construction.

1. Throughout the contract Contractor shall provide protection for materials and equipment against loss or damage and the effects of weather. Prior to installation, store items in indoor, dry locations. Provide heating in storage areas for items subject to corrosion under damp conditions. Specific storage requirements shall be in accordance with the System Integrator's recommendations.

B. Cleaning and touch-up painting.

1. Keep the premises free from accumulation of waste material or rubbish. Upon completion of work, remove materials, scraps, and debris from premises and from interior and exterior of all devices and equipment. Touch-up scratches, scrapes, or chips in interior and exterior surfaces of devices and equipment with finishes matching as nearly as possible the type, color, consistency, and type of surface of the original finish.

C. Panels and panel-mounted equipment.

1. Panels and panel-mounted devices shall be assembled as completely as possible at the System Integrator's facility. No work other than field terminations and correction of minor defects or minor transit damage shall be done on the panels at the job site.

D. Inspections.

1. System Integrator shall provide services of qualified service personnel to supervise and inspect equipment installation to ensure system is installed in accordance with System Integrator's recommendations.
2. All materials, equipment, and workmanship shall be subject to observation at any time by Engineer's representatives.

END OF SECTION

SECTION 40 61 20
PROCESS CONTROL SYSTEM (PCS) – CONFIGURATION SERVICES

PART 1 – GENERAL

1.01 SUMMARY

A. Items specified in this section shall conform to general requirements of Section 40 61 13.

B. Configuration of Process Control System (PCS) in conjunction with following Sections:

1. Section 40 61 93 Process Control System I/O List.
2. Section 40 61 96 Process Control Descriptions.

1.02 RESPONSIBILITIES

A. Configuration Services (PLC Programming) shall be provided by the Application Engineer as defined in Section 40 61 13 using the following software:

1. PLC programming shall utilize Rockwell Studio 5000 Programming software (latest edition fully compatible with all hardware).

B. Configuration Services (Operator Interface Terminal Programming) shall be provided by the Application Engineer as defined in Section 40 61 13 using the following software:

1. OIT programming shall utilize OIT embedded Rockwell FactoryTalk ME.

C. Configuration Services (SCADA HMI Programming) shall be provided by the Application Engineer defined in Section 40 61 13 using the following software:

1. HMI programming shall utilize either Ignition software by Inductive Automation or iFix software by GE Digital. Application Engineer to confirm with Owner on HMI software prior to implementation.

1.03 DEFINITIONS

A. Plant-Wide Process Network

1. A virtual network created by the Ethernet Switches. The Process Network shall primarily handle data communication between HMI Server and the PLC's in the system. This traffic shall contain collected data and control commands.

1.04 SYSTEM DESCRIPTION

A. Design requirements:

1. System consists of several Personal Computers (PCs), including automation software, serving as a Human/Machine Interface (HMI) Unit working in conjunction with Programmable Logic Controller (PLC) based data acquisition and control panels. PCs and automation software shall be configured for redundant server application.
2. System shall use PLC form factor I/O subsystems to connect local and remote Equipment.
3. System shall provide separate 24 volts direct current regulated power supplies to power I/O subsystem and to power analog instrumentation loops as required.
4. System shall provide peer-to-peer communication between PLCs, HMI computers, and other devices connected to System.
5. System shall be provided with quantity and type of I/O as specified in Section 40 61 93 and

as shown on the drawings. System shall be expandable, at future date, to accommodate additional I/O.

B. Performance requirements:

1. HMI shall serve only as operator interface to PLCs and shall not contain automatic control functions. Automatic control functions shall be programmed into the PLCs. Timers, time clocks, and repeat cycle timers shall be a function of the PLC.
2. PLCs shall be programmed to be autonomous; a loss of the Process Control Network (PCN) shall not cause any PLC to lose the ability to maintain control of its respective processes.
3. System shall perform process monitoring and supervisory control using PLCs and HMI computers.
4. PLCs shall send/receive process data to/from field devices and be capable of following when configured:

    a. Receive analog data from primary control elements; convert to engineering units, process for alarms and responsibility checks, and store.
    b. Receive digital data from primary control elements, check for alarm and status change, and store.
    c. Perform control and arithmetic calculations, including software PID and other regulatory control functions, based on system parameters and real-time data and output the properly conditioned control commands to final control elements.
    d. Perform sequential control functions.
    e. Ascertain off-normal conditions of process parameters and generate alarms for monitoring at the HMI. The HMI shall not be the source of alarm generation.
    f. Communicate with HMI computer over Ethernet data highway.
    g. Communicate with all Plant Operator Interface Terminals (OIT's).
    h. Respond to operator requests for data and to control commands from HMI.
    i. Respond to inhibit, enable and interlock signals from other sources.
    j. Respond to supervisory requests for data, to control commands and to process parameter setting changes from plant PCS.

5. HMI computers shall receive/send process data from/to PLCs, maintain databases, and be capable of following when configured.

    a. Real-time data collection. Receive and store process data from PLCs.
    b. Receive and store manually entered data from keyboard or pointing device such as operator changes and process parameter setting changes.
    c. Send operator and process parameter setting changes to PLCs.
    d. Display plant activity with alphanumeric and color graphic displays of I/O associated with PLC.
    e. Data collection for maintenance management. Provide operating information from which to generate reports and logs.
    f. Historical data storage and reporting.
    g. Provide overall plant alarm and status monitoring with visual and audible alarming.
    h. Record alarms and events on screen and store to file.
    i. Allow operator input of data not collected automatically.

6. "Local" mode of field mounted Local/Remote selector switches shall enable field control of equipment. PLC control shall be inhibited in "Local" mode. "Remote" mode shall enable PLC based Manual or Automatic control. Field control shall be inhibited in "Remote" mode.
7. Control logic for "Automatic" mode shall be programmed functions of the PLC.

C. Control Panel Requirements:

1. Unless otherwise specified, "running" signals shall be derived from equipment motor starter

normally open auxiliary contacts.

2. Equipment on panels shall be identified as follows:

    a. Indicating Light Off: Equipment Not Running.
    b. Indicating Light Red: Equipment in Operation.
    c. Indicating Light Amber: Equipment in Alarm Condition.
    d. Indicating Light White: Power Supply Energized.

3. Fail Logic: Failure of equipment, after having been "called to run", shall generate a Fail alarm. Typical points of failure are motor overload (overcurrent), motor undercurrent (blower surge), motor under voltage, fail-to-start and power fail. Power fail shall include, in addition to loss of control power, the tripping of equipment circuit breakers while equipment is called to run. Provide necessary logic to sense discrepancy between "called to run" and "running" signals and activate Fail Alarm signal after adjustable time delay.
4. References to "selector switch" refer to maintained contact type functions. Loss and return of control power to circuit does not change control mode or requirement as dictated by switch position.
5. References to "pushbutton" refer to momentary contact type functions. Loss and return of control power to circuit reverts control mode or requirement to default condition. Initiating pushbutton is required to re-establish control mode or requirement.

D. Instrumentation & Control

1. Design is based upon the concept of facilities with automatic and semi-automatic control of specific plant functions. With this in mind, the following design concepts were developed:

    a. Use of custom fabricated, PLC – based control panels. Panels shall act as area controllers, located in several of the process areas.
    b. Operator access to the PLC panels shall be through a system of distributed desktop type personal computers running HMI software (HMI terminal server computers). Wherever possible, these units shall be located in proximity to the PLC panels. PLC panels shall not incorporate panel-mounted PCs unless absolutely necessary.
    c. Use of a distributed HMI computer system to monitor critical and non-critical alarms, equipment run times, status conditions, plant flows and levels, and to act as input terminals for supervisory setpoint and timer function changes.
    d. Use of locally mounted OIT's provide monitoring and control of systems throughout the Plant along with operational status, critical, non-critical, and dial-out alarm conditions.
    e. Vendor furnished panels with PLC's or communications modules for data link interface small be connected to the PCN.

PART 2 – SERVICES

2.01 SUMMARY

A. Provide configuration services for Process Control System HMI computers, Control Panel PLC's, Control Panel OIT's.

B. Graphic displays (screens) shall be formatted as schematic or symbolic representations of equipment shown on drawings.

C. Provide, as a minimum, one graphic display per major piece of process equipment.

2.02 PLC PROGRAMMING GUIDELINES

A. PLC programming shall follow existing Plant programming guidelines and standards. Any and all deviations shall be approved by the Owner prior to initiating programming work.

B. Set-points, alarm values, timer values, control loop tuning parameters, and other numeric values used within PLC and HMI programs shall be part of continuous common data table within program. Parameter changes shall not require modification to instructions within program. Parameter changes shall be adjustable by changing data table through operator input via HMI.

C. Unless specified otherwise, procedure for control power fail Restart for equipment shall be as follows:

1. Equipment shall shut down on loss of control power.
2. Upon restoration of power, previously running equipment shall be restarted using same sequence of startup used for “Auto” control.
3. Prior to Restart, Auxiliary equipment shall be placed in “Off” position.
4. Equipment Restart shall be sequenced through use of timer functions to prevent simultaneous restart.

D. PLC shall not be enabled to control equipment unless respective field Hand/Off/Auto, Local/Remote, On/Off/Remote or Open/Close/Remote selector switch is in “Remote” or “Auto” position. Equipment status monitoring/ displaying and process parameter logging/ trending shall continue in all modes of control.

E. Determination of high (low) Off-Normal conditions shall be by comparing an analog input value to Operator entered set-point values. Off-Normal status bit shall be set when rising (falling) input value is equal or greater (less) than entered set-point value. Off-Normal status bit shall be reset when falling (rising) input value is equal or less (greater) than entered set-point value minus (plus) entered deadband value. Operator entered high (low) set-point values are absolute values and deadband values are relative values. All values are entered through HMI.

F. Setting of Off-Normal status bits shall cause status conditions to be displayed and/or alarmed at HMI.

G. Resetting Off-Normal status bits shall cause status conditions displayed and/or alarmed at HMI to be cleared.

H. Adjustable delay timers on alarm points shall prevent nuisance alarming or nuisance clearing of alarms. Timer values shall be ranged 0-30 seconds. Initial setting, unless otherwise specified, shall be 5 sec.

I. All status conditions alarmed at HMI shall also be logged to data table.

J. Motor Running status shall be monitored and displayed at HMI continuously.

K. Setting of Motor Failed status bits:

1. If motor is required to run via PLC control (control station Hand/Off/Auto selector switch in “Auto”),
2. And If absence of Motor Running feedback status causes Motor Fail watchdog timer to time out,
3. Then Motor Failed status bit shall be set.

L. Setting a Motor Failed status bit shall cause motor command output to be inhibited and shall cause Motor Failed status to be displayed and alarmed at HMI.

M. Resetting of Motor Failed status bits:

1. If control station Hand/Off/Auto selector switch is in “Auto” position,

2. And if HMI On/Off/Auto control function is cycled to “Off” position from either “On” or “Auto” positions,
3. Then Motor Failed status bit shall be reset.

N. Resetting a Motor Failed status bit shall cause motor command output to be re-enabled and shall cause Motor Failed status displayed and alarmed at HMI to be cleared.

O. Unless specified otherwise the following watchdog timer values shall cause equipment fail status bits to be Set:

1. Valve fail to open: 30 sec.
2. Valve fail to close: 30 sec.
3. Equipment fail to start: 30 sec.

P. Adjustable filtering of analog inputs shall eliminate process upsets due to noise. Filtering shall be by running-average method.

Q. Integration algorithm shall be included for “Totalizing” analog flow signals.

R. Integration algorithm shall be included for “Totalizing” Equipment Run times (Elapsed Time Meter).

S. Proportional/Integral/Derivative (PID) control outputs shall utilize sample and hold algorithm. Intent is to allow slow reacting processes to stabilize before additional control output changes are made by maintaining constant output from PID control for adjustable time period. PID control shall utilize deviation set-points to reactivate controller in event deviation is exceeded during controller off time. Unless specified otherwise off time shall have an adjustable range of 0-30 minutes.

T. Equipment Sequencer:

1. When more than one piece of similar equipment controls a process, then a sequencing strategy shall be employed regarding the operational sequence for the equipment, when the equipment is in an “auto” mode.

a. Lead: shall be the first called to run based on process demand.
b. Lag: shall be the second called to run (when more than one Lag exists, then Lag1, Lag2, Lag3, etc. shall be used).
c. Standby: shall be equipment not normally called to run during the sequence of operation. Note: not every sequencer will have a Standby position.

2. Lead/Lag/Standby equipment is rotated within the sequencer based on: runtime hours, on-off cycles, day of the week, or manual selection as Owner preference dictates (see Section 40 61 96 Functional Descriptions for details).
3. When a piece of equipment fails, it is placed in the Standby position of the sequencer. Equipment previously in the Standby position, is moved into the last Lag position of the sequencer.

U. PLC input coils shall be configured as non-latched unless specified otherwise.

V. PLC output contacts shall be configured as maintained unless specified otherwise.

2.03 HMI COMPUTER PROGRAMMING GUIDELINES

A. HMI/OIT programming shall follow existing Plant programming guidelines and standards. Any and all deviations shall be approved by the Owner prior to initiating programming work.

B. For the purposes of this section, HMI and OIT functionality shall be functionally similar.

C. Screens:

1. Overview screens and reports shall be the first screens configured. Coordinate layout and information requirements with Owner prior to development of screens.
2. Graphic screens for HMI shall be formatted to resemble Process and Instrumentation Diagrams shown in the Drawings. As a minimum, one graphic display per process loop shall be provided.
3. Screens shall be simplified representation of process flow stream and associated equipment as shown on Drawings. Only major devices shall be shown. Non-reporting equipment (isolation valves, check valves, indicators) shall not be shown.
4. In addition to process related display screens, the following shall also be provided:

    a. Main Screen: Director for all other screens. Selection of any other screens shall be by cursor pick of description for that screen or function key identifier for that screen.
    b. Utility Screen: Equipment status, Motor Run totalizer (hours).
    c. Alarm Screens: Screen for points in alarm as selected by alarm selection matrix and screen for equipment in off-normal state (ie. Out of Service).
    d. Data Screens: Listing of all Operator and Engineering entered values.
    e. Trend Screen: Operator selected points for trending.
    f. Report Screen: Operator initiated report generator.

5. Operator and Engineering screens shall be segregated to allow password protection of engineering-entered values.
6. There shall be pick-fields on all screens that will allow for return to main menu or to adjacent process flow screen (continuation of all process flow paths, either entering or existing).
7. Pick-fields shall be activated by placing mouse cursor on object or text and clicking left mouse button, or by selection of associated function key (F1-F12).

D. Data Input:

1. Data entry areas shall be provided at HMI for adjustment of process and alarm set-points. Data entry areas shall be password protected.
2. Upper and lower limits shall be provided for all data entry values. Entry of values outside of limits shall not be accepted and shall generate appropriate error message on screen. Upper and lower limit values shall be adjustable at HMI and shall be password protected.
3. Upper and lower limits shall be provided for all logged analog input values. Logged values outside of limits shall generate appropriate alarm. Upper and lower limit values shall be adjustable at HMI and shall be password protected.
4. Upper and lower limits shall determine range of analog input value. Value shall be scaled in standard Engineering Units.
5. Password protection shall consist of alpha-numeric sequence and shall be intended for Plant Supervisor and Head Operator entry only.
6. Unless otherwise specified in Functional Descriptions, process points shall be scanned as follows:

    a. Critical Alarm points and analog input process points shall be scanned continuously.
    b. Non-Critical Alarm points shall be scanned only on change of state into alarm condition.
    c. All other points scanned only when required for display at HMI/OIT.

7. All dynamic screen displays shall be updated every 2 seconds, minimum.

E. Equipment sequencer:

1. When more than one piece of similar equipment controls a process, then a sequencing strategy shall be employed regarding the operational sequence for the equipment, when the equipment is in an “auto” mode.

    a. A spreadsheet-style matrix shall be used for equipment sequencing whereby equipment position within the sequencer is selected by the Operator using Lead/Lag/Standby verbiage. Note: not every sequencer will have a Standby position.
    b. Additional information, such as pressure, level or flow requirements may be included as a guide to the selection process.
    c. Equipment Sequencer shall allow Lead/Lag/Standby selection based on: runtime hours, on-off cycles, day of the week, or manual selection as Owner preference dictates.
    d. Equipment Sequencer shall indicate when a piece of equipment has been moved to Standby position as a result of equipment failure.

F. Display Objects – General

1. Process piping and pumps/fans/mixers may be animated with color to show active/non-active status.
2. Tankage shall be rendered in 3D.
3. Use graphic symbology for rendering of objects.

G. Display Objects – Process Lines and Inline Device Symbology

1. Where inline devices are dynamic in nature, their equipment symbols shall be formatted as Display Objects to change color based upon feedback. Coordinate color use with Owner’s existing HMI configuration. Recommended color use:

    a. Off – Green.
    b. On – Red.
    c. Warning – Amber, Solid.
    d. Fail/Alarm – Amber, Flashing.

2. Inline devices shall have alphanumeric tag identified near them, adjacent to associated symbol.
3. Arrow heads shall be used as pointers for flow direction at all points of entrance to equipment, at all points where process lines change direction and at points of merger.
4. Process lines entering or leaving screen shall have points of continuation identified by boxed text, indicating From/To screen. One end of box shall form arrow to show direction of flow and act as pick-field for selection of screen of continuation. Color shall be same as associated process line.
5. Process lines shall be identified with flow stream abbreviation as listed in standard symbolic table and as shown on P&IDs, where convenient.

H. Display Objects – Large Equipment Symbology

1. Symbol shape shall be simple reflection of true shape of equipment being depicted.
2. Outline color shall be white.
3. Equipment tag and description name shall be located within shape. If not practical, locate near shape. Text shall be white and enclosed in white border box. For example:

    a. Tank levels shall be displayed within tank symbol as vertical bar, with bar color representative of fluid within tank.
    b. Tank level bar height shall be proportional to analog input value scaled from 0 to 100%. 100% shall be equal to full vertical height of symbol.

I. Display Objects – Data Fields

1. Analog process data not conducive to graphic symbology shall be formatted as rectangular Data Fields:
2. Process values (i.e. Flow, pH, D.O., Elapsed Time) shall be displayed as Data Fields near associated device symbol and shall consist of: alphanumeric tag, green in color; data value, white in color, right justified; engineering unit, green in color. Entire field shall be grouped as one block.
3. Data Fields shall be configured with high and low limits as described above.

J. Display Objects – Status Displays

1. Status Displays shall be similar to Data Fields but shall be linked to discrete data points or status bits:
2. Discrete equipment parameters (i.e. Run, Fail, On/Off, Open/Close) shall be indicated as rectangular Status Displays and shall consist of: alphanumeric tag, green in color; single or dual-state equipment value, white in color, center justified. Entire field shall be grouped as one block.
3. Displays shall be classified as Alarms or Events (see below).

K. Control Objects

1. Control Objects shall reside on graphic screens as either visible objects or as pop-up objects.
2. Visible Control Objects shall be restricted to simple functions. For example:

    a. Single-State Pushbutton (i.e. Reset, Silence, Acknowledge, GoTo):

        1) Display alphanumeric tag of equipment or function to be manipulated. Function shall be independent of equipment control mode. There shall be graphic representation of one pushbutton, black in color with white or green text, center justified. Button shall act as pick-field and when selected by cursor and activated by clicking left mouse button, shall generate programmed output. Output shall not latch. Button, when activated, shall highlight with white border.

    b. Dual-State Pushbutton (i.e. Open/Close, On/Off, Start/Stop):

        1) Display alphanumeric tag of equipment or function to be manipulated. Function shall be dependent upon equipment control mode. There shall be graphic representation of one pushbutton, black in color with white or green text, center justified. Button shall act as pick-field and when selected by cursor and activated by clicking left mouse button, shall generate programmed output. Pick-field shall indicate change of state by changing text within object and/or changing color. Output shall latch, requiring mouse click to toggle back to original state. Button, when activated, shall highlight with white border.

    c. Data Entry Field:

        1) Similar to Data Display Field described above. Allows operator entry of process values such as set-points.

3. Pop-up activation for dynamic control of equipment shall be by pick-fields associated with symbol of device to be controlled. Pop-up shall be small window or graphic overlay on current screen in location that will not interfere with current operation. Pop-up will contain necessary symbolism for dynamic control and worded prompts as necessary. Examples of pop-up Control Objects:

a. PID Controller Faceplate:

1) Display alphanumeric tag of final element being controlled. Mode of field Hand/Off/Auto, On/Off/Remote or Open/Close/Remote selector switch shall be displayed. If in Auto, word “Auto” shall be displayed next to controller. If not in Auto, word “Hand” shall be displayed – depending on field condition. Set-point, Process Variable, and Control Variable shall be displayed in vertical bargraph and digital formats. Bargraph shall be graduated scale equal to range of final element. Display bar shall be equal in length to graduated scale. Set-point and Process Variables shall be scaled in engineering units. Control Variable shall be scaled in percent of output. There shall be a graphic representation of a two-position pushbutton set (see below) labeled as “Auto-Manual” and shall act as pick-field. When selected by cursor and activated by clicking left mouse button, selector shall toggle between “Auto” and “Manual” modes of control. When selector is in “Auto”, PID controller calculates Control Variable. When selector is in “Manual”, Control Variable output shall follow setting by Operator. Control shall be available only when field selector switch is in “Auto”.

b. Flow Controller Faceplate:

1) Display alphanumeric tag of valve being controlled. Mode of field Hand/Off/Auto, On/Off/Remote or Open/Close/Remote selector switch shall be displayed. If in Auto, word “Auto” shall be displayed next to controller. If not in Auto, word “Hand” shall be displayed – depending on field condition. Set-point, Process Variable, and Control Variable shall be displayed in horizontal bargraph and digital formats. Bargraph shall be graduated scale equal to range of associated flow. Display bar shall be equal in length to graduated scale. Setpoint and Process Variables shall be scaled in engineering units. Control Variable shall be scaled in percent of valve position. There shall be a graphic representation of a two-position selector (see below) labeled as “Auto-Manual” and shall act as pick-field. When selected by cursor and activated by clicking left mouse button, selector shall toggle between “Auto” and “Manual” modes of control. When selector is in “Auto”, Flow Controller calculates Control Variable. When selector is in “Manual”, Control Variable output shall follow setting by operator. Control shall be available only when field selector switch is in “Auto”.

c. 2-Position Pushbutton Set (i.e. Manual/Auto, Start/Stop, Open/Close):

1) Operationally the same as Dual-state Pushbutton described above. Display alphanumeric tag of equipment to be controlled. Mode of field Hand/Off/Auto, On/Off/Remote or Open/Close/Remote selector switch shall be displayed. If in Auto, word “Auto” shall be displayed next to controller. If not in Auto, word “Hand” or “Off” shall be displayed – depending on field condition. There shall be graphic representation of two pushbuttons, one red in color, the other green in color. Buttons shall act as pick-fields and when selected by cursor and activated by clicking left mouse button, shall indicate and generate programmed output. Output shall remain latched until other button is activated. Button activated shall highlight with black border. Pick-fields shall be available only when field selector switch is in “Auto”.

d. 3-Position Switch Set (i.e. Local/Off/Remote, Hand/Off/Auto, Open/Stop/Close):

1) Display alphanumeric tag of equipment to be controlled. Mode of field Hand/Off/Auto, On/Off/Remote or Open/Close/Remote selector switch shall be displayed. If in Auto, word “Auto” shall be displayed next to controller. If not in Auto, word “Hand” or “Off” shall be displayed – depending on field condition. There shall be graphic representation of three pushbuttons, one red in color, one green in color,

the other white (amber) in color. Buttons shall act as pick-fields and when selected by cursor and activated by clicking left mouse button, shall indicate and generate programmed output. Output shall remain latched until another button is activated. Button activated shall highlight with black border. Pick-fields shall be available only when field selector switch is in “Auto”.

e. Analog Output Control (i.e. “Speed-Pot”, Process Set-point Control):

1) Display alphanumeric tag of equipment to be controlled. Mode of field Hand/Off/Auto, On/Off/Remote or Open/Close/Remote selector switch shall be displayed. If in Auto, word “Auto” shall be displayed next to controller. If not in Remote, word "Local" shall be displayed. Analog Output Control shall be displayed in vertical (horizontal) bargraph and digital formats. Bargraph shall be graduated scale equal to range of output. Display bar shall be equal in length to graduated scale. Process Variable units shall be scaled in engineering units. Speed or Valve Position units shall be scaled in percent of output. Control shall be available only when field selector switch is in “Auto”.

4. Pop-up Control Objects shall not be continually visible. Functions become complex depending upon numbers and types of smaller objects grouped together to create them. For example, a valve control object might be created by grouping a 2-Position Pushbutton Set (Local/Remote), a 3-Position Position Pushbutton Set (Open/Stop/Close) and Status Display Objects (Open, Closed) together.

L. Alarming Requirements

1. Alarms shall be provided for conditions which would result in a safety or health risk, environmental damage, property or equipment damage, or process failure.
2. Alarms are considered critical or non-critical in nature and are defined as follows:

a. Critical Alarms are for conditions which would result in a safety or health risk, environmental damage, significant property or equipment damage, failure of process operations critical to meeting effluent limitations if not attended to and corrected immediately, or other conditions the Owner wishes to be notified of immediately.
b. Non-Critical Alarms are for conditions which if not attended to and corrected within a specific timeframe, may eventually cause a safety or health risk, environmental or property damage, or process failure.

3. Critical Alarms shall be annunciated at a location where personnel responsible for operation of the facilities are expected to be stationed or on call at all times. Critical alarms generated after working hours shall notify the on-call plant operator.
4. Non-critical Alarms shall be indicated at a location where the presence of an operator is expected periodically. Non-critical alarms generated after working hours will not call out.
5. Operator shall be provided with a matrix to designate each alarm as Critical or Non-Critical.
6. Alarms and Events shall be logged to data file.
7. Provide alarm summary screen(s) at HMI.
8. Display only current alarms. Acknowledged alarms which are no longer active shall not be displayed.
9. Allow operator to acknowledge alarms using single keystroke or cursor pick at alarm summary screen.
10. Alarm Display shall include following information:

a. Time and date alarm initially occurred.
b. Alarm point identification.
c. Alarm value and engineering units for alarms generated from analog process points.
d. Description of alarm (up to 40 characters).

11. Events shall be logged to separate data file. Events shall not be displayed unless evoked and shall not be annunciated.

M. Data Logging requirements – Analog and Discrete

1. All input process points shall be logged to the hard disk of the HMI computer.
2. Procedure for data collection and storage shall be as follows:

a. HMI I/O driver shall poll process points as specified on I/O list and transfer data to image table.
b. HMI shall scan image table for analog process points once every second, and log value to data base.
c. HMI shall calculate minimum, maximum and average for each analog process point and log to data base.
d. HMI shall scan image table for discrete process points on status change only, and log value to data base.

N. Trend Display Requirements

1. Configure HMI computer to display logged data in graphical trend format.
2. Trend Display Requirements:

a. Identification of process point being displayed. Use same nomenclature as used on HMI screens.
b. Start and end time of data being displayed.
c. Display shall incorporate movable vertical cursor along time axis. Parameter values at cursor date and time shall be displayed digitally.
d. Initial configuration of displays shall display data from present time back to 72 hrs prior to present time. Provide capability for operator to enter new start time for data being displayed to view parameter trend more than 72 hrs old.
e. Displays shall include y-axis range identification, including values and engineering units.
f. Configure trend displays to use maximum of computer screen area possible for purpose of increased resolution.
g. Trend displays shall be accessible, via single keystroke, from graphic screen displaying trended point.

3. Organize graphics screens for trend displays into categories by process:

a. Provide separate graphic screen within each category to display each process point trend. Provide different color for each process point.
b. Provide separate category for manually entered data from HMI computer.

PART 3 – EXECUTION

3.01 PERFORMANCE

A. Configure PLC's and HMI computers consistent with Drawings and Specifications.

B. During course of Work and Warranty period, furnish all software and firmware with latest revisions published.

C. Label hardware revision levels on equipment and spares installed.

END OF SECTION

SECTION 40 61 21
PROCESS CONTROL SYSTEM (PCS) – TESTING

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes in-factory and field testing requirements.

B. Testing of Process Control System (PCS) in conjunction with following Sections.

1. Section 40 61 93 Process Control System I/O List.
2. Section 40 61 96 Process Control Descriptions.

1.02 SUBMITTALS

A. In addition to submittal requirements of Section 40 61 13, provide the following:

1. Test Results:

a. Pass/fail status of all digital I/O.
b. Results of analog I/O testing.

2. Miscellaneous:

a. Detailed step-by-step in-factory and field test procedure at least 6 wks in advance of scheduled test date. Include sign-off sheets and punch list forms and description of configurations to be tested.
b. Complete inventory of equipment to be tested at factory including make, model, and serial number. Label each piece of equipment.

3. Submit in accordance with Section 01 33 00.

PART 2 – SERVICES

2.01 PREPARATION

A. In-Factory Testing Aids and Equipment:

1. Provide following documents.

a. One copy of submittals applicable to equipment to be tested.
b. One copy of Drawings and Specifications, with Addenda and Change Orders.
c. One copy of test procedure.
d. Complete inventory of equipment to be tested including make, model, and serial number.

B. Meet following criteria prior to start of test.

1. Complete submittals and resolve disputes, if any.
2. Engineer review of test procedure.
3. Coordinate test date agreeable to each party.

C. Schedule:

1. At end of test, meet to review list of deficiencies. Engineer will indicate those items which must be corrected prior to shipment.

2. Confirm, in writing, times and dates 2 weeks before tests.

2.02 IN-FACTORY INSPECTION AND PLC I/O TESTING

A. In-Factory inspection and testing shall be performed at site of panel fabrication.

B. Owner and Engineer shall be invited to witness inspection and testing.

C. Process Control System PLC shall pass in-factory inspection and testing prior to shipment to job site.

D. In-Factory Inspection.

1. In-Factory inspection will verify following in accordance with approved submittals:

a. Panel dimensions.
b. Equipment layout.
c. Wiring.
d. Wire and terminal identification.

2. Verify proper access to equipment for maintenance.
3. Verify proper access to field wire termination points.
4. Inspect for neatness of wiring and wire harness construction.

E. In-Factory Testing and Demonstration.

1. Install PLC programming software, furnished as part of the project, to permit following:

a. Diagnostic test of PLC processor to assure proper run mode operation.
b. Diagnostic test of remote I/O to assure proper operation.
c. Inspection of PLC data table to allow viewing of discrete input on/off status.
d. Inspection of PLC data table to view register contents when inputs are tested at 0, 4, 12, and 20 mAdc.
e. Forcing of all digital outputs.
f. Generation of 4, 12, and 20 mAdc signals for all analog outputs.

2. Test as follows:

a. Verify equipment and manuals against inventory lists.
b. Run hardware diagnostics.
c. Testing of all input and output (I/O) signals at terminal strip used for field terminations.

1) Test change of state for all discrete inputs.
2) Test analog inputs at 0, 4, 12, and 20 mAdc.
3) Manipulate PLC data table or use forces to test response of all discrete output signals.
4) Manipulate PLC data table to test response of all analog output signals at 4, 12, and 20 mAdc.

3. Correct any deficiencies discovered prior to shipment to job-site.

F. Documentation

1. Prepare in-factory inspection and testing sign-off document. Document shall include following as a minimum.

a. Project description and number.
b. Company name for PLC supplier, Owner, and Engineer.
c. Section labeled “In-Factory Inspection”, with listing of items to be inspected as described above.

    1) For each item, include area for initials of PLC supplier, Owner, and Engineer representative indicating passing of inspection.
    2) Include area for handwritten notes of any corrections required.

d. Section labeled “In-Factory Testing”, with listing of items to be tested as described above.

    1) For each item, include area for initials of PLC supplier, Owner, and Engineer representative indicating passing of inspection. Include separate line for I/O point to be tested.
    2) Include area for handwritten notes of any corrections required.

2.03 FIELD I/O AND SOFTWARE TESTING

A. General:

1. Field testing is intended to check installation of the Process Control System PLC’s in addition to providing a diagnostic check of field equipment and wiring.
2. Field testing shall make use of operator workstation provided in Section 40 62 00
3. Testing shall begin after Process Control System PLC has been installed and all terminations are complete.
4. Use PLC configuration utilized for In-Factory Testing.
5. Test as follows:

    a. Run hardware diagnostics.
    b. Testing of all input and output (I/O) signals by activation or injection of signal at field device.

        1) Digital input signals:

            a) For all equipment run signals, test by on/off operation of equipment. If operation of equipment is deemed inadvisable by Owner or PLC supplier due to potential process upset, inaccessibility of generating device, hazard to personnel or other factors, test by jumpering of motor starter auxiliary contact or other source of run signal.
            b) For all alarm or status signals, test by activation of device generating alarm. If generation of alarm is deemed inadvisable by Owner or PLC supplier due to potential process upset, inaccessibility of generating device, hazard to personnel or other factors, test by jumpering of alarm contact at nearest accessible location to generating device.
            c) For signals designated as spare, test by jumpering of signal at Process Control System PLC panel field termination point.
            d) Demonstrate change of state in PLC data table.
            e) Demonstrate change of state at SCADA HMI.
            f) Demonstrate change of state at Operator Interface Terminal.

        2) Digital or Relay output signals:

            a) Manipulate PLC data table or use forces to test response of all discrete output signals.
            b) Verify proper response of other devices in loop to signals.

c) For signals designated as spare, test by checking signal at Process Control System PLC panel field termination point.

3) Analog input signals:

a) Verify impedance capabilities of transmitting device has not been exceeded by installation of Process Control System PLC.
b) Disconnect transmitting device and inject 0, 4, 12, and 20 mAdc into loop.
c) Demonstrate proper response to various signals in PLC data table.
d) Demonstrate change of value at SCADA HMI.
e) Demonstrate change of value at Operator Interface Terminal.
f) Verify proper response of other devices in analog loop to various signals.
g) For signals designated as spare, test by injection of signal at Process Control System PLC panel field termination point.

4) Analog output signals:

a) Verify impedance capabilities of analog outputs are not exceeded.
b) Generate 4, 12, and 20 mAdc signals for all analog outputs through PLC data table.
c) Demonstrate change of value at SCADA HMI.
d) Demonstrate change of value at Operator Interface Terminal.
e) Verify proper response of other devices in analog loop to various signals. Verify proper loop current through measurement.
f) For signals designated as spare, test by measuring of signal at Process Control System PLC panel field termination point.

6. Documentation

a. Prepare field testing sign-off document. Document shall include following as a minimum:

1) Project description and number.
2) Company name for Owner, PLC supplier, and Engineer.
3) For each I/O point, include area for initials of PLC supplier, Owner, and Engineer representative indicating passing of inspection. Include separate line for I/O point to be tested.
4) Include area for handwritten notes of any corrections required.

7. Problem field devices or wiring.

a. Provide written documentation of any problems encountered with Owner's existing field devices or wiring during testing.

PART 3 – EXECUTION

3.01 PERFORMANCE

A. Test PLC's and Operator Interface Terminal consistent with Drawings and Specifications.

END OF SECTION

SECTION 40 61 26
PROCESS CONTROL SYSTEM (PCS) – TRAINING

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes process control system training requirements.

B. Include training on the following subjects:

1. Overview of equipment and how it interacts with equipment and processes.
2. Operation and use of control programs residing at each PLC and HMI.
3. Overview of equipment areas and how they interact with field panels and instruments and other area equipment.
4. Care-taking procedures for PLC's.
5. Overview of plant communications hardware and equipment.

C. Comply with requirements of Section 01 79 30.

1.02 ABBREVIATIONS AND REFERENCES

A. HMI Human Machine Interface

B. OIT Operator Interface Terminal

C. PLC Programmable Logic Controller

D. SCADA Supervisory Control And Data Acquisition

1.03 SUBMITTALS

A. General:

1. Two weeks prior to training provide to Engineer a copy of the training documents to be presented to participants.
2. Material shall be arranged in a 3-ring tabbed binder separated by primary subjects as defined below.
3. Material shall be comprensive, yet arranged in a manner easy to find or reference key information.
4. Partial submittals are not acceptable.

PART 2 – PRODUCTS – Not Applicable

PART 3 – EXECUTION

3.01 MAINTENANCE TRAINING

A. Cover following areas as a minimum:

1. Testing programs which can isolate faults to functional area.
2. Theory, logic flow, physical hardware awareness, and interface connections and assembly of each equipment item.
3. Diagnostic procedures using special and general purpose test equipment. Theory, testing, and troubleshooting procedures given for special test equipment.
4. Operation of computers and peripherals.

5. Programming routines and procedures to enable students to take advantage of on-line and standby equipment for maintenance and performance verification.
6. Present short operator's course to ensure students understand operator functions and man/machine interfaces. Explain displays and printouts so students understand how information is derived, when it is presented incorrectly, and use of guidelines to differentiate between software and hardware problems.

3.02 INSTRUMENT TRAINING

A. Cover following areas as a minimum:

1. General principle of operation.
2. Calibration schedule.
3. Calibration procedure.
4. Calibration equipment required (if needed).
5. Recommended spare parts.
6. Consumable part – recommended replacement schedule (e.g. reagents, filters, probe tips) and procedure.
7. General care and maintenance with special consideration to all instruments that may require cleaning such as level elements, etc.

3.03 HMI/OIT/PLC TRAINING

A. HMI functionality.

B. OIT functionality.

C. How key components work; shall include, but not be limited to:

1. Entering of set points.
2. Using Dialer alarm matrix.
3. Acknowledging and clearing alarms.

D. Block diagram of how PLC program works.

END OF SECTION

SECTION 40 61 30
PROCESS CONTROL SYSTEM (PCS) – O&M DATA

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes requirements for Operations and Maintenance (O&M) data for Process Control System.

B. Comply with requirements of:

1. Section 01 33 00 Submittal Procedures.
2. Section 01 78 23 Operation and Maintenance Data.

PART 2 – SERVICES

2.01 HARDWARE MANUALS

A. General:

1. Include equipment comprising system. Provide instructions for O&M of installed system and individual equipment units comprising system.
2. Provide level of comprehension so experienced electronics technician can understand them. Convey understanding of how system operates and provide sufficient procedures for O&M. Use abbreviated tabular data such as charts, tables, checklists, and diagrams whenever practical, in lieu of written text. Make Drawings and tables integral part of manuals.
3. Standard hardware manuals are acceptable, if errata sheets are included to reflect specific equipment provided.

B. Organization and Content:

1. Introduction Section: Brief explanation of function of equipment covered. Be concise and do not include detailed descriptions. Provide quick orientation to use and purpose of manual and its relationship to system and equipment.
2. Safety Precautions: Major hazards to personnel and equipment peculiar to equipment or jobs covered. Intersperse specific hazard information, cautions or warning notes at appropriate points throughout other sections of manual.
3. Physical Description: Physical description (size, dimension, weight, special attachments, and physical orientation or clearances) for installation and operation. Identify special environmental (cooling, exhausting or noise) constraints.
4. Functional Description: How various functions operate together to cause desired results. Include block diagrams and flow diagrams for clarification and understanding. Provide text and diagrams which mutually support each other.
5. Operating procedures: Include maintenance-oriented operating procedures for individual equipment so maintenance personnel will be able to verify proper operation.

    a. Describe each equipment, unit, and assembly in detail with regard to technical or theoretical operation. Include information to component level. Describe each circuit and mechanical mechanism. Cross-reference descriptions so functions of each piece of equipment are covered. Use schematic diagrams, sketches, equivalent diagrams, tables, and graphs to supplement text.
    b. Applicable checkout, troubleshooting, servicing, removal and replacement, and in-place repair procedures which are performed on system basis. Provide written procedures for every adjustment point of equipment.

6. Checkout Procedures: Verify satisfactory operation of system, subsystem or unit as applicable. If checkout requires detailed step-by-step procedure include such procedures. Indicate why checkout is performed and what conditions are to be satisfied.
7. Troubleshooting Procedures: Isolate faulty components. Sequence troubleshooting procedures in logical progression from malfunction indication to location of faulty component(s). Indicate special connections or test equipment required for troubleshooting.
8. Servicing Requirements: Cleaning, lubricating, replenishing, and other housekeeping and preventive maintenance procedures applying to particular equipment. Make reference to applicable manuals which describe various servicing procedures.
9. Removal and Replacement Procedures: Step-by-step instructions for removal and replacement of items subject to frequent replacement. If special tools are required, identify by name and part number.
10. Diagrams: Schematic diagrams, logic diagrams, and associated data necessary for maintenance personnel to trace circuits, make continuity checks, and accomplish general and specific troubleshooting on inoperative or malfunctioning circuits. Provide pin wiring diagrams and cabling and plug tables showing to-and-from wiring information. Provide symbol chart where necessary to explain graphic symbols appearing on diagrams.
11. Tabular Listing: Special tools, equipment, and test equipment applicable to test, adjustment, and fault isolation procedures. Write systems maintenance instructions to enable correct use of test equipment.
12. Parts Lists: Provide clear traceability from equipment to replaceable component. Identify each component part with original manufacturer's name and part number. Identify component parts or assemblies modified for Project by part number. Parts lists may be tabulated or supplied in form of engineering or manufacturing drawings.

2.02 SOFTWARE AND CONFIGURATION MANUALS

A. General:

1. Manufacturer's standard PLC programming and software manuals.
2. Manufacturer's standard PLC data highway network programming and software manuals.

B. Provide complete, organized, and standardized documentation. Structure documentation so each level develops different degree of detail. Begin with broad approach (Systems Manual), focus on smaller pieces of overall system (Subsystem Documentation), and finally pinpoint finest detail (Program Documentation).

C. Systems Manual: Describe overall content of systems software. Describe what is included in software and not how components function. Provide global view of system and complete description of interaction of various software subsystems. Include following.

1. Table of contents.
2. Overall narrative of system including special techniques and general philosophies.
3. Block diagram showing subsystem interaction.
4. List of subsystems including brief discussion of purpose of each.
5. List of programs included, categorized by subsystem, to which each belongs.
6. Description of files or tables within system which are not unique to any particular subsystem. Files or tables used uniquely within subsystem may be defined therein.

D. Cold Boot Manual and Boot Disks: Provide detailed instructions and bootstrap software for restoring all configured equipment to normal operation in the event of an equipment crash. Document all soft and hard points used, both in programming code and in Excel format.

2.03 SYSTEM CONFIGURATION DRAWING AND MANUALS

A. System configuration drawing showing Process Control System Equipment including, but not

limited to PLC, HMI's, OITs, and local area network hardware. Show cabling and interconnection between system components.

B. Configuration data manual describing how final system configured. Describe unique data and system parameters.

2.04 DRAWINGS

A. Provide following for Process Control System elements.

1. Block Diagram: Diagram showing major Process Control System components. Identify components by manufacturer and model number. Show interconnecting cables diagrammatically.
2. Power and Grounding Interconnection Diagrams:

    a. Power diagrams shall detail interconnections from power source through power conditioning equipment, to process control system equipment.
    b. Grounding diagram shall illustrate grounding philosophy and implementation.

3. Interconnecting Wiring Diagrams: Show Process Control System elements, interconnecting cables and wiring terminations, and terminations to interacting elements and subsystems. Number terminations. Label terminations for circuits extending outside PLC assemblies.

    a. Coordinate external circuit portion of diagram with Work specified under Division 26 and bear Contractor's mark showing Work is complete.
    b. Nomenclature for external connections shall be in accordance with I/O lists in these Contract Documents and on Drawings.

4. Shop Drawings for specifically assembled Process Control System equipment such as panels, consoles, and cabinets. Drawings shall include, but not be limited to, following.

    a. Complete connection diagram.
    b. Bill of materials listing each major item of assembly. Provide data sheets for each item, annotated as necessary to describe specific items/options furnished.
    c. Layout and fabrication drawings showing locations of components.
    d. Installation and mounting detail drawings.
    e. Anchor bolt size and location.
    f. Equipment weights.
    g. Cabinet details and location.

        1) Exterior dimensions.
        2) Cable ingress and egress areas.
        3) Cable routing.
        4) Power termination location.
        5) Ground lug location.
        6) Cable termination points.
        7) Nameplate schedules.

PART 3 – EXECUTION

NOT USED

END OF SECTION

SECTION 40 61 93
PROCESS CONTROL SYSTEM (PCS) – INPUT/OUTPUT LIST

PART 1 – GENERAL

1.01 SUMMARY

A. Items specified in this Section shall conform to general requirements of Section 40 61 13 - PCS General Provisions.

B. Section includes Process Control System hard-wired PLC I/O and programming parameters, and is to be used in conjunction with the following Sections:

1. Section 40 61 20 PCS Configuration Services.
2. Section 40 61 96 Process Control Descriptions.

C. I/O List as shown in Schedule 1 of this Section contains information to configure I/O subsystem hardware and to indicate range conversion or signal function.

D. I/O list does not include existing signals, and/or signals communicated over radio or networks.

1.02 ABBREVIATIONS AND REFERENCES

A. I/O Inputs/Outputs

B. PLC Programmable Logic Controller

C. RTD Resistance Temperature Detector

1.03 I/O LIST DEFINITIONS

A. LOCATION is the tag number for the PLC/RIO/RTU panel the I/O point terminates at.

B. DRAWING is the Drawing number of Process and Instrumentation Diagram (P&ID) in which the I/O point is located.

C. TAG is the field tagname given to the I/O point as designated on the Drawings.

1. This list is not to be considered a comprehensive list of PLC tagnames.

D. EQUIPMENT describes the equipment associated with the I/O point.

1. Equipment in Schedule 1 table may be truncated and/or abbreviated due to space considerations.
2. Shop Submittals for PLC Drawings shall have Equipment tagnames as described on Process and Instrumentation Diagram (P&ID) Drawings.

E. FUNCTION describes associated process parameter or programmable controller action.

F. I/O TYPE is defined as one of following:

1. AI Designates Analog Input.
2. AO Designates Analog Output.
3. DI Designates Discrete Input.
4. DO Designates Discrete Output (non-relay)
5. RO Designates Relay Output; momentary, maintained or latched relay contact output.

G. SIGNAL TYPE Description:

1. Analog Input (AI):

a. 4-20mA DC.
b. DATA 1: Process parameter range.
c. DATA 2: Process parameter engineering units.
d. POLL TIME: 0.25 second.

2. Analog Output (AO):

a. 4-20mA DC.
b. DATA 1: Process parameter range.
c. DATA 2: Process parameter engineering units.

3. Discrete Input (DI):

a. 120Vac.
b. DATA 1: Condition existing when field contact open.
c. DATA 2: Condition existing when field contact closed.
d. POLL TIME: Change-of-State, exception-based.

4. Discrete Output (DO):

a. 120Vac.
b. DATA 1: Contact open function.
c. DATA 2: Contact closed function.

5. Relay Output (RO):

a. 120Vac.
b. DATA 1: Contact open function.
c. DATA 2: Contact closed function.

H. DATA 1 and DATA 2 describe function or signal characteristics. These are further defined under SIGNAL TYPE above.

1. I/O point data fields are subject to review and modification by Engineer during Shop Drawing review phase. Incorporate modifications into entire system.

PART 2 – PRODUCTS – NOT USED

PART 3 – EXECUTION

3.01 I/O CONFIGURATION

A. I/O shall be configured such that any single I/O module failure shall not prevent operation of all equipment for a given unit process. The objective of this configuration is to avoid a total unit process failure because of a single I/O module failure. For example, if a treatment system includes 4 pumps, the I/O for each pump should be placed such that the failure of an I/O module will only affect one of the four pumps so the remaining pumps can operate normally.

B. Spare I/O points and utilization:

1. Required spare I/O points are not included in the Schedule attached to this Section.
2. Include sufficient I/O modules to provide 25% spare I/O prewired to terminal strips. Where

no I/O of a listed type (digital input, digital output, analog input, analog output, etc.) is shown, provide one spare prewired I/O module.

3. All spare I/O shall be wire to terminal blocks.
4. Incorporate spare points into active point data base. Include changing point names, descriptions, ranges, or status from spare to new point. Include related documentation changes.
5. Spares utilization will be subject to following limitations:

    a. Incorporation shall not significantly alter control software functions. Minor change is addition of device alarm input. Significant change is addition of control device.
    b. Incorporation shall not significantly alter local area panels or field wiring to device. Minor alterations include additions of signals to terminations. Significant alterations include addition of major equipment.
    c. Additions shall not increase size of reports beyond that specified elsewhere.
    d. Changes shall not be made subsequent to submittal approval for a given panel or process area loop drawings.
    e. Treat changing of active points to spare points in same manner as incorporation of spares.

(See following pages for Schedule 1 of this Section)

LOCATION	DRAWING	TAG	EQUIPMENT	FUNCTION	I/O TYPE	SIGNAL TYPE	DATA 1	DATA 2
PLC-10	009-N-1	PLC10-LF-FAIL	LCP LINE FILTER	FAIL	DI	120VAC	ALARM	NORMAL
PLC-10	009-N-1	PLC10-UPS-FAIL	PLC-10-UPS	FAIL	DI	120VAC	ALARM	NORMAL
PLC-10	009-N-1	PLC10-UPS-LOW	PLC-10-UPS	LOW BATTERY	DI	120VAC	ALARM	NORMAL
PLC-10	009-N-1	PLC10-UPS-BATT	PLC-10-UPS	ON BATTERY MODE	DI	120VAC	ALARM	NORMAL
PLC-10	009-N-1	[1]	SODIUM HYPOCHLORITE TRANSFER PUMP P-1	IN REMOTE	DI	120VAC	NOT IN REMOTE	IN REMOTE
PLC-10	009-N-1	[1]	SODIUM HYPOCHLORITE TRANSFER PUMP P-1	RUNNING	DI	120VAC	NOT RUNNING	RUNNING
PLC-10	009-N-1	[1]	SODIUM HYPOCHLORITE TRANSFER PUMP P-1	FAIL	DI	120VAC	ALARM	NORMAL
PLC-10	009-N-1	[1]	SODIUM HYPOCHLORITE TRANSFER PUMP P-2	IN REMOTE	DI	120VAC	NOT IN REMOTE	IN REMOTE
PLC-10	009-N-1	[1]	SODIUM HYPOCHLORITE TRANSFER PUMP P-2	RUNNING	DI	120VAC	NOT RUNNING	RUNNING
PLC-10	009-N-1	[1]	SODIUM HYPOCHLORITE TRANSFER PUMP P-2	FAIL	DI	120VAC	ALARM	NORMAL
PLC-10	009-N-1	[1]	SODIUM HYPOCHLORITE FEED EMERGENCY SHOWER/EYEWASH	ALARM	DI	120VAC	ALARM	NORMAL
PLC-10	009-N-1	[1]	SODIUM HYPOCHLORITE STORE EMERGENCY SHOWER/EYEWASH	ALARM	DI	120VAC	ALARM	NORMAL
PLC-10	009-N-1	NAOC-T4-LSH	SODIUM HYPOCHLORITE DAY TANK T-4	LEVEL HIGH	DI	120VAC	ALARM	NORMAL
PLC-10	009-N-1	NAOC-T5-LSH	SODIUM HYPOCHLORITE DAY TANK T-5	LEVEL HIGH	DI	120VAC	ALARM	NORMAL
PLC-10	009-N-1	[1]	SODIUM HYPOCHLORITE SUMP	LEVEL HIGH	DI	120VAC	ALARM	NORMAL
PLC-10	009-N-1	[1]	NAOC VALVE 1	IN REMOTE	DI	120VAC	NOT IN REMOTE	IN REMOTE
PLC-10	009-N-1	[1]	NAOC VALVE 1	OPEN INDICATION	DI	120VAC	NOT OPENED	OPENED
PLC-10	009-N-1	[1]	NAOC VALVE 1	CLOSED INDICATION	DI	120VAC	NOT CLOSED	CLOSED
PLC-10	009-N-1	[1]	NAOC VALVE 2	IN REMOTE	DI	120VAC	NOT IN REMOTE	IN REMOTE
PLC-10	009-N-1	[1]	NAOC VALVE 2	OPEN INDICATION	DI	120VAC	NOT OPENED	OPENED
PLC-10	009-N-1	[1]	NAOC VALVE 2	CLOSED INDICATION	DI	120VAC	NOT CLOSED	CLOSED
PLC-10	009-N-1	[1]	NAOC VALVE 3	IN REMOTE	DI	120VAC	NOT IN REMOTE	IN REMOTE
PLC-10	009-N-1	[1]	NAOC VALVE 3	OPEN INDICATION	DI	120VAC	NOT OPENED	OPENED
PLC-10	009-N-1	[1]	NAOC VALVE 3	CLOSED INDICATION	DI	120VAC	NOT CLOSED	CLOSED
PLC-10	009-N-1	[1]	NAOC VALVE 4	IN REMOTE	DI	120VAC	NOT IN REMOTE	IN REMOTE
PLC-10	009-N-1	[1]	NAOC VALVE 4	OPEN INDICATION	DI	120VAC	NOT OPENED	OPENED
PLC-10	009-N-1	[1]	NAOC VALVE 4	CLOSED INDICATION	DI	120VAC	NOT CLOSED	CLOSED
PLC-10	009-N-1	[1]	NAOC VALVE 5	IN REMOTE	DI	120VAC	NOT IN REMOTE	IN REMOTE
PLC-10	009-N-1	[1]	NAOC VALVE 5	OPEN INDICATION	DI	120VAC	NOT OPENED	OPENED
PLC-10	009-N-1	[1]	NAOC VALVE 5	CLOSED INDICATION	DI	120VAC	NOT CLOSED	CLOSED
PLC-10	009-N-1	[1]	NAOC VALVE 6	IN REMOTE	DI	120VAC	NOT IN REMOTE	IN REMOTE
PLC-10	009-N-1	[1]	NAOC VALVE 6	OPEN INDICATION	DI	120VAC	NOT OPENED	OPENED
PLC-10	009-N-1	[1]	NAOC VALVE 6	CLOSED INDICATION	DI	120VAC	NOT CLOSED	CLOSED
PLC-10	009-N-1	[1]	NAOC VALVE 7	IN REMOTE	DI	120VAC	NOT IN REMOTE	IN REMOTE
PLC-10	009-N-1	[1]	NAOC VALVE 7	OPEN INDICATION	DI	120VAC	NOT OPENED	OPENED
PLC-10	009-N-1	[1]	NAOC VALVE 7	CLOSED INDICATION	DI	120VAC	NOT CLOSED	CLOSED
PLC-10	009-N-1	[1]	NAOC VALVE 8	IN REMOTE	DI	120VAC	NOT IN REMOTE	IN REMOTE
PLC-10	009-N-1	[1]	NAOC VALVE 8	OPEN INDICATION	DI	120VAC	NOT OPENED	OPENED
PLC-10	009-N-1	[1]	NAOC VALVE 8	CLOSED INDICATION	DI	120VAC	NOT CLOSED	CLOSED
PLC-10	009-N-1	[1]	NAOC VALVE 9	IN REMOTE	DI	120VAC	NOT IN REMOTE	IN REMOTE
PLC-10	009-N-1	[1]	NAOC VALVE 9	OPEN INDICATION	DI	120VAC	NOT OPENED	OPENED
PLC-10	009-N-1	[1]	NAOC VALVE 9	CLOSED INDICATION	DI	120VAC	NOT CLOSED	CLOSED
PLC-10	009-N-1	[1]	NAOC VALVE 10	IN REMOTE	DI	120VAC	NOT IN REMOTE	IN REMOTE
PLC-10	009-N-1	[1]	NAOC VALVE 10	OPEN INDICATION	DI	120VAC	NOT OPENED	OPENED
PLC-10	009-N-1	[1]	NAOC VALVE 10	CLOSED INDICATION	DI	120VAC	NOT CLOSED	CLOSED
PLC-10	009-N-1	NAOC-REM-V11A	NAOC VALVE 11A	IN REMOTE	DI	120VAC	NOT IN REMOTE	IN REMOTE
PLC-10	009-N-1	NAOC-ZSO-V11A	NAOC VALVE 11A	OPEN INDICATION	DI	120VAC	NOT OPENED	OPENED
PLC-10	009-N-1	NAOC-ZSC-V11A	NAOC VALVE 11A	CLOSED INDICATION	DI	120VAC	NOT CLOSED	CLOSED
PLC-10	009-N-1	NBOC-REM-V11B	NAOC VALVE 11B	IN REMOTE	DI	120VAC	NOT IN REMOTE	IN REMOTE
PLC-10	009-N-1	NBOC-ZSO-V11B	NAOC VALVE 11B	OPEN INDICATION	DI	120VAC	NOT OPENED	OPENED
PLC-10	009-N-1	NBOC-ZSC-V11B	NAOC VALVE 11B	CLOSED INDICATION	DI	120VAC	NOT CLOSED	CLOSED
PLC-10	009-N-1	[1]	SODIUM HYPOCHLORITE METERING PUMP P-3	IN REMOTE	DI	120VAC	NOT IN REMOTE	IN REMOTE
PLC-10	009-N-1	[1]	SODIUM HYPOCHLORITE METERING PUMP P-3	RUNNING	DI	120VAC	NOT RUNNING	RUNNING
PLC-10	009-N-1	[1]	SODIUM HYPOCHLORITE METERING PUMP P-3	FAIL	DI	120VAC	ALARM	NORMAL
PLC-10	009-N-1	[1]	SODIUM HYPOCHLORITE METERING PUMP P-4	IN REMOTE	DI	120VAC	NOT IN REMOTE	IN REMOTE
PLC-10	009-N-1	[1]	SODIUM HYPOCHLORITE METERING PUMP P-4	RUNNING	DI	120VAC	NOT RUNNING	RUNNING
PLC-10	009-N-1	[1]	SODIUM HYPOCHLORITE METERING PUMP P-4	FAIL	DI	120VAC	ALARM	NORMAL
PLC-10	009-N-1	[1]	SODIUM HYPOCHLORITE METERING PUMP P-5	IN REMOTE	DI	120VAC	NOT IN REMOTE	IN REMOTE
PLC-10	009-N-1	[1]	SODIUM HYPOCHLORITE METERING PUMP P-5	RUNNING	DI	120VAC	NOT RUNNING	RUNNING
PLC-10	009-N-1	[1]	SODIUM HYPOCHLORITE METERING PUMP P-5	FAIL	DI	120VAC	ALARM	NORMAL

[1]: I/O's from existing Chemical Building PLC. System Integrator to confirm TAG, DATA 1, and DATA 2 prior to implementation.

LOCATION	DRAWING	TAG	EQUIPMENT	FUNCTION	I/O TYPE	SIGNAL TYPE	DATA 1	DATA 2
PLC-10	009-N-1	[1]	SODIUM HYPOCHLORITE METERING PUMP P-6	IN REMOTE	DI	120VAC	NOT IN REMOTE	IN REMOTE
PLC-10	009-N-1	[1]	SODIUM HYPOCHLORITE METERING PUMP P-6	RUNNING	DI	120VAC	NOT RUNNING	RUNNING
PLC-10	009-N-1	[1]	SODIUM HYPOCHLORITE METERING PUMP P-6	FAIL	DI	120VAC	ALARM	NORMAL
PLC-10	009-N-1	NAOC-HTR1-FAIL	SODIUM HYPOCHLORITE HEAT TRACE CONTROLLER 1	FAIL	DI	120VAC	ALARM	NORMAL
PLC-10	009-N-1	NAOC-HTR2-FAIL	SODIUM HYPOCHLORITE HEAT TRACE CONTROLLER 2	FAIL	DI	120VAC	ALARM	NORMAL
PLC-10	009-N-1	NAOC-HTR3-FAIL	SODIUM HYPOCHLORITE HEAT TRACE CONTROLLER 3	FAIL	DI	120VAC	ALARM	NORMAL
PLC-10	009-N-1	NAOC-HTR4-FAIL	SODIUM HYPOCHLORITE HEAT TRACE CONTROLLER 4	FAIL	DI	120VAC	ALARM	NORMAL
PLC-10	009-N-1	NAOC-HTR5-FAIL	SODIUM HYPOCHLORITE HEAT TRACE CONTROLLER 5	FAIL	DI	120VAC	ALARM	NORMAL
PLC-10	009-N-1	NAOC-HTR6-FAIL	SODIUM HYPOCHLORITE HEAT TRACE CONTROLLER 6	FAIL	DI	120VAC	ALARM	NORMAL
PLC-10	009-N-2	[1]	AQUA AMMONIA STORAGE EMERGENCY SHOWER/EYEWASH	ALARM	DI	120VAC	ALARM	NORMAL
PLC-10	009-N-2	[1]	AQUA AMMONIA FEED EMERGENCY SHOWER/EYEWASH	ALARM	DI	120VAC	ALARM	NORMAL
PLC-10	009-N-2	[1]	AQUA AMMONIA STORAGE TANK T-1	PRESSURE HIGH	DI	120VAC	ALARM	NORMAL
PLC-10	009-N-2	[1]	CHEMICAL BUILDING EMERGENCY SHOWER/EYEWASH	ALARM	DI	120VAC	ALARM	NORMAL
PLC-10	009-N-2	[1]	CHEMICAL BUILDING SPRINKLER SYSTEM TAMPER SWITCH #1	ALARM	DI	120VAC	ALARM	NORMAL
PLC-10	009-N-2	[1]	CHEMICAL BUILDING SPRINKLER SYSTEM TAMPER SWITCH #2	ALARM	DI	120VAC	ALARM	NORMAL
PLC-10	009-N-2	[1]	CHEMICAL BUILDING SPRINKLER SYSTEM TAMPER SWITCH #3	ALARM	DI	120VAC	ALARM	NORMAL
PLC-10	009-N-2	[1]	CHEMICAL BUILDING TEMPERATURE CONTROL PANEL	ALARM	DI	120VAC	ALARM	NORMAL
PLC-10	009-N-2	[1]	AQUA AMMONIA METERING PUMP P-1	IN AUTO	DI	120VAC	NOT IN AUTO	IN AUTO
PLC-10	009-N-2	[1]	AQUA AMMONIA METERING PUMP P-1	RUNNING	DI	120VAC	NOT RUNNING	RUNNING
PLC-10	009-N-2	[1]	AQUA AMMONIA METERING PUMP P-1	FAIL	DI	120VAC	ALARM	NORMAL
PLC-10	009-N-2	[1]	AQUA AMMONIA METERING PUMP P-2	RUNNING	DI	120VAC	NOT IN AUTO	IN AUTO
PLC-10	009-N-2	[1]	AQUA AMMONIA METERING PUMP P-2	FAIL	DI	120VAC	NOT RUNNING	RUNNING
PLC-10	009-N-2	[1]	AQUA AMMONIA METERING PUMP P-2	FAIL	DI	120VAC	ALARM	NORMAL
PLC-10	009-N-2	[1]	AIR COMPRESSOR	COMMON ALARM	DI	120VAC	ALARM	NORMAL
PLC-10	009-N-2	[1]	AQUA AMMONIA FLOW	DETECTED	DI	120VAC	NO FLOW	FLOW
PLC-10	009-N-2	[1]	AQUA AMMONIA FLOW	HIGH	DI	120VAC	ALARM	NORMAL
PLC-10	009-N-2	[1]	AQUA AMMONIA SUMP	LEVEL HIGH	DI	120VAC	ALARM	NORMAL
PLC-10	009-N-3	[1]	SODIUM HYDROXIDE FEED EMERGENCY SHOWER/EYEWASH	ALARM	DI	120VAC	ALARM	NORMAL
PLC-10	009-N-3	[1]	SODIUM HYDROXIDE STORE EMERGENCY SHOWER/EYEWASH	ALARM	DI	120VAC	ALARM	NORMAL
PLC-10	009-N-3	NAOH-ZSO-T1	NAOH T-1 VALVE	OPEN INDICATION	DI	120VAC	NOT OPENED	OPENED
PLC-10	009-N-3	NAOH-ZSC-T1	NAOH T-1 VALVE	CLOSED INDICATION	DI	120VAC	NOT CLOSED	CLOSED
PLC-10	009-N-3	NAOH-ZSO-T2	NAOH T-2 VALVE	OPEN INDICATION	DI	120VAC	NOT OPENED	OPENED
PLC-10	009-N-3	NAOH-ZSC-T2	NAOH T-2 VALVE	CLOSED INDICATION	DI	120VAC	NOT CLOSED	CLOSED
PLC-10	009-N-3	[1]	SODIUM HYDROXIDE TRANSFER PUMP P-1	IN REMOTE	DI	120VAC	NOT IN REMOTE	IN REMOTE
PLC-10	009-N-3	[1]	SODIUM HYDROXIDE TRANSFER PUMP P-1	RUNNING	DI	120VAC	NOT RUNNING	RUNNING
PLC-10	009-N-3	[1]	SODIUM HYDROXIDE TRANSFER PUMP P-1	FAIL	DI	120VAC	ALARM	NORMAL
PLC-10	009-N-3	[1]	SODIUM HYDROXIDE TRANSFER PUMP P-2	IN REMOTE	DI	120VAC	NOT IN REMOTE	IN REMOTE
PLC-10	009-N-3	[1]	SODIUM HYDROXIDE TRANSFER PUMP P-2	RUNNING	DI	120VAC	NOT RUNNING	RUNNING
PLC-10	009-N-3	[1]	SODIUM HYDROXIDE TRANSFER PUMP P-2	FAIL	DI	120VAC	ALARM	NORMAL
PLC-10	009-N-3	NAOH-T3-LSH	SODIUM HYDROXIDE DAY TANK T-3	HIGH LEVEL	DI	120VAC	ALARM	NORMAL
PLC-10	009-N-3	[1]	SODIUM HYDROXIDE SUMP	LEVEL HIGH	DI	120VAC	[1]	[1]
PLC-10	009-N-3	[1]	SODIUM HYDROXIDE METERING PUMP P-3	IN AUTO	DI	120VAC	NOT IN AUTO	IN AUTO
PLC-10	009-N-3	[1]	SODIUM HYDROXIDE METERING PUMP P-3	RUNNING	DI	120VAC	NOT RUNNING	RUNNING
PLC-10	009-N-3	[1]	SODIUM HYDROXIDE METERING PUMP P-3	FAIL	DI	120VAC	ALARM	NORMAL
PLC-10	009-N-3	[1]	SODIUM HYDROXIDE METERING PUMP P-4	IN AUTO	DI	120VAC	NOT IN AUTO	IN AUTO
PLC-10	009-N-3	[1]	SODIUM HYDROXIDE METERING PUMP P-4	RUNNING	DI	120VAC	NOT RUNNING	RUNNING
PLC-10	009-N-3	[1]	SODIUM HYDROXIDE METERING PUMP P-4	FAIL	DI	120VAC	ALARM	NORMAL
PLC-10	009-N-3	[1]	SODIUM HYDROXIDE METERING PUMP P-5	IN AUTO	DI	120VAC	NOT IN AUTO	IN AUTO
PLC-10	009-N-3	[1]	SODIUM HYDROXIDE METERING PUMP P-5	RUNNING	DI	120VAC	NOT RUNNING	RUNNING
PLC-10	009-N-3	[1]	SODIUM HYDROXIDE METERING PUMP P-5	FAIL	DI	120VAC	ALARM	NORMAL
PLC-10	009-N-4	[1]	HYDROFLUOROSILICIC FEED EMERGENCY SHOWER/EYEWASH	ALARM	DI	120VAC	ALARM	NORMAL
PLC-10	009-N-4	[1]	HYDROFLUOROSILICIC STORAGE EMERGENCY SHOWER/EYEWASH	ALARM	DI	120VAC	ALARM	NORMAL
PLC-10	009-N-4	[1]	HYDROFLUOROSILICIC ACID SUMP	LEVEL HIGH	DI	120VAC	ALARM	NORMAL
PLC-10	009-N-4	[1]	HYDROFLUOROSILICIC ACID TRANSFER PUMP P-1	IN REMOTE	DI	120VAC	[1]	[1]
PLC-10	009-N-4	[1]	HYDROFLUOROSILICIC ACID TRANSFER PUMP P-1	RUNNING	DI	120VAC	[1]	[1]
PLC-10	009-N-4	[1]	HYDROFLUOROSILICIC ACID TRANSFER PUMP P-1	FAIL	DI	120VAC	[1]	[1]
PLC-10	009-N-1	[1]	SODIUM HYPOCHLORITE TRANSFER PUMP P-1	START	DO	120VAC	[1]	[1]
PLC-10	009-N-1	[1]	SODIUM HYPOCHLORITE TRANSFER PUMP P-1	STOP	DO	120VAC	[1]	[1]
PLC-10	009-N-1	[1]	SODIUM HYPOCHLORITE TRANSFER PUMP P-1	EMERGENCY STOP	DO	120VAC	[1]	[1]

[1]: I/O's from existing Chemical Building PLC. System Integrator to confirm TAG, DATA 1, and DATA 2 prior to implementation.

LOCATION	DRAWING	TAG	EQUIPMENT	FUNCTION	I/O TYPE	SIGNAL TYPE	DATA 1	DATA 2
PLC-10	009-N-1	[1]	SODIUM HYPOCHLORITE TRANSFER PUMP P-2	START	DO	120VAC	[1]	[1]
PLC-10	009-N-1	[1]	SODIUM HYPOCHLORITE TRANSFER PUMP P-2	STOP	DO	120VAC	[1]	[1]
PLC-10	009-N-1	[1]	SODIUM HYPOCHLORITE TRANSFER PUMP P-2	EMERGENCY STOP	DO	120VAC	[1]	[1]
PLC-10	009-N-1	[1]	SODIUM HYPOCHLORITE METERING PUMP P-3	RUN COMMAND	DO	120VAC	NO ACTION	RUN
PLC-10	009-N-1	[1]	SODIUM HYPOCHLORITE METERING PUMP P-4	RUN COMMAND	DO	120VAC	NO ACTION	RUN
PLC-10	009-N-1	[1]	SODIUM HYPOCHLORITE METERING PUMP P-5	RUN COMMAND	DO	120VAC	NO ACTION	RUN
PLC-10	009-N-1	[1]	SODIUM HYPOCHLORITE METERING PUMP P-6	RUN COMMAND	DO	120VAC	NO ACTION	RUN
PLC-10	009-N-1	[1]	NAOC VALVE 1	OPEN COMMAND	DO	120VAC	NO ACTION	OPEN
PLC-10	009-N-1	[1]	NAOC VALVE 1	CLOSE COMMAND	DO	120VAC	NO ACTION	CLOSE
PLC-10	009-N-1	[1]	NAOC VALVE 2	OPEN COMMAND	DO	120VAC	NO ACTION	OPEN
PLC-10	009-N-1	[1]	NAOC VALVE 2	CLOSE COMMAND	DO	120VAC	NO ACTION	CLOSE
PLC-10	009-N-1	[1]	NAOC VALVE 3	OPEN COMMAND	DO	120VAC	NO ACTION	OPEN
PLC-10	009-N-1	[1]	NAOC VALVE 3	CLOSE COMMAND	DO	120VAC	NO ACTION	CLOSE
PLC-10	009-N-1	[1]	NAOC VALVE 4	OPEN COMMAND	DO	120VAC	NO ACTION	OPEN
PLC-10	009-N-1	[1]	NAOC VALVE 4	CLOSE COMMAND	DO	120VAC	NO ACTION	CLOSE
PLC-10	009-N-1	[1]	NAOC VALVE 5	OPEN COMMAND	DO	120VAC	NO ACTION	OPEN
PLC-10	009-N-1	[1]	NAOC VALVE 5	CLOSE COMMAND	DO	120VAC	NO ACTION	CLOSE
PLC-10	009-N-1	[1]	NAOC VALVE 6	OPEN COMMAND	DO	120VAC	NO ACTION	OPEN
PLC-10	009-N-1	[1]	NAOC VALVE 6	CLOSE COMMAND	DO	120VAC	NO ACTION	CLOSE
PLC-10	009-N-1	[1]	NAOC VALVE 7	OPEN COMMAND	DO	120VAC	NO ACTION	OPEN
PLC-10	009-N-1	[1]	NAOC VALVE 7	CLOSE COMMAND	DO	120VAC	NO ACTION	CLOSE
PLC-10	009-N-1	[1]	NAOC VALVE 8	OPEN COMMAND	DO	120VAC	NO ACTION	OPEN
PLC-10	009-N-1	[1]	NAOC VALVE 8	CLOSE COMMAND	DO	120VAC	NO ACTION	CLOSE
PLC-10	009-N-1	[1]	NAOC VALVE 9	OPEN COMMAND	DO	120VAC	NO ACTION	OPEN
PLC-10	009-N-1	[1]	NAOC VALVE 9	CLOSE COMMAND	DO	120VAC	NO ACTION	CLOSE
PLC-10	009-N-1	[1]	NAOC VALVE 10	OPEN COMMAND	DO	120VAC	NO ACTION	OPEN
PLC-10	009-N-1	[1]	NAOC VALVE 10	CLOSE COMMAND	DO	120VAC	NO ACTION	CLOSE
PLC-10	009-N-1	NAOC-ZCC-V11A	NAOC VALVE 11A	OPEN COMMAND	DO	120VAC	NO ACTION	OPEN
PLC-10	009-N-1	NAOC-ZCO-V11A	NAOC VALVE 11A	CLOSE COMMAND	DO	120VAC	NO ACTION	CLOSE
PLC-10	009-N-1	NAOC-ZCC-V11B	NAOC VALVE 11B	OPEN COMMAND	DO	120VAC	NO ACTION	OPEN
PLC-10	009-N-1	NAOC-ZCO-V11B	NAOC VALVE 11B	CLOSE COMMAND	DO	120VAC	NO ACTION	CLOSE
PLC-10	009-N-2	[1]	ALARM HORN	ACTIVATE	DO	120VAC	NO ACTION	SOUND
PLC-10	009-N-2	[1]	AQUA AMMONIA METERING PUMP P-1	RUN COMMAND	DO	120VAC	NO ACTION	RUN
PLC-10	009-N-2	[1]	AQUA AMMONIA METERING PUMP P-2	RUN COMMAND	DO	120VAC	NO ACTION	RUN
PLC-10	009-N-3	[1]	SODIUM HYDROXIDE TRANSFER PUMP P-1	START COMMAND	DO	120VAC	[1]	[1]
PLC-10	009-N-3	[1]	SODIUM HYDROXIDE TRANSFER PUMP P-1	STOP COMMAND	DO	120VAC	[1]	[1]
PLC-10	009-N-3	[1]	SODIUM HYDROXIDE TRANSFER PUMP P-1	EMERGENCY STOP	DO	120VAC	[1]	[1]
PLC-10	009-N-3	[1]	SODIUM HYDROXIDE TRANSFER PUMP P-2	START COMMAND	DO	120VAC	[1]	[1]
PLC-10	009-N-3	[1]	SODIUM HYDROXIDE TRANSFER PUMP P-2	STOP COMMAND	DO	120VAC	[1]	[1]
PLC-10	009-N-3	[1]	SODIUM HYDROXIDE TRANSFER PUMP P-2	EMERGENCY STOP	DO	120VAC	[1]	[1]
PLC-10	009-N-3	[1]	SODIUM HYDROXIDE METERING PUMP P-3	RUN COMMAND	DO	120VAC	NO ACTION	RUN
PLC-10	009-N-3	[1]	SODIUM HYDROXIDE METERING PUMP P-4	RUN COMMAND	DO	120VAC	NO ACTION	RUN
PLC-10	009-N-4	[1]	HYDROFLUOROSILICIC ACID TRANSFER PUMP P-1	START COMMAND	DO	120VAC	[1]	[1]
PLC-10	009-N-4	[1]	HYDROFLUOROSILICIC ACID TRANSFER PUMP P-1	STOP COMMAND	DO	120VAC	[1]	[1]
PLC-10	009-N-4	[1]	HYDROFLUOROSILICIC ACID TRANSFER PUMP P-1	ENABLE	DO	120VAC	[1]	[1]
PLC-10	009-N-4	[1]	HYDROFLUOROSILICIC ACID TRANSFER PUMP P-1	EMERGENCY STOP	DO	120VAC	[1]	[1]
PLC-10	009-N-3	[1]	SODIUM HYDROXIDE METERING PUMP P-5	RUN COMMAND	DO	120VAC	NO ACTION	RUN
PLC-10	009-N-4	[1]	HYDROFLUOROSILICIC ACID METERING PUMP P-2	RUN COMMAND	DO	120VAC	NO ACTION	RUN
PLC-10	009-N-4	[1]	HYDROFLUOROSILICIC ACID METERING PUMP P-3	RUN COMMAND	DO	120VAC	NO ACTION	RUN
PLC-10	009-N-1	[1]	SODIUM HYPOCHLORITE STORAGE TANK T-1	LEVEL	AI	4-20ma	[1]	[1]
PLC-10	009-N-1	[1]	SODIUM HYPOCHLORITE STORAGE TANK T-2	LEVEL	AI	4-20ma	[1]	[1]
PLC-10	009-N-1	[1]	SODIUM HYPOCHLORITE STORAGE TANK T-3	LEVEL	AI	4-20ma	[1]	[1]
PLC-10	009-N-1	[1]	SODIUM HYPOCHLORITE DAY TANK T-4	LEVEL	AI	4-20ma	[1]	[1]
PLC-10	009-N-1	[1]	SODIUM HYPOCHLORITE DAY TANK T-5	LEVEL	AI	4-20ma	[1]	[1]
PLC-10	009-N-1	[1]	SODIUM HYPOCHLORITE METERING PUMP P-3	SPEED	AI	4-20ma	[1]	[1]
PLC-10	009-N-1	[1]	SODIUM HYPOCHLORITE METERING PUMP P-4	SPEED	AI	4-20ma	[1]	[1]
PLC-10	009-N-1	[1]	SODIUM HYPOCHLORITE METERING PUMP P-5	SPEED	AI	4-20ma	[1]	[1]
PLC-10	009-N-1	[1]	SODIUM HYPOCHLORITE METERING PUMP P-6	SPEED	AI	4-20ma	[1]	[1]
PLC-10	009-N-2	[1]	AQUA AMMONIA STORAGE TANK T-1	LEVEL	AI	4-20ma	[1]	[1]

[1]: I/O's from existing Chemical Building PLC. System Integrator to confirm TAG, DATA 1, and DATA 2 prior to implementation.

LOCATION	DRAWING	TAG	EQUIPMENT	FUNCTION	I/O TYPE	SIGNAL TYPE	DATA 1	DATA 2
PLC-10	009-N-2	[1]	AQUA AMMONIA METERING PUMP P-1	SPEED FEEDBACK	AI	4-20ma	[1]	[1]
PLC-10	009-N-2	[1]	AQUA AMMONIA METERING PUMP P-2	SPEED FEEDBACK	AI	4-20ma	[1]	[1]
PLC-10	009-N-3	[1]	SODIUM HYDROXIDE STORAGE TANK T-1	LEVEL	AI	4-20ma	[1]	[1]
PLC-10	009-N-3	[1]	SODIUM HYDROXIDE STORAGE TANK T-2	LEVEL	AI	4-20ma	[1]	[1]
PLC-10	009-N-3	[1]	SODIUM HYDROXIDE DAY TANK T-3	LEVEL	AI	4-20ma	[1]	[1]
PLC-10	009-N-3	[1]	SODIUM HYDROXIDE METERING PUMP P-3	SPEED FEEDBACK	AI	4-20ma	[1]	[1]
PLC-10	009-N-3	[1]	SODIUM HYDROXIDE METERING PUMP P-4	SPEED FEEDBACK	AI	4-20ma	[1]	[1]
PLC-10	009-N-3	[1]	SODIUM HYDROXIDE METERING PUMP P-5	SPEED FEEDBACK	AI	4-20ma	[1]	[1]
PLC-10	009-N-4	[1]	HYFROFLUOSILICIC ACID STORAGE TANK T-1	LEVEL	AI	4-20ma	[1]	[1]
PLC-10	009-N-4	[1]	HYDROFLUOROSILICIC ACID DAY TANK T-2	LEVEL	AI	4-20ma	[1]	[1]
PLC-10	009-N-1	[1]	SODIUM HYPOCHLORITE METERING PUMP P-3	SPEED CONTROL	AO	4-20ma	[1]	[1]
PLC-10	009-N-1	[1]	SODIUM HYPOCHLORITE METERING PUMP P-4	SPEED CONTROL	AO	4-20ma	[1]	[1]
PLC-10	009-N-1	[1]	SODIUM HYPOCHLORITE METERING PUMP P-5	SPEED CONTROL	AO	4-20ma	[1]	[1]
PLC-10	009-N-1	[1]	SODIUM HYPOCHLORITE METERING PUMP P-6	SPEED CONTROL	AO	4-20ma	[1]	[1]
PLC-10	009-N-2	[1]	AQUA AMMONIA METERING PUMP P-1	SPEED CONTROL	AO	4-20ma	[1]	[1]
PLC-10	009-N-2	[1]	AQUA AMMONIA METERING PUMP P-2	SPEED CONTROL	AO	4-20ma	[1]	[1]
PLC-10	009-N-3	[1]	SODIUM HYDROXIDE METERING PUMP P-3	SPEED CONTROL	AO	4-20ma	[1]	[1]
PLC-10	009-N-3	[1]	SODIUM HYDROXIDE METERING PUMP P-4	SPEED CONTROL	AO	4-20ma	[1]	[1]
PLC-10	009-N-3	[1]	SODIUM HYDROXIDE METERING PUMP P-5	SPEED CONTROL	AO	4-20ma	[1]	[1]
PLC-10	009-N-4	[1]	HYDROFLUOROSILICIC ACID METERING PUMP P-2	RATE CONTROL	AO	4-20ma	[1]	[1]
PLC-10	009-N-4	[1]	HYDROFLUOROSILICIC ACID METERING PUMP P-3	RATE CONTROL	AO	4-20ma	[1]	[1]

[1]: I/O's from existing Chemical Building PLC. System Integrator to confirm TAG, DATA 1, and DATA 2 prior to implementation.

LOCATION	DRAWING	TAG	EQUIPMENT	FUNCTION	I/O TYPE	SIGNAL TYPE	DATA 1	DATA 2
PLC-7B	009-N-1	NAOC-ZSC-V12A	NAOC VALVE 12A	IN REMOTE	DI	120VAC	NOT IN REMOTE	REMOTE
PLC-7B	009-N-1	NAOC-REM-V12A	NAOC VALVE 12A	OPEN INDICATION	DI	120VAC	NOT OPENED	OPENED
PLC-7B	009-N-1	NAOC-ZSO-V12A	NAOC VALVE 12A	CLOSED INDICATION	DI	120VAC	NOT CLOSED	CLOSED
PLC-7B	009-N-1	NAOC-ZSC-V12B	NAOC VALVE 12B	IN REMOTE	DI	120VAC	NOT IN REMOTE	REMOTE
PLC-7B	009-N-1	NAOC-REM-V12B	NAOC VALVE 12B	OPEN INDICATION	DI	120VAC	NOT OPENED	OPENED
PLC-7B	009-N-1	NAOC-ZSO-V12B	NAOC VALVE 12B	CLOSED INDICATION	DI	120VAC	NOT CLOSED	CLOSED
PLC-7B	009-N-2	NHOH-REM-V1A	NHOH VALVE 1A	IN REMOTE	DI	120VAC	NOT IN REMOTE	REMOTE
PLC-7B	009-N-2	NHOH-ZSO-V1A	NHOH VALVE 1A	OPENED	DI	120VAC	NOT OPENED	OPENED
PLC-7B	009-N-2	NHOH-ZSC-V1A	NHOH VALVE 1A	CLOSED	DI	120VAC	NOT CLOSED	CLOSED
PLC-7B	009-N-2	NHOH-REM-V1B	NHOH VALVE 1B	IN REMOTE	DI	120VAC	NOT IN REMOTE	REMOTE
PLC-7B	009-N-2	NHOH-ZSO-V1B	NHOH VALVE 1B	OPENED	DI	120VAC	NOT OPENED	OPENED
PLC-7B	009-N-2	NHOH-ZSC-V1B	NHOH VALVE 1B	CLOSED	DI	120VAC	NOT CLOSED	CLOSED
PLC-7B	009-N-3	NAOH-HTR7-FAIL	BUILDING 300 HEAT TRACE PANEL	FAIL	DI	120VAC	ALARM	NORMAL
PLC-7B	009-N-3	NAOH-REM-V1A	NAOH VALVE 1A	IN REMOTE	DI	120VAC	NOT IN REMOTE	REMOTE
PLC-7B	009-N-3	NAOH-ZSO-V1A	NAOH VALVE 1A	OPENED	DI	120VAC	NOT OPENED	OPENED
PLC-7B	009-N-3	NAOH-ZSC-V1A	NAOH VALVE 1A	CLOSED	DI	120VAC	NOT CLOSED	CLOSED
PLC-7B	009-N-3	NAOH-REM-V1B	NAOH VALVE 1B	IN REMOTE	DI	120VAC	NOT IN REMOTE	REMOTE
PLC-7B	009-N-3	NAOH-ZSO-V1B	NAOH VALVE 1B	OPENED	DI	120VAC	NOT OPENED	OPENED
PLC-7B	009-N-3	NAOH-ZSC-V1B	NAOH VALVE 1B	CLOSED	DI	120VAC	NOT CLOSED	CLOSED
PLC-7B	009-N-4	HFSA-ZSC-V1A	VALVE HFSA-V-1A	IN REMOTE	DI	120VAC	NOT IN REMOTE	REMOTE
PLC-7B	009-N-4	HFSA-REM-V1A	VALVE HFSA-V-1A	OPENED	DI	120VAC	NOT OPENED	OPENED
PLC-7B	009-N-4	HFSA-ZSO-V1A	VALVE HFSA-V-1A	CLOSED	DI	120VAC	NOT CLOSED	CLOSED
PLC-7B	009-N-4	HFSA-ZSC-V1B	VALVE HFSA-V-1B	IN REMOTE	DI	120VAC	NOT IN REMOTE	REMOTE
PLC-7B	009-N-4	HFSA-REM-V1B	VALVE HFSA-V-1B	OPENED	DI	120VAC	NOT OPENED	OPENED
PLC-7B	009-N-4	HFSA-ZSO-V1B	VALVE HFSA-V-1B	CLOSED	DI	120VAC	NOT CLOSED	CLOSED
PLC-7B	009-N-5	FLTR-REM-V321	BACKWASH HOLDING BASIN ISOLATION VALVE	IN REMOTE	DI	120VAC	NOT IN REMOTE	REMOTE
PLC-7B	009-N-5	FLTR-ZSO-V321	BACKWASH HOLDING BASIN ISOLATION VALVE	OPENED	DI	120VAC	NOT OPENED	OPENED
PLC-7B	009-N-5	FLTR-ZSC-V321	BACKWASH HOLDING BASIN ISOLATION VALVE	CLOSED	DI	120VAC	NOT CLOSED	CLOSED
PLC-7B	009-N-5	FLTR-FTL-V321	BACKWASH HOLDING BASIN ISOLATION VALVE	FAULT	DI	120VAC	NORMAL	ALARM
PLC-7B	009-N-5	FLTR-ON-P330	BACKWASH PUMP NO. 2	IN ON	DI	120VAC	NOT IN ON	IN ON
PLC-7B	009-N-5	FLTR-REM-P330	BACKWASH PUMP NO. 2	IN REMOTE	DI	120VAC	NOT IN REMOTE	REMOTE
PLC-7B	009-N-5	FLTR-MS-P330	BACKWASH PUMP NO. 2	RUNNING	DI	120VAC	NOT RUNNING	RUNNING
PLC-7B	009-N-5	FLTR-OL-P330	BACKWASH PUMP NO. 2	OVERLOAD	DI	120VAC	NORMAL	OVERLOAD
PLC-7B	009-N-5	FLTR-TSH-P330	BACKWASH PUMP NO. 2 MOTOR	OVER TEMP	DI	120VAC	NORMAL	OVER TEMP
PLC-7B	009-N-1	NAOC-ZCC-V12A	NAOC VALVE 12A	OPEN COMMAND	DO	120VAC	NO ACTION	OPEN
PLC-7B	009-N-1	NAOC-ZCO-V12A	NAOC VALVE 12A	CLOSE COMMAND	DO	120VAC	NO ACTION	CLOSE
PLC-7B	009-N-1	NAOC-ZCC-V12B	NAOC VALVE 12B	OPEN COMMAND	DO	120VAC	NO ACTION	OPEN
PLC-7B	009-N-1	NAOC-ZCO-V12B	NAOC VALVE 12B	CLOSE COMMAND	DO	120VAC	NO ACTION	CLOSE
PLC-7B	009-N-2	NHOH-ZCC-V1A	NHOH VALVE 1A	OPEN COMMAND	DO	120VAC	NO ACTION	OPEN
PLC-7B	009-N-2	NHOH-ZCO-V1A	NHOH VALVE 1A	CLOSE COMMAND	DO	120VAC	NO ACTION	CLOSE
PLC-7B	009-N-2	NHOH-ZCC-V1B	NHOH VALVE 1B	OPEN COMMAND	DO	120VAC	NO ACTION	OPEN
PLC-7B	009-N-2	NHOH-ZCO-V1B	NHOH VALVE 1B	CLOSE COMMAND	DO	120VAC	NO ACTION	CLOSE
PLC-7B	009-N-3	NAOH-ZCO-V1A	NAOH VALVE 1A	OPEN COMMAND	DO	120VAC	NO ACTION	OPEN
PLC-7B	009-N-3	NAOH-ZCC-V1A	NAOH VALVE 1A	CLOSE COMMAND	DO	120VAC	NO ACTION	CLOSE
PLC-7B	009-N-3	NAOH-ZCO-V1B	NAOH VALVE 1B	OPEN COMMAND	DO	120VAC	NO ACTION	OPEN
PLC-7B	009-N-3	NAOH-ZCC-V1B	NAOH VALVE 1B	CLOSE COMMAND	DO	120VAC	NO ACTION	CLOSE
PLC-7B	009-N-4	HFSA-ZCC-V1A	VALVE HFSA-V-1A	OPEN COMMAND	DO	120VAC	NO ACTION	OPEN
PLC-7B	009-N-4	HFSA-ZCO-V1A	VALVE HFSA-V-1A	CLOSE COMMAND	DO	120VAC	NO ACTION	CLOSE
PLC-7B	009-N-4	HFSA-ZCC-V1B	VALVE HFSA-V-1B	OPEN COMMAND	DO	120VAC	NO ACTION	OPEN
PLC-7B	009-N-4	HFSA-ZCO-V1B	VALVE HFSA-V-1B	CLOSE COMMAND	DO	120VAC	NO ACTION	CLOSE
PLC-7B	009-N-5	FLTR-ZCO-V321	BACKWASH HOLDING BASIN ISOLATION VALVE	OPEN COMMAND	DO	120VAC	NO ACTION	CLOSE
PLC-7B	009-N-5	FLTR-ZCC-V321	BACKWASH HOLDING BASIN ISOLATION VALVE	CLOSE COMMAND	DO	120VAC	NOT OPENED	OPENED
PLC-7B	009-N-5	FLTR-MC-P330	BACKWASH PUMP NO. 2	REQUIRED	DO	120VAC	NOT REQUIRED	REQUIRED

[1]: I/O's from existing Chemical Building PLC. System Integrator to confirm TAG, DATA 1, and DATA 2 prior to implementation.

SECTION 40 61 96
PROCESS CONTROL DESCRIPTIONS

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes Process Control System in conjunction with P&IDs.

B. Items specified in this section shall conform to general requirements of Section 40 61 13.

1.02 REFERENCES

A. NEMA: National Electrical Manufacturer's Association

1.03 ABBREVATIONS

A. HMI: Human/Machine Interface

B. NEC: National Electrical Code

C. PC: Personal Computer

D. PCS: Process Control System

E. P&IDs: Process and Instrumentation Diagrams

F. PLC: Programmable Logic Controller

G. SCADA : Supervisory Control and Data Acquisition

H. I&C: Instrumentation and Controls

PART 2 – PROCESS CONTROL DESCRIPTIONS

2.01 PLC-BASED CONTROL PANELS – GENERAL

A. PLC-Based Control Panel Functional Descriptions - General:

1. Functional Descriptions for PLC-based control panels that follow pertain to "Auto" modes requiring supervisory control with interactive logic.
2. PLC control of equipment shall require "Hand/Off/Auto" selector switches to be in the "Auto" position. Equipment not in "Auto" shall be considered to be in "Hand" mode and shall be controlled manually at the equipment. "Hand" mode shall be for maintenance purposes and may inhibit equipment safeguards such as seal fail or overtemp conditions.
3. Equipment that is capable of auto operation (and controlled from Plant PLC) shall alarm the Operator if the equipment has been removed from "Remote" or "Auto" operation for longer than 24 hours.
4. Stop or emergency stops shall work as designed for all modes of operation.
5. All equipment fail signals shall be alert the Operator, alarm the equipment, and remove from equipment sequencer.
6. All adjustable set-points described in this Section shall be by the Operator or higher level authority such as a Supervisor. Hierarchy shall be defined with the Owner by the HMI SCADA Programmer.
7. Nominal dimensions for new PLC panels are estimates, and shall be determined by the System Integrator during detailed design. Final dimensions of each panel shall be included

in shop drawing submittals, and shall be coordinated with the Contractor for properly sizing of concrete housekeeping pads when not wall mounted.

2.02 CHEMICAL BUILDING CONTROL PANEL – PLC-10

A. Sodium Hypochlorite Storage and Transfer Pumping (009-N-1)

1. The Sodium Hypochlorite Storage System consists of the following:

   a. Sodium Hypochlorite Storage Tank T-1 (NAOC-T-1).
   b. Sodium Hypochlorite Storage Tank T-1 Level Transmitter/Sensor (NAOC-LIT-1/ NAOC-LE-1).
   c. Sodium Hypochlorite Storage Tank T-2 (NAOC-T-2).
   d. Sodium Hypochlorite Storage Tank T-2 Level Transmitter/Sensor (NAOC-LIT-2/ NAOC-LE-2).
   e. Sodium Hypochlorite Storage Tank T-3 (NAOC-T-3).
   f. Sodium Hypochlorite Storage Tank T-3 Level Transmitter/Sensor (NAOC-LIT-3/ NAOC-LE-3).
   g. Sodium Hypochlorite Day Tank T-4 (NAOC-T-4).
   h. Sodium Hypochlorite Day Tank T-4 Level Transmitter/Sensor (NAOC-LIT-4/ NAOC-LE-4).
   i. Sodium Hypochlorite Day Tank T-4 High Level Vertical Float Switch (NAOC-LSH-4).
   j. Sodium Hypochlorite Day Tank T-5 (NAOC-T-5).
   k. Sodium Hypochlorite Day Tank T-5 Level Transmitter/Sensor (NAOC-LIT-5/ NAOC-LE-5).
   l. Sodium Hypochlorite Day Tank T-5 High Level Vertical Float Switch (NAOC-LSH-5).
   m. Sodium Hypochlorite Transfer Pump P-1 (NAOC-P-1).
   n. Sodium Hypochlorite Transfer Pump P-2 (NAOC-P-2).
   o. Sodium Hypochlorite Valve 1 (NAOC-V-1).
   p. Sodium Hypochlorite Valve 2 (NAOC-V-2).
   q. Sodium Hypochlorite Valve 3 (NAOC-V-3).
   r. Sodium Hypochlorite Valve 4 (NAOC-V-4).
   s. Sodium Hypochlorite Valve 5 (NAOC-V-5).
   t. Sodium Hypochlorite Valve 6 (NAOC-V-6).
   u. Sodium Hypochlorite Valve 7 (NAOC-V-7).
   v. Sodium Hypochlorite Valve 8 (NAOC-V-8).
   w. Sodium Hypochlorite Valve 8 (NAOC-V-9).
   x. Sodium Hypochlorite Valve 8 (NAOC-V-10).

2. The level for Sodium Hypochlorite Storage Tank T-1, T-2 and T-3 shall be continuously monitored by the associated radar level sensor. The remote transmitters shall display and relay the value to PLC-10. Tank level shall be displayed and tended on SCADA HMI in both feet and gallons. Alarms shall be generated at Plant HMI when Operator-adjustable set-points are reached. The set-points for each of the tank shall be:

   a. Sodium Hypochlorite Storage Tank T-* High Level Alarm (x3)
   b. Sodium Hypochlorite Storage Tank T-* Low Level Alarm (x3)
   c. Sodium Hypochlorite Storage Tank T-* Reorder (x3)

3. The level Sodium Hypochlorite Day Tank T-4 and T-5 shall be continuously monitored by the associated radar level sensor and high-level vertical float switch. The remote transmitters shall display and relay the value to PLC-10. Tank level shall be displayed and tended on SCADA HMI in both feet and gallons. Alarms shall be generated at Plant HMI when Operator-adjustable set-points are reached and/or the float switch is activated. The set-points for each of the tank shall be:

a. Sodium Hypochlorite Day Tank T-* High Level Alarm (x2)
b. Sodium Hypochlorite Day Tank T-* Low Level Alarm (x2)
c. Sodium Hypochlorite Storage Tank T-* Fill (x2)

4. Hypochlorite can be manually or automatically transferred from the storage tanks to the day tanks by Sodium Hypochlorite Transfer Pump P-1 and P-2 as well as a series of actuated valves that will allow the operator to select the storage tank, pump and day tank on SCADA HMI.
5. When in Manual mode, the entire process for filling the day tank will be operator controlled, meaning the operator must set the valves and start and stop the pump.
6. When in Auto mode, filling of the day tanks will be controlled by the PLC based on the levels of the storage tanks and day tanks.

    a. When the Sodium Hypochlorite Day Tanks low level alarm goes off, the PLC will select a Sodium Hypochlorite Transfer Pump to fill the Sodium Hypochlorite Day Tank to the fill level. Once the fill cycle is complete, the PLC will cycle Sodium Hypochlorite Transfer Pumps for the next fill cycle.

7. Interlocks – Equipment interlocks

    a. Pump overload.
    b. Day Tank High Level (x2).
    c. Storage Tank Low Level (x3).

8. Alarms – Equipment alarms to the Operator at the HMI are as follows.

    a. Storage Tank Low Level (x3).
    b. Storage Tank High Level(x3).
    c. Motor Overload (x2).
    d. Pump fail - not running after being called to run (x2).
    e. Day Tank High Level (x2).
    f. Day Tank Low Level (x2).

B. <u>Sodium Hypochlorite Feed Pumping (009-N-1)</u>

1. Sodium Hypochlorite Metering Skid 1 includes 4 metering pumps.
2. Sodium Hypochlorite Metering Pump P-3 (NAOC-P-3) will be primarily used to feed hypochlorite to the primary rapid mix chamber.
3. Sodium Hypochlorite Metering Pump P-4 (NAOC-P-4) will be primarily used to feed hypochlorite to the combined filter effluent via Sodium Hypochlorite Valve 12A (NAOC-V-12A) or Sodium Hypochlorite Valve 12B (NAOC-V-12B).
    a. Sodium Hypochlorite Valve 12A (NAOC-V-12A) and Sodium Hypochlorite Valve 12B (NAOC-V-12B) shall be located in filter building and wired to PLC-7B.

4. Sodium Hypochlorite Metering Pump P-5 (NAOC-P-5) will be a swing pump.
5. Sodium Hypochlorite Metering Pump P-6 (NAOC-P-6) will be primarily used to feed hypochlorite to the secondary slow mix chamber via Sodium Hypochlorite Valve 11a (NAOC-V-11A) or Sodium Hypochlorite Valve 11b (NAOC-V-11B).
6. With the Sodium Hypochlorite Metering Pumps are in Manual mode, the following control options are available at the pump's digital interface.

    a. Start – This selection starts the pump.
    b. Stop – This selection stops the pump.
    c. Speed – This selection sets the speed of the pump from 0-100%.

7. With the Sodium Hypochlorite Metering Pumps are in Auto mode, the pumps will start and stop as required by the PLC for each of the 3 feed points.

    a. Feed Point 1: Primary Rapid Mix Chamber

        1. Under normal operation, the Sodium Hypochlorite Metering Pumps shall be flow based and based on the total water flow into the facility as measured at the settling basin parshall flume. The metering pumps shall not operate when no flow is measured at the parshall flume.

    b. Feed Point 2: Combined Filter Effluent

        1. Under normal operation, the Sodium Hypochlorite Metering Pumps shall be flow based and based on the total water flow into the facility as measured at the settling basin parshall flume. The metering pumps shall not operate when no flow is measured at the parshall flume.
        2. NAOC-V-11A Open – Primary feed line is in use. Operator to check the primary isolation valve at the feed point is open.
        3. NAOC-V-11A Close – Primary feed line is closed.
        4. NAOC-V-11B Open – Spare feed line is in use. Operator to check the spare isolation valve at the feed point is open.
        5. NAOC-V-11B Close – Spare feed line is closed.

    c. Feed Point 3: Secondary Slow Mix Chamber

        1. Under normal operation, the Sodium Hypochlorite Metering Pumps shall be flow based and based on the total water flow into the facility as measured at the settling basin parshall flume. The metering pumps shall not operate when no flow is measured at the parshall flume.
        2. NAOC-V-12A Open – Primary feed line is in use. Operator to check the primary isolation valve at the feed point is open.
        3. NAOC-V-12A Close – Primary feed line is closed.
        4. NAOC-V-12B Open – Spare feed line is in use. Operator to check the spare isolation valve at the feed point is open.
        5. NAOC-V-12B Close – Spare feed line is closed.

    d. The pump speed required for the dosing setpoint shall be calculated based on the dose requested, the strength (weight concentration) and density of the chemical solution, the flow pacing flow rate, and an adjustable calibration factor. This calculation shall be in accordance with the equation and information listed in Schedule 1 to this Section.

8. Interlocks – Equipment interlocks (when in Auto) are as follows:

    a. Pump Fail (x4).
    b. Day Tank Low Level (x2).
    c. Valve Not Open

9. Alarms – Equipment alarms to the Operator at the HMI are as follows.

    a. Leak detected.
    b. Pump fail - not running after being called to run (x4).
    c. Heat Trace Fail (x3)

C. <u>Aqua Ammonia Feed Pumping (009-N-2)</u>

1. The Aqua Ammonia feed system consists of

a. Aqua Ammonia Storage Tank T-1 (NHOH-T-1)
b. Aqua Ammonia Storage Tank T-1 Level Transmitter (NHOH-LIT-1)
c. Aqua Ammonia Storage Tank T-1 Level Sensor (NHOH-LE-1)
d. Aqua Ammonia Metering Skid 1 (NHON-M-1)

1) Aqua Ammonia Metering Pump P-1 (NHON-P-1)
2) Aqua Ammonia Metering Pump P-2 (NHON-P-2)

e. Aqua Ammonia Metering Skid 1 Flow Switch (NHOH-FSH-3)
f. NHOH Valve 1A (NHOH-V-1A)
g. NHOH Valve 1B (NHOH-V-1B)
1) Aqua Ammonia Valve 1A (NHOH-V-1A) and Aqua Ammonia Valve 1B (NHOH-V-1B) shall be located in filter building and wired to PLC-7B.

2. When the Aqua Ammonia Metering Pumps are in Manual mode, the following control options are available at the pump's digital interface.

b. Start – This selection starts the pump.
c. Stop – This selection stops the pump.
d. Speed – This selection sets the speed of the pump from 0-100%.

3. When the Aqua Ammonia Metering Pumps are in Auto mode, the pumps will start and stop as required by the PLC.

a. Feed Point: Combined Filter Effluent

1) Under normal operation, the Aqua Ammonia Metering Pumps shall be flow based and based on the total water flow into the facility as measured at the settling basin parshall flume. The metering pumps shall not operate when no flow is measured at the parshall flume.
2) NAOH-V-1A Open – Primary feed line is in use. Operator to check the primary isolation valve at the feed point is open.
3) NAOH-V-1A Close – Primary feed line is closed.
4) NAOH-V-1B Open – Spare feed line is in use. Operator to check the spare isolation valve at the feed point is open.
5) NAOH-V-1B Close – Spare feed line is closed

b. The pump speed required for the dosing setpoint shall be calculated based on the dose requested, the strength (weight concentration) and density of the chemical solution, the flow pacing flow rate, and an adjustable calibration factor. This calculation shall be in accordance with the equation and information listed in Schedule 1 to this Section.

4. Interlocks – Equipment interlocks (when in Auto) are as follows:

a. Pump Fail (x2).
b. Storage Tank Low Level (x2).
c. Valve Not Open (x2)

5. Alarms – Equipment alarms to the Operator at the HMI are as follows.

a. Pump fail - not running after being called to run (x4).
b. Heat Trace Fail

D. <u>Sodium Hydroxide Storage and Transfer Pumping (009-N-3)</u>

1. The Sodium Hydroxide Storage System consists of the following:

    a. Sodium Hydroxide Storage Tank T-1 (NAOH-T-1).
    b. Sodium Hydroxide Storage Tank T-1 Level Transmitter/Sensor (NAOH-LIT-1/ NAOH-LE-1).
    c. Sodium Hydroxide Storage Tank T-1 Supply Valve Position Switch (NAOH-ZS-1)
    d. Sodium Hydroxide Storage Tank T-2 (NAOH-T-2).
    e. Sodium Hydroxide Storage Tank T-2 Level Transmitter/Sensor (NAOH-LIT-2/ NAOH-LE-2).
    f. Sodium Hydroxide Storage Tank T-2 Supply Valve Position Switch (NAOH-ZS-2)
    g. Sodium Hydroxide Day Tank T-3 (NAOH-T-3).
    h. Sodium Hydroxide Day Tank T-3 Level Transmitter/Sensor (NAOH-LIT-3/ NAOH-LE-3).
    i. Sodium Hydroxide Day Tank T-3 High Level Vertical Float Switch (NAOH-LSH-3).
    j. Sodium Hydroxide Transfer Pump P-1 (NAOH-P-1).
    k. Sodium Hydroxide Transfer Pump P-2 (NAOH-P-2).
    l. Sodium Hydroxide Valve 1 (NAOH-V-1A).
    m. Sodium Hydroxide Valve 2 (NAOH-V-1B).

2. The level for Sodium Hydroxide Storage Tank T-1 and T-2 shall be continuously monitored by the associated radar level sensor. The remote transmitters shall display and relay the value to PLC-10. Tank level shall be displayed and tended on SCADA HMI in both feet and gallons. Alarms shall be generated at Plant HMI when Operator-adjustable set-points are reached. The set-points for each of the tank shall be:

    a. Sodium Hydroxide Storage Tank T-* High Level Alarm (x2)
    b. Sodium Hydroxide Storage Tank T-* Low Level Alarm (x2)
    c. Sodium Hydroxide Storage Tank T-* Reorder (x2)

3. The level Sodium Hydroxide Day Tank T-3 shall be continuously monitored by the associated radar level sensor and high-level vertical float switch. The remote transmitters shall display and relay the value to PLC-10. Tank level shall be displayed and tended on SCADA HMI in both feet and gallons. Alarms shall be generated at Plant HMI when Operator-adjustable set-points are reached and/or the float switch is activated. The set-points for each of the tank shall be:

    a. Sodium Hydroxide Day Tank T-* High Level Alarm
    b. Sodium Hydroxide Day Tank T-* Low Level Alarm
    c. Sodium Hydroxide Storage Tank T-* Fill

4. Sodium Hydroxide is manually transferred from the storage tanks to the day tanks by Sodium Hydroxide Transfer Pump P-1 and P-2 as well as a series of manual valves that will allow the operator to select the storage tank, pump and day tank on SCADA HMI.
5. The entire process for filling the day tank will be operator controlled, meaning the operator must open the valves and start and stop the pump.
6. Interlocks – Equipment interlocks

    a. Pump overload.
    b. Day Tank High Level.
    c. Storage Tank Low Level (x2).
    d. Storage Tank Supply Valve Position (x2).

7. Alarms – Equipment alarms to the Operator at the HMI are as follows.

    a. Storage Tank Low Level (x3).
    b. Storage Tank High Level(x3).
    c. Motor Overload (x2).

d. Pump fail - not running after being called to run (x2).
e. Day Tank High Level (x2).
f. Day Tank Low Level (x2).

E. Sodium Hydroxide Feed Pumping (009-N-3)

8. Sodium Hydroxide Metering Skid 1 includes 3 metering pumps.
9. Sodium Hydroxide Metering Pump P-3 (NAOH-P-3) will be primarily used to feed Hydroxide to the primary rapid mix chamber.
10. Sodium Hydroxide Metering Pump P-4 (NAOH-P-4) will be primarily used to feed Hydroxide to the combined filter effluent via Sodium Hydroxide Valve 1A (NAOH-V-1A) or Sodium Hydroxide Valve 1B (NAOH-V-1B).
11. Sodium Hydroxide Metering Pump P-5 (NAOH-P-5) will be a swing pump.
12. With the Sodium Hydroxide Metering Pumps are in Manual mode, the following control options are available at the pump's digital interface.

    a. Start – This selection starts the pump.
    b. Stop – This selection stops the pump.
    c. Speed – This selection sets the speed of the pump from 0-100%.

13. With the Sodium Hydroxide Metering Pumps are in Auto mode, the pumps will start and stop as required by the PLC for each of the 2 feed points.

    a. Feed Point 1: Primary Rapid Mix Chamber

        1) Under normal operation, the Sodium Hydroxide Metering Pumps shall be flow based and based on the total water flow into the facility as measured at the settling basin parshall flume. The metering pumps shall not operate when no flow is measured at the parshall flume.

    b. Feed Point 2: Combined Filter Effluent

        1) Under normal operation, the Sodium Hydroxide Metering Pumps shall be flow based and based on the total water flow into the facility as measured at the settling basin parshall flume. The metering pumps shall not operate when no flow is measured at the parshall flume.
        2) NAOH-V-1A Open – Primary feed line is in use. Operator to check the primary isolation valve at the feed point is open.
        3) NAOH-V-1A Close – Primary feed line is closed.
        4) NAOH-V-1B Open – Spare feed line is in use. Operator to check the spare isolation valve at the feed point is open.
        5) NAOH-V-1B Close – Spare feed line is closed.

    c. The pump speed required for the dosing setpoint shall be calculated based on the dose requested, the strength (weight concentration) and density of the chemical solution, the flow pacing flow rate, and an adjustable calibration factor. This calculation shall be in accordance with the equation and information listed in Schedule 1 to this Section.

14. Interlocks – Equipment interlocks (when in Auto) are as follows:

    a. Pump Fail.
    b. Day Tank Low Level .
    c. Valve Not Open (x2)

15. Alarms – Equipment alarms to the Operator at the HMI are as follows.

a. Pump fail - not running after being called to run (x4).
b. Heat Trace Fail

F. Hydrofluosilicic Acid Feed Valve (009-N-4)

1. The Sodium Hydrofluosilicic Acid Feed Valves shall be controlled by the operator manually at the SCADA/HMI for each of the 2 feed lines.

a. Feed Point: Combined Filter Effluent

1) HFSA-V-1A Open – Primary feed line is in use. Operator to check the primary isolation valve at the feed point is open.
2) HFSA -V-1A Close – Primary feed line is closed.
3) HFSA -V-1B Open – Spare feed line is in use. Operator to check the spare isolation valve at the feed point is open.
4) HFSA -V-1B Close – Spare feed line is closed.

2. Interlocks – Equipment interlocks (when in Auto) are as follows:

a. Valve Not Open (x2)

3. Alarms – Equipment alarms to the Operator at the HMI are as follows.

a. Valve Fail - not opening after being called to open (x2).
b. Heat Trace Fail

2.03 BACKWASH PUMPING SYSTEM

A. Backwash Pumping (009-N-5)

1. The purpose of the backwash pumping system is to send backwash water from the filter effluent pipe to either the backwash holding basin or the filters. The system consists of the following:

a. Backwash Pump No. 1 (FLTR-P-320).
b. Backwash Pump No. 2 (FLTR-P-330).
c. Backwash Control Valve (FLTR-V-26)
d. Backwash Tank Isolation Valve (FLTR-V-321)
e. Backwash Holding Basin

2. The entire process for initiating a backwash will be operator controlled, meaning the operator must open the valves and start and stop the pumps.

a. Operator shall select which Backwash pump to run.
b. Operator shall select a speed set point and run time.

3. Interlocks – Equipment interlocks (when in Auto) are as follows:

a. Motor over temperature.
b. Backwash Tank Isolation Valve and Washwater Control Valve both closed.

4. Alarms – Equipment alarms to the Operator at the HMI are as follows.

a. Pump fail - not running after being called to run (x2).
b. Motor over temperature (x2).

c. Motor over current (x2).
d. Fail to start (x2).

PART 3 – EXECUTION – NOT USED

SCHEDULE 1 TO SECTION 40 61 96
PROCESS CONTROL DESCRIPTIONS
CHEMICAL SETPOINTS AND PARAMETERS SCHEDULE
(ALL PARAMETERS AND SETPOINTS TO BE ADJUSTABLE BY OPERATOR)

Chemical	Initial Dose Setpoint (mg/L active)	Strength (% by weight active)	Specific Gravity
Sodium Hypochlorite – Feed Point 1	3.0	12.5%	1.20
Sodium Hypochlorite – Feed Point 2	2.6		
Sodium Hypochlorite – Feed Point 3	3.0		
Aqua Ammonia	1.0	19.5%	0.90
Sodium Hydroxide – Feed Point 1	4.0	50%	1.30
Sodium Hydroxide – Feed Point 2	4.0		

*To be confirmed with Chemical Systems Supplier based on product selected

Chemical Flow Pacing Equation:

X * Q * 8.34 ÷ (Y/100) ÷ (8.34*SG) ÷ 24 ÷ Z * CF = Pump Speed Request (% of max)

X = chemical dose setpoint (mg/L)
Q = flow pacing flow rate (MGD)
Y = chemical solution strength (% by weight)
SG = specific gravity
Z = pump output at 100% speed (gallons per hour)
CF = calibration factor

END OF SECTION

SECTION 40 62 63
OPERATOR INTERFACE TERMINALS

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes panel-mount Operator Interface Terminals.

1.02 SUBMITTALS

A. See Section 40 61 13 for submittal requirements.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Manufacturer:

1. Rockwell Automation; PanelView Plus 7 Performance
2. No substitutes.

2.02 OPERATOR INTERFACE UNITS

A. General:

1. Microprocessor based graphical operator interface.
2. Enclosure Rating: NEMA 12, 13 and 4X, (IP66).
3. 0-50°C operating range.
4. Touch style.
5. PLC peer to peer network, Ethernet or direct serial interface.
6. System Memory: 512MB RAM, 512MB Storage
7. User Memory: 80MB nonvolatile.
8. Battery Backup.
9. Input Voltage: 100-240Vac.

B. Display

1. Size: 15 inch diagonal.
2. Resolution: 1280 X 1024 SXGA 24-bit color graphics.
3. Aspect Ratio: 5:4.
4. Active matrix Thin Film Transistor.
5. Analog resistive screen.

C. Software:

1. Rockwell Automation FactoryTalk View Machine Edition.

D. Additional:

1. Provide 2GB SD Card (1784-SD2).
2. Provide clear polyester (0.007”) anti-glare overlay (2711P-RGT19P).

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install and wire in accordance with equipment manufacturer's written instructions, approved submittals, applicable requirements of the NEC, NEIS, and recognized industry practices.

3.02 TRAINING

A. Training shall be provided in accordance with Section 40 61 30.

END OF SECTION

SECTION 40 63 43
PROGRAMMABLE LOGIC CONTROLLERS

PART 1 – GENERAL

1.01 SUMMARY

A. Specification includes hardware required for a fully functional Programmable Logic Control System.

B. Programmable Logic Control System shall be from single manufacturer.

1.02 ABBREVIATIONS

A. IEC: International Electrotechnical Commission

B. I/O: Input/Output

C. PLC: Programmable Logic Controller

D. RTD: Resistance Temperature Detector

1.03 REFERENCES

A. NEC: National Electrical Code

B. NEIS: National Electrical Installation Standards

C. UL: Underwriters Laboratories

1.04 SYSTEM DESCRIPTION

A. Specification includes hardware using the CompactLogix™ PLC platform by Rockwell Automation.

1.05 SUBMITTALS

A. General:

1. Submit Product Data in sufficient detail to confirm compliance with requirements of this Section. Submit Product Data and Shop Drawings in one complete submittal package. Partial submittals are not acceptable.

B. Product Data:

1. Catalog cuts and product specifications for hardware specified.
2. Dimensional data of PLC equipment.
3. Interface terminations and cable data for each module.
4. Hardware manuals (4 sets).
5. Detailed bill of materials with manufacturer’s part numbers for each rack.

C. Shop Drawings:

1. Installation and assembly drawings and specifically prepared technical data for hardware.
2. Wiring Diagrams: Show control connections and distinguish between factory-installed and

field-installed wiring.
3. Addressing system and card layout, including special configuration rules and limitations for each rack.
4. Submit in accordance with Section 40 61 13.

D. Operation and Maintenance (O&M) Data:

1. Provide in accordance with Sections 01 78 23 and 40 61 30.
2. Operating instructions and maintenance data for materials and products for inclusion in O&M Manual.
3. Manufacturer's written instructions for periodic replacement of any backup batteries used on equipment including estimated battery replacement calendar dates.

1.06 QUALITY ASSURANCE

A. Items provided under this section shall be listed or labeled by Underwriters Laboratories Inc. (UL) or other Nationally Recognized Testing Laboratory (NRTL).

1. Term "NRTL" shall be as defined in Occupational Safety and Health Administration (OSHA) Regulation 1910.7.
2. Terms "listed" and "labeled" shall be as defined in National Electrical Code (NEC), Article 100.

B. Single Source Responsibility: Obtain hardware from single manufacturer with responsibility for entire system. Unit shall be representative product built from components that have proven compatibility and reliability.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver equipment and system components to their final location in protective wrappings, containers, and other protection that will exclude dirt and moisture and prevent damage. Remove protection only after equipment is made safe from such hazards and ready to install.

B. Store items in a clean, dry, and secure location.

1.08 MAINTENANCE

A. Extra Materials:

1. Furnish extra materials matching products installed, as described below, packaged with protective covering for storage, dated, and identified with labels describing contents.

a. One shelf spare unit for each type of I/O module used on project.
b. One shelf spare unit for each type of communications module used on project.
c. One shelf spare unit for each type power supply used on project.

PART 2 – PRODUCTS

2.01 MANUFACTURER

A. Allen Bradley 5069 CompactLogix™ Series.

B. No Substitute Permitted.

2.02 PROCESSOR

A. 5069-L340ER 4MB memory.

B. 1784-SD2 (2GB memory card).

2.03 FIELD POTENTIAL DISTRIBUTOR

A. 5069-FPD.

B. 5069-RTB6 Screw Removable Terminal Block.

2.04 I/O MODULES

A. I/O modules specifically designed for interfacing of I/O signals to PLC processor.

B. 120/240V Digital AC Input Module:

1. 120Vac as required by application.
2. 16 points per module.
3. LED indication of on/off status of each point.
4. 5069-IA16.

C. 85-264VAC Digital Output Module:

1. Output voltage range: 85-264V AC.
2. Output voltage frequency: 47-63 Hz.
3. 16 point per module.
4. LED indication of on/off status of each point.
5. 5069-OA16.

D. 24Vdc or 120Vac Digital Relay Output Module:

1. 5-30VDC, 5-264VAC relay contact outputs.
2. Contact Rating: 2 amps continuous at 120vac.
3. Contact configuration: Normally open
4. 2 isolated groups of 8 points each.
5. LED indication of on/off status of each point.
6. 5069-OW16

E. Analog Input:

1. 8 inputs per module.
2. Differential or single ended.
3. Accepts 4-20 mAdc.
4. 5069-IF8.

F. Analog Output:

1. 8 outputs per module.
2. Differential, single-ended.
3. Transmits 4-20 mAdc.
4. 5069-OF8.

G. EtherNet/IP Adapter

1. Dual Ethernet port.
2. Supports up to 31 I/O modules.
3. 5069-AENTR.

H. Address Reserve Module:

1. 5069-ARM.

2.05 WIRING AND TERMINATION SYSTEMS

A. Wiring of PLC I/O modules shall be in accordance with Rockwell 5069 wiring systems.

B. Provide sufficient terminations to accommodate active I/O points, spares, and future expansion.

2.06 PLC PROGRAMMING

A. PLC shall be programmed using Rockwell Automation Studio 5000 Software.

1. Latest firmware version compatible with all supporting operating systems and hardware.
2. IEC 61131-3 compliant (as standard).

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install and wire in accordance with System Integrator and/or Equipment manufacturer's written instructions and approved submittals, applicable requirements of the NEC, NECA "Standard of Installation", and recognized industry practices.

B. Each installation shall monitor raw incoming power (prior to a UPS) in order to identify plant power failures. This power failure shall be monitored by a normally closed (utility power available) discrete input.

C. Provide orderly shutdown on PLC Panel power failure, saving register contents with automatic restart on power restoration.

D. Each input shall be individually fused.

1. Exception: when a group of inputs serve a common device or common function such as a remote control station for equipment.

E. Include sufficient I/O modules to accommodate 25% spare I/O prewired to terminal strips. Where no I/O of a listed type (digital input, digital output, analog input, analog output, etc.) is shown, provide one spare prewired module.

F. I/O shall be configured such that any single I/O module failure shall not prevent operation of all equipment for a given unit process. The objective of this configuration is to avoid a total unit process failure because of a single I/O module failure. For example, if a treatment system includes 4 pumps, the I/O for each pump should be placed such that the failure of an I/O module will only affect one of the four pumps so the remaining pumps can operate normally.

G. Analog I/O shall use specialty field terminal blocks specifically designed for 4-20mA signal wiring.

H. Communication software and configuration shall meet monitoring and control requirements of each process in accordance with functional descriptions.

I. Each hardware unit communicating over data highway shall include executive routines or traffic controller to control and coordinate activities on communication links. Use integrated, standard products for communication software to manage transmission protocols, line error detection, and message switching.

J. Provide Owner one hardcopy (in 3-ring binder format) of fully-commented PLC programs at the completion of the project for each processor installed.

END OF SECTION

SECTION 40 67 15
CONTROL PANELS

PART 1 – GENERAL

1.01 SUMMARY

A. Items specified in this section shall conform to general requirements of Section 40 61 13.

B. Section includes panel and enclosure requirements for Process Instrumentation and Control Equipment.

1.02 ABBREVIATIONS AND REFERENCES

A. NEC: National Electrical Code

B. NEIS: National Electrical Installation Standards

C. NEMA: National Electrical Manufacturers Association

D. NFPA: National Fire Protection Agency

E. UL: Underwriters Laboratories

1.03 SUBMITTALS

A. General:

1. Submit Product Data in sufficient detail to confirm compliance with requirements of this Section. Submit Product Data and Shop Drawings in one complete submittal package. Partial submittals are not acceptable.

B. Product Data:

1. Catalog cuts and product specifications for panels and enclosures specified.

C. Shop Drawings:

1. Installation and assembly drawings and specifically prepared technical data for panels and enclosures specified.
2. Submit in accordance with Section 01 33 00.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Firms experienced in manufacturing panels and enclosures of types and materials indicated that have record of successful in-service performance.

B. Enclosures and components contained within the enclosure provided under this Section shall be listed or labeled by Underwriters Laboratories Inc. (UL) or other Nationally Recognized Testing Laboratory (NRTL).

1. Term "NRTL" shall be as defined in Occupational Safety and Health Administration (OSHA) Regulation 1910.7.
2. Terms "listed" and "labeled" shall be as defined in National Electrical Code (NEC),

Article 100.

C. In-Factory Inspection – see Section 40 61 21.

1. Verify following in accordance with approved submittals:

a. Panel dimensions.
b. Equipment layout.
c. Wiring.
d. Wire and terminal identification.
e. Device identification.

2. Verify proper access to equipment for maintenance.
3. Verify proper access to field wire.
4. Inspect for neatness of wiring and wire harness construction.

1.05 DELIVERY, STORAGE, AND HANDLING

D. Deliver panels and enclosures to their final locations in protective wrappings, containers, and other protection that will exclude dirt, moisture and prevent damage from construction operations. Remove protection only after equipment is made safe from such hazards, and is ready for immediate installation.

E. Store panels and enclosures in clean, dry location.

1.06 MAINTENANCE

A. Extra Materials:

1. Furnish extra materials matching products installed, as described below packaged with protective covering for storage, dated and identified with labels describing contents.

a. Provide minimum of 5 or 10%, whichever is greater, of each type fuse used on project.
b. Provide minimum of 5 or 10%, whichever is greater, of each type relay used on project.
c. Provide minimum of 5 or 10%, whichever is greater, of each type pilot light replacement bulb used on project.

PART 2 – PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Panels shall be constructed using factory-fabricated enclosures.

B. Follow PLC manufacturer's written installation requirements for layout of PLC-specific panels.

C. Provide a minimum of 25% free back panel space for future expansion unhindered by current devices, wiring, etc.

D. Provide a minimum of 25% free terminal blocks of each type used in each panel. This is in additional to planned spare wiring terminations. Spares shall be shown on panel drawings.

E. The panel builder shall be a current Underwriters laboratories listed UL-508A industrial control panel builder and shall present its follow-up service procedure file number on submittals. All devices within the panel shall be UL listed and/or recognized where applicable

and shall be mounted and wired in accordance with the most current edition of UL-508A and the NEC. A serialized UL-508A label shall be applied to all control panels prior to shipment to the Project site.

F. Install instruments and devices, plumb, and wire panels at panel shop or other facility prior to shipment to job-site.

G. Standard Signal Interfaces:

1. Unless otherwise specified, discrete input and output signals shall conform to the following:

a. Isolated non-powered (dry) contact closure.
b. Dry contacts shall be powered from panel or device receiving signal.
c. PLC based outputs shall be provided with an interposing relay when any of the following conditions apply:

1) When driving solenoids.
2) Potential in-rush current exceeds 75% of rated capacity of the I/O Module.
3) The current requirement of the driven device is insufficient to fully engage the output module consistently.
4) The voltage required to drive the output is incompatible with the output module.

2. Unless otherwise specified, analog input and output signals shall conform to the following:

a. 4-20 mAdc.
b. For 2-wire, loop-powered transmitters, provide regulated, fused, and isolated 24Vdc power supply at panel for driving of devices. Size power supply for 30% minimum spare capacity minimum.
c. Where isolation is required for interfacing with particular equipment supplied, provide necessary I/I converters. Provide I/I converters where impedance capabilities of new or existing signal transmitter will be exceeded by addition of PLC input.

H. Wiring:

1. In addition to Division 26, NEC and NEMA requirements, wiring shall conform to following:

a. Power: 12 AWG stranded minimum, type MTW, 600V.
b. Control: 16 AWG stranded minimum, type MTW, 300V.
c. Analog Signal: Twisted pair, 18 AWG, Beldon 8760 or equal.

2. Wire color code:

a. AC neutral conductor: White.
b. AC hot conductor: Black.
c. Grounding conductor: Green.
d. AC control conductor, powered from within panel: Red.
e. AC control conductor, powered from remote source: Orange.
f. DC (+) power conductor, discrete signal: Blue.
g. DC (-) power conductor, discrete signal: Blue with white stripe.
h. DC control conductor, discrete signal: Blue.
i. Twisted pair cable (+) signal conductor, analog signal: White.
j. Twisted pair cable (-) signal conductor, analog signal: Black.
k. Intrinsically safe wiring: Light Blue.

3. Design control panels to keep 480Vac power, 120Vac power and discrete signals, and analog and other low voltage signals separated.

    a. Do not run 480Vac power, 120Vac power and discrete signals, or analog or other low voltage signals in the same conduit or wire-duct.
    b. Where 480Vac power, 120Vac power and discrete signals, or analog or other low voltage signals must cross, they shall do so at right angles.

4. Wiring Within Wire Duct:

    a. Wherever feasible plastic wire duct with cover shall be used for routing of wire within control panel.
    b. Size wire duct to be no more than 50% full.
    c. Maintain 2” clearance between wire duct and terminals.

5. Wiring outside of wire duct.

    a. Wiring outside of ducts shall be restrained by use of plastic wire-ties.
    b. Restrain wiring every six inches (minimum).
    c. Provide abrasion protection for wires passing through holes or across abrasive metal edges.
    d. Adhesive type wire fasteners shall not be used. Hard screw type shall be employed.

6. Each conductor or twisted pair cable shall be labeled near its termination point.
7. Color-coded multi-conductor cable or multi-pair cable shall be labeled on overall jacket near its point of fan-out. Each pair of a multi-pair cable, when not color-coded, shall be labeled at its termination point in addition to the overall jacket.
8. Labels shall be machine-printed wrap-around types with tag visible from front without removal of wire from termination.

I. Terminations:

1. Wiring within control panel shall be continuous and terminated only at terminal blocks or equipment terminals. Splices or butt connectors shall not be used within panel.
2. No more than two wires shall be terminated at any one terminal.
3. Make external connections by way of numbered terminal blocks on numbered terminal strips.
4. When signals are powered from remote location, switched terminal blocks shall be used where conductors enter or leave panel.
5. When signals are powered from within panel, fused terminal blocks shall be used where conductors enter or leave panel.
6. Provide integral bussing system on terminal block array where more than two terminations require common source or drain connection. Jumpered terminations shall not be acceptable.
7. Provide knife disconnect-type terminal blocks with test sockets for all analog loops.
8. Include provisions for grounding of shields on shielded twisted pair cables entering or leaving panel. Cable shields shall be grounded at terminal block end only. Shields shall run entire length of cable within panels. Running of twisted pairs without shields within panels is not permissible.
9. Provide separate terminal strips for each of the following types of signals.

    a. 480Vac power circuits.
    b. 120Vac power circuits.
    c. 120Vac discrete signals.
    d. 12Vdc, 24Vdc or 48Vdc discrete signals.

e. Analog signals.
f. Serial or parallel digital communication signals.
g. Intrinsically safe circuits.

J. Power Distribution:

1. Panels having 240Vac or 480Vac power supply:

a. Provide internal main circuit breaker to isolate power to panel.
b. Provide circuit breakers for all motor starters provided.
c. If panel includes separate 120Vac control power supply, provide auxiliary contact to isolate control power when main circuit breaker is opened.
d. 480Vac to 120Vac control power transformer requirements:

1) Both primary leads shall be fused.
2) First secondary lead shall be fused.
3) Second secondary lead shall be grounded.
4) Provide single-phase surge suppression/line conditioner, sized for total panel loadings (Benden Isotrol, or equal) between secondary leads and 120vac power distribution block.

2. Panels having 120Vac power supply:

a. Provide circuit breaker on power supply entering panel.
b. Provide single-phase surge suppression/line conditioner, sized for total panel loadings (Benden, Isotrol) between circuit breaker and 120Vac power distribution block.
c. Provide monitoring relay on incoming power supply to indicate presence of utility power to the PLC. Utility Power, UPS Status, and Surge Protection Device (SPD) status shall be continuously monitored by SCADA system.

3. Provide separately fused power supply to each major panel component.
4. Additional panel requirements.

a. Provide separately fused power circuits for panel powered devices entering panel from field. Provide separate circuit for each device. Devices may be 5-Amp fused terminal blocks.

1) Solenoid actuated valves
2) Loop powered transmitters
3) 120Vac switched cord and receptacles
4) Relays

b. Include digital transient surge suppressor/varistor installed in parallel with output contact at terminal strip for each PLC output signal driving an inductive load including:

1) Relays.
2) Solenoids.
3) Motor starters.
4) Motors.

K. PLC input and outlet module connections:

1. Input and output signals for process equipment serving the same function shall be assigned to separate I/O Modules so that failure of any one module does not disable an entire unit

process. E.g. failure of one card shall not prevent every blower from running.
2. Inputs and outputs shall be configured in accordance with Sections 40 61 20 and 40 61 93.
3. Except for 4-wire instruments, all analog loops shall be powered from respective process control panel.
4. 120 volts alternating and direct current for Process Control System inputs shall be sourced from respective process control panel.
5. 120 volts alternating and direct current for Process Control System outputs shall be sourced from respective location receiving control signal.

L. Labels and Nameplates:

1. Panel Designation:

a. Engraved with Engineer's tag number and description shown on the Drawings and in Specifications.
b. Laminated white plastic with ½-in. high black characters.
c. Fastened with stainless steel screws.

2. Front of panel mounted devices.

a. Provide nameplate for each front of panel device with descriptive phrase using nomenclature as listed on Drawings and in Specifications.
b. Laminated white plastic with 3/16-in. high black characters.
c. Fastened with stainless steel screws.

3. Rear of panel mounted devices.

a. Provide nametag for each rear of panel device with labels used on panel drawings.
b. Thermo-embossed or laser printed with 1/8-in. high black characters on clear or white background or laminated white plastic with 3/16-in. high black characters.
c. Self-adhesive backing.
d. Clean area with mineral spirits prior to affixing labels

M. Panel Finish:

1. Remove mill scale, grease, and oil.
2. Primer thickness shall be 0.8 mil., minimum.
3. Finish coat shall be two-part epoxy or baked dry powder, 3-mil., minimum dry film thickness.
4. Color: Standard manufacturer's finish.

N. Conveniences:

1. Freestanding and floor mounted control panels shall be provided with door-activated, internal LED lighting units.

a. One unit shall be provided for every 3 feet of panel width and shall be mounted on the inside, top of the panel.
b. Lighting shall be consistent for entire project.

2. Freestanding and floor mounted control panels shall be provided with 120Vac, service outlet circuits within the back-of-panel area. The circuits shall be provided with three-wire, 120Vac, 15-ampere duplex GFCI receptacles, one for every 3 feet of panel width and spaced evenly along the back-of-panel area. GFCI receptacles shall not be used for supplying power to UPS.

3. UPS receptacle – Provide simplex non-GFCI receptacle for plug in of UPS where applicable. Receptacle shall be labeled “120VAC FOR UPS ONLY”.

2.02 ENCLOSURES

A. MANUFACTURERS

1. Hoffman.
2. Saginaw.
3. Hammond.
4. Rittal.
5. Or Equal.

B. Enclosures shall conform to NEMA requirements as follows:

1. NEMA 7 for exterior or interior enclosures in Class I, Division 1 or 2 hazardous (classified) locations. NEMA 7 enclosures located in wet or exterior locations shall be provided with an O-ring or gasket for the cover.
2. NEMA 9 for exterior or interior enclosures in Class II, Division 1 or 2 (classified) locations.
3. NEMA 4X type 316 stainless steel for exterior in general or interior enclosures in wet or dusty environments.
4. NEMA 4X plastic or fiberglass for interior enclosures in corrosive environments.
5. NEMA 12 for interior enclosures not in classified, wet, or corrosive environments.

C. In addition to NEMA standards, conform to the following requirements:

1. Minimum metal thickness: 14 Ga.
2. Indoor enclosures: equip with rubber-gasketed doors with continuous metal hinges. Equip doors with 3-point lockable latches.
3. Outdoor enclosures: equip with hinged dead-front inner doors and rubber-gasketed, continuous metal hinged outer weather doors. Equip weather doors with toggle style door clamps.
4. Equip outdoor enclosures with thermostatically controlled heaters capable of maintaining internal panel temperature of 50°F with 20mph wind at ambient temperature of -20°F. Heater shall operate at 120Vac, 60Hz power.
5. NEMA 4X enclosures shall be furnished with door gaskets.
6. Size to adequately dissipate heat generated by equipment mounted in or on panel.

D. Prior to final fabrication of panels, verify layout of front-of-panel devices with respect to rear-of-panel devices. Maintain minimum of 3 inches clearance between door and sub-panel mounted devices.

2.03 CHEMICAL BUILDING CONTROL PANEL (PLC-10)

A. Panel

1. Indoor Enclosure.
2. NEMA 12.
3. Free Standing.
4. Dimensions (Approximate): 72”H x 48”W x 20”D
5. 120Vac Power Supply.

B. Front of Panel Mounted Devices

1. Data Outlet.
2. Operator Interface Terminal.

3. Power OK Pilot Light.

C. Rear of Panel Mounted Devices

1. CompactLogix PLC.
2. Uninterruptible Power Supply (UPS).
3. Line Filter.
4. 24Vdc Power Supplies.
5. Relays and Timers (as required).
6. Cooling fan with thermostat.
7. Circuit breakers and fuses as required.

D. PLC I/O signals

1. Provide in accordance with Section 40 61 93.
2. PLC-10 is a replacement to existing control panel that shall remain and repurposed as terminal junction box. all existing signals shall be extended to new PLC-10 panel. System integrator shall be responsible for ensuring all signals are incorporated into new PLC.

2.04 AQUA AMMONIA METERING PUMPS LOCAL CONTROL PANEL (NHOH-LCP-1)

A. Panel

1. Wall-mounted indoor enclosure with 3-point latch.
2. NEMA 4X – 316 Stainless Steel.
3. Dimensions (Approximate): 30”H x 24”W x 12”D
4. 120Vac Power Supply.

B. Front of Panel Mounted Devices

1. Hand-Off-Auto selector switch (x2).
2. Running pilot light with red lens (x2).
3. Fail pilot light with amber lens (x2).
4. Potentiometer (x2).

C. Rear of Panel Mounted Devices

1. Relays and Timers as required.
2. Circuit breakers and fuses as required.

2.05 SODIUM HYDROXIDE METERING PUMPS LOCAL CONTROL PANEL (NAOH-LCP-1)

A. Panel

1. Wall-mounted indoor enclosure.
2. NEMA 4X – Fiberglass.
3. Dimensions (Approximate): 30”H x 24”W x 12”D
4. 120Vac Power Supply.

B. Front of Panel Mounted Devices

1. Hand-Off-Auto selector switch (x3).
2. Running pilot light with red lens (x3).
3. Fail pilot light with amber lens (x3).
4. Potentiometer (x3).

C. Rear of Panel Mounted Devices

1. Relays and Timers as required.
2. Circuit breakers and fuses as required.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install and wire in accordance with equipment/instrument manufacturer's written instructions, approved submittals, applicable requirements of the NEC, NEIS, and recognized industry practices.

B. Coordinate housecleaning pad dimensions with enclosure dimensions.

C. Install control panels in locations indicated on Drawings and in accordance with manufacturer's written instructions and approved submittals.

D. Touch-up panel finish if marred during installation using manufacturer's paint matching enclosure.

E. Each Panel shall have (3) sets of "as built" final circuit Drawings.

F. Perform In-Factory inspection and testing of PCS control panels at site of panel fabrication. Inform Engineer at least 3 weeks prior to date of scheduled testing. Owner and Engineer shall witness test at their discretion.

G. In-Factory testing shall conform to Section 40 61 21.

H. Field installation and wiring of panel components shall be in accordance with approved submittals, manufacturer's recommendations, and any applicable federal, state, and local codes.

I. Perform field test of PCS upon completion of installation, wiring and field inspection.

J. Field testing shall conform to Section 40 61 21.

3.02 IDENTIFICATION

A. Engrave Engineer name and tag number as listed in Specifications and on Drawings.

END OF SECTION

SECTION 40 67 63
CONTROL PANEL-MOUNTED UNINTERRUPTIBLE POWER SUPPLY

PART 1 – GENERAL

1.01 SUMMARY

A. Items specified in this section shall conform to general requirements of Section 40 61 13.

B. Section includes UPS equipment.

C. Site Conditions:

1. Input power: 120Vac utility grade.

1.02 ABBREVIATIONS AND REFERENCES

A. NEC National Electrical Code

B. NEIS National Electrical Installation Standards

C. PLC Programmable Logic Controller

D. UL Underwriters Laboratories

E. UPS Uninterruptible Power Supply

1.03 SUBMITTALS

A. General:

1. Tabulated listing of all device and equipment power loads connected to UPS for each installation. This shall be used to identify UPS sizing requirements together with requirements listed below.
2. Submit Product Data in sufficient detail to confirm compliance with requirements of this Section.
3. Submit Product Data and Shop Drawings in one complete submittal package.
4. Partial submittals are not acceptable.

B. Product Data:

1. Catalog cuts and product specifications for equipment specified.

C. Shop Drawings:

1. Installation and assembly drawings and specifically prepared technical data for equipment specified.
2. Submit in accordance with Section 01 33 00.

D. Operation and Maintenance (O&M) Data:

1. Operating instructions and maintenance data for materials and products for inclusion in O&M Manual.
2. Manufacturer's written instructions for periodic test for equipment in service.
3. Manufacturer's written instructions for periodic battery replacement for equipment in service.
4. Submit in accordance with Section 01 78 23.

PART 2 – PRODUCTS

2.01 UNINTERRUPTIBLE POWER SUPPLY

A. Manufacturer:

1. APC
2. Emerson
3. Alpha
4. Eaton
5. Sola

B. Features:

1. UPS shall supply power to PLC, HMI, Ethernet Switches, DC power supplies, field instruments, and other low voltage control devices as specified and as shown on Drawings and Plans.
2. Size UPS at 125% of connected electrical load (minimum).
3. Minimum UPS size shall be 1000VA.
4. Tower form factor shall be used unless stated otherwise on Drawings or Specifications.
5. Provide true on-line non switching uninterruptible power supply (UPS).
6. Double power conversion on-line operation including rectifier and inverter, constantly conditioned AC output.
7. UPS shall have enough capacity to power connected devices for a period of 15 minutes after the utility power has failed. Provide with extended battery module(s) to meet this requirement.

    a. Additional batteries shall be contained within panel enclosure unless approved by Owner and Engineer.
    b. UPS shall include dry contact status signal outputs including as minimum: low battery, on battery mode, and equipment malfunction/failure.

8. UL Listed.
9. Provide bypass contactor or other means to automatically bypass UPS allowing operation of system controls in event of UPS failure. Device contacts shall be rated for inductive loads and shall meet or exceed current protection of circuit.
10. Each system shall consist of a static dc to ac sine wave inverter, a battery charger, sealed batteries, a monitor and transfer switch, and accessories as listed below.
11. Each system shall operate on a 120-volt, 60-Hz ac branch circuit. The input ac circuit shall supply energy to the battery charger which shall supply energy to the inverter as well as to the battery to maintain its charge. The output of the inverter shall supply energy to the load. If the input ac circuit is interrupted, the inverter shall continue to supply energy to the load without interruption, drawing power from the battery. If the input ac circuit is restored prior to discharge of the battery, the charger shall resume the supply of energy to the inverter and shall restore the battery to full charge. In the event of malfunction of the battery charger, battery or inverter that results in interruption of the output from the inverter, the monitor shall detect this condition and shall automatically transfer the load to the system's ac input circuit within 25 milliseconds. After the malfunction is corrected, the load shall be retransferred to the inverter manually.
12. System output voltage shall be regulated within plus or minus 5 percent of 120 volts and frequency stability shall be plus or minus 1/2 percent of 60-Hz. The output characteristic shall be sinusoidal with not more than 5 percent total harmonic distortion at full load with input ac circuit at 120 volts. For a 20 percent instantaneous load change, voltage overshoot or undershoot shall be not more than plus or minus 10 percent. For a 10 to 90 percent load change, recovery time shall be not longer than 100 milliseconds.
13. Input protection shall be provided by a panel-mount circuit breaker. Each inverter shall be

the load current-limiting type and each shall have overload and short circuit protection provided by a circuit breaker. Efficiency shall be 75 percent for the inverter and 85 percent for the battery charger minimum.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Condition power as required to provide stable Process Control System.

B. Install and wire in accordance with equipment/instrument manufacturer's written instructions, approved submittals, applicable requirements of the NEC, NEIS, and recognized industry practices.

END OF SECTION

SECTION 40 71 00
FLOW MEASUREMENT

PART 1 – GENERAL

1.01 SUMMARY

A. Items specified in this section shall conform to general requirements of Section 40 61 13.

B. Section includes field flow elements, sensors, and transmitters for Process Instrumentation and Control flow measurement.

1.02 SUBMITTALS

A. General:

1. Submit Product Data in sufficient detail to confirm compliance with requirements of this Section. Submit Product Data and Shop Drawings in one complete submittal package. Partial submittals are not acceptable.

B. Product Data:

1. Catalog cuts and product specifications for instrumentation specified.

C. Shop Drawings:

1. Installation and assembly drawings and specifically prepared technical data for instrumentation specified.
2. Submit in accordance with Section 01 33 00.

D. Operation and Maintenance (O&M) Data:

1. Operating instructions and maintenance data for materials and products for inclusion in O&M Manual.
2. Manufacturer's written instructions for periodic test/calibration/cleaning for instrumentation and controls in service.
3. Submit in accordance with Section 01 78 23.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Firms experienced in manufacturing instrumentation of types and capacities indicated that have record of successful in-service performance.

B. Items provided under this section shall be listed or labeled by Underwriters Laboratories Inc. (UL) or other Nationally Recognized Testing Laboratory (NRTL).

1. Term "NRTL" shall be as defined in Occupational Safety and Health Administration (OSHA) Regulation 1910.7.
2. Terms "listed" and "labeled" shall be as defined in National Electrical Code (NEC), Article 100.

PART 2 – PRODUCTS

2.01 THERMAL DISPERSION FLOW SWITCH

A. Manufacturer:

1. Sierra Instruments, Inc., InnovaSwitch.
2. Fluid Components, Inc., FLT93.
3. Endress+Hauser.

B. All instruments in contact with water being treated for distribution shall be NSF/ANSI 61 and NSF/ANSI 372 certified.

C. Sensor:

1. 3/4" NPT adapter for process connection.
2. Integral electronics housing.
3. 120Vac Power supply.
4. Minimum of 2 AC relay (normally open) outputs for flow presence detection and high flow detection.
5. Medium Temperature Range: 40°F to 140°F.
6. Thermal Dispersion type using RTD's.
7. 316 stainless steel wetted parts.

D. Measurement and Performance:

Tag	Description	Service	Pipe Dia. (in)	Setting
NHOH-FSH-3	Aqua Ammonia Flow Switch	Aqueous Ammonia	1-1/2	*

*: Contractor shall field-verify and match settings with existing instrument.

PART 3 – **EXECUTION**

3.01 INSTALLATION

A. Install and wire in accordance with equipment/instrument manufacturer's written instructions, approved submittals, applicable requirements of the NEC, NEIS, and recognized industry practices.

B. Instrumentation transmitters, displays, and other indicators shall be orientated such that they are easily readable and accessible from operating locations.

3.02 IDENTIFICATION

A. Provide Type 316 stainless steel tag permanently affixed to each unit (where sensor and transmitter separately mounted).

B. Engrave with process application as listed in Specifications.

C. Include Engineer tag number as listed in Specifications and on Drawings.

3.03 TRAINING

A. Provide training as specified in Section 40 61 26.

END OF SECTION

SECTION 40 72 00
LEVEL MEASUREMENT

PART 1 – GENERAL

1.01 SUMMARY

A. Items specified in this section shall conform to general requirements of Section 40 61 13.

B. Section includes field level elements, sensors, and transmitters for Process Instrumentation and Control.

1.02 SUBMITTALS

A. General:

1. Submit Product Data in sufficient detail to confirm compliance with requirements of this Section. Submit Product Data and Shop Drawings in one complete submittal package. Partial submittals are not acceptable.

B. Product Data:

1. Catalog cuts and product specifications for instrumentation specified.

C. Shop Drawings:

1. Installation and assembly drawings and specifically prepared technical data for instrumentation specified.
2. Submit in accordance with Section 01 33 00.

D. Operation and Maintenance (O&M) Data:

1. Operating instructions and maintenance data for materials and products for inclusion in O&M Manual.
2. Manufacturer's written instructions for periodic test/calibration/cleaning for instrumentation and controls in service.
3. Submit in accordance with Section 01 78 23.

1.03 QUALITY ASSURANCE

A. Manufacturer Qualifications: Firms experienced in manufacturing instrumentation of types and capacities indicated that have record of successful in-service performance.

B. Items provided under this section shall be listed or labeled by Underwriters Laboratories Inc. (UL) or other Nationally Recognized Testing Laboratory (NRTL).

1. Term "NRTL" shall be as defined in Occupational Safety and Health Administration (OSHA) Regulation 1910.7.
2. Terms "listed" and "labeled" shall be as defined in National Electrical Code (NEC), Article 100.

PART 2 – PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. All instruments in contact with water being treated for distribution shall be NSF/ANSI 61 and

NSF/ANSI 372 certified.

B. Instrumentation shall be made of material resistant to chemical ev

2.02 LEVEL SWITCH, VERTICAL FLOAT

A. Manufacturers:

1. Anchor
2. Contegra FS 90.
3. Evoqua Water Technologies 9G-EF
4. Or Equal.

B. Requirements:

1. Float shall be made of material resistant to corrosion from chemical in tank.
2. Provide sufficient length of PVC jacketed cable.
3. For hazardous (classified) locations, provide intrinsically safe relays in corresponding control panel.
4. Mounting Hardware shall be made of material resistant to corrosion from chemical in tank.
5. Switch: Non-Mercury tilt type 1A @ 150VAC/VDC non-inductive.

C. Measurement and Performance:

Tag	Description	Measuring Medium	Process Connection	Setting
NAOC-LSH-4	Sodium Hypochlorite Day Tank T-4 Level Switch	Sodium Hypochlorite	3” flange	*
NAOC-LSH-5	Sodium Hypochlorite Day Tank T-5 Level Switch	Sodium Hypochlorite	3” flange	*
NAOH-LSH-3	Sodium Hydroxide Day Tank T-3 Level Switch	Sodium Hydroxide	3” flange	*

*: Contractor shall field verify elevation of overflow pipe invert and provide probe with adequate length to detect chemical overflow.

2.03 MICROWAVE RADAR LEVEL ELEMENT AND TRANSMITTER

A. Manufacturers:

1. Vega, VEGAPULS 6X sensor with VEGADIS 82 transmitter.
2. Magnetrol
3. Endress+Hauser
4. Siemens
5. Or Equal.

B. Antenna:

1. Design transducer to emit radar signal with time lapse between transmitted and received signal converted into usable voltage capable of driving totalizer, sample rate counter, and flow rate meter or liquid level indicator. DC voltage produced shall be proportional to distance from detector to material being measured.
2. Measuring frequency: 80 GHz.

3. Maximum beam angle: 8˚.
4. Process connection as shown below.
5. Operating temperatures: -40°F to +392°F.
6. Electronic housings and sensor materials shall be compatible with service chemicals as shown below.
7. Impervious to damage from submersion in wastewater or concentrated ferric chloride or alum, and have high resistance to corrosive and gaseous industrial atmosphere.
8. Mounting shall be as shown on Drawings. Other methods of mounting will be considered if recommended by detector manufacturer.
9. Non-contact design detector with no moving parts or mechanical linkages.
10. Shall be Factory Mutual approved when located in classified environment.

C. Transmitter:

1. Input power: DC loop power with 4-20mA current loop.
2. Display: 5-digit display with backlight.
3. Linear, isolated 4-20 mAdc, signal for remote indication from each monitoring unit.
4. Enclosure: NEMA 12 for interior applications, NEMA 4X for exterior application or wet locations. Housings materials shall be compatible with service chemicals as shown below
5. Wall mounted where noted, otherwise integral with sensor.
6. Shall be Factory Mutual approved when located in classified environment.
7. Ambient temperature: -20 … +70 °C (-4 … +158 °F)

D. Cable:

1. Provide sufficient length of cable as standard with manufacturer to connect level sensor to monitoring unit without splicing.

E. Design Requirements:

1. Accuracy of system: +1% of full scale at any point in calibrated range.
2. Based on Drawings, installation details, and site requirements radar manufacturer shall select radar equipment; type of antenna, horn diameter and coordinate antenna length, or extensions required, with Contractor for each monitoring location.
3. Radar shall be configured and programmed by manufacturer's representative on-site.

F. Measurement and Performance:

Tag	Description	Measuring Medium	Process Connection	Range (Feet)
NAOC-LIT-1 NAOC-LE-1	Sodium Hypochlorite Storage Tank T-1 Level Sensor and Transmitter	Sodium Hypochlorite	8" flange*	0-20.0
NAOC-LIT-2 NAOC-LE-2	Sodium Hypochlorite Storage Tank T-2 Level Sensor and Transmitter	Sodium Hypochlorite	8" flange*	0-20.0
NAOC-LIT-3 NAOC-LE-3	Sodium Hypochlorite Storage Tank T-3 Level Sensor and Transmitter	Sodium Hypochlorite	8" flange*	0-20.0
NAOC-LIT-4 NAOC-LE-4	Sodium Hypochlorite Day Tank T-4 Level Sensor and Transmitter	Sodium Hypochlorite	8" flange*	0-10.0
NAOC-LIT-5 NAOC-LE-5	Sodium Hypochlorite Day Tank T-5 Level Sensor and Transmitter	Sodium Hypochlorite	8" flange*	0-10.0
NHOH-LIT-1 NHOH-LE-5	Aqua Ammonia Storage Tank T-1 Level Sensor with integral Transmitter	Aqua Ammonia	6" flange*	0-15.0
NAOH-LE-1 NAOH-LIT-1	Sodium Hydroxide Storage Tank T-1 Level Sensor and Transmitter	Sodium Hydroxide	8" flange*	0-20.0

NAOH-LIT-2 NAOH-LE-2	Sodium Hydroxide Storage Tank T-2 Level Sensor and Transmitter	Sodium Hydroxide	8” flange*	0-20.0
NAOH-LIT-3 NAOH-LE-3	Sodium Hydroxide Storage Tank T-3 Radar Level Sensor and Transmitter	Sodium Hydroxide	6” flange*	0-10.0
HFSA-LIT-1** HFSA-LE-1	Hydrofluorosilicic Acid Storage Tank T-1 Level Sensor and Transmitter	Hydrofluorosilicic Acid	8” flange*	0-20.0

*: Where flange size is not available from sensor manufacturer, System Integrator shall coordinate with Contractor to provide adapter accordingly.
**: Provide if Alternate 1 is accepted.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install and wire in accordance with equipment/instrument manufacturer’s written instructions, approved submittals, applicable requirements of the NEC, NEIS, and recognized industry practices.

B. Instrumentation transmitters, displays, and other indicators shall be orientated such that they are easily readable and accessible from operating locations.

3.02 IDENTIFICATION

A. Provide Type 316 stainless steel tag permanently affixed to each unit (where sensor and transmitter separately mounted).

B. Engrave with process application as listed in Specifications.

C. Include Engineer tag number as listed in Specifications and on Drawings.

3.03 TRAINING

A. Provide training as specified in Section 40 61 26.

END OF SECTION

SECTION 40 73 00
PRESSURE, STRAIN, AND FORCE MEASUREMENT

PART 1 – GENERAL

1.01 SUMMARY

A. Items specified in this section shall conform to general requirements of Section 40 61 13.

B. Section includes field pressure elements, sensors, switches, and transmitters for Process Instrumentation and Control.

1.02 SUBMITTALS

A. General:

1. Submit Product Data in sufficient detail to confirm compliance with requirements of this Section. Submit Product Data and Shop Drawings in one complete submittal package. Partial submittals are not acceptable.

B. Product Data:

1. Catalog cuts and product specifications for instrumentation specified.

C. Shop Drawings:

1. Installation and assembly drawings and specifically prepared technical data for instrumentation specified.
2. Submit in accordance with Section 01 33 00.

D. Operation and Maintenance (O&M) Data:

1. Operating instructions and maintenance data for materials and products for inclusion in O&M Manual.
2. Manufacturer's written instructions for periodic test/calibration/cleaning for instrumentation and controls in service.
3. Submit in accordance with Section 01 78 23.

1.03 QUALITY ASSURANCE

A. Manufacturer Qualifications: Firms experienced in manufacturing instrumentation of types and capacities indicated that have record of successful in-service performance.

B. Items provided under this section shall be listed or labeled by Underwriters Laboratories Inc. (UL) or other Nationally Recognized Testing Laboratory (NRTL).

1. Term "NRTL" shall be as defined in Occupational Safety and Health Administration (OSHA) Regulation 1910.7.
2. Terms "listed" and "labeled" shall be as defined in National Electrical Code (NEC), Article 100.

PART 2 – PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. All instruments in contact with water being treated for distribution shall be NSF/ANSI 61 and

NSF/ANSI 372 certified.

2.02 PRESSURE GAUGE/ INDICATOR

A. Manufacturer:

1. Wika.
2. Ashcroft 1009.
3. U.S. Gauge, Division of Ametek, Inc.
4. Or Equal.

B. Requirements:

1. Gauge Housing Material: 316 Stainless Steel
2. Mounting: Stem
3. Dial Size: 3-1/2 inch minimum.
4. Units shall be bellows or Bourdon tube actuated pressure gauges.
5. Accuracy shall be ±1% of span at ambient conditions of 73.4°F and 29.92" Hg barometric pressure. ASME B40.100 Grade 1A minimum.
6. The sensing element material shall be phosphor-bronze if coupled with diaphragm seal, otherwise provide type 316 stainless steel.
7. Element shall sense pressure or vacuum.
8. Element shall be suitable for temperatures of media monitored.
9. Liquid filled for alleviation of vibration.
10. For positive displacement pump applications:

    a. In addition to liquid filled, provide throttle plug pulsation dampener on the discharge side of pump.
    b. Select material and NPT connection based on application and installation.

C. Accessories:

1. Include isolation valve to isolate from process when being serviced.
2. When indicated below or shown on Drawings, provide with diaphragm seal as specified in this Section.

D. Measurement and Performance:

Tag	Description	Service	Seal Type	Range
NAOC-PI-1	Sodium Hypochlorite Transfer Pump P-1 Discharge Pressure	Sodium Hypochlorite	Diaphragm	0-60 psi
NAOC-PI-2	Sodium Hypochlorite Transfer Pump P-2 Discharge Pressure	Sodium Hypochlorite	Diaphragm	0-60 psi
NAOH-PI-1	Sodium Hydroxide Transfer Pump P-1 Discharge Pressure	Sodium Hydroxide	Diaphragm	0-30 psi
NAOH-PI-2	Sodium Hydroxide Transfer Pump P-2 Discharge Pressure	Sodium Hydroxide	Diaphragm	0-30 psi
NHOH-PI-1	Hydrofluosilicic Acid Transfer Pump P-1 Discharge Pressure	Hydrofluorosilicic Acid	Diaphragm	0-60 psi
FLTR-PI-330	Backwash Pump No. 2 Discharge Pressure	Filter Backwash	None	0-100 psi

2.03 PRESSURE SEAL, DIAPHRAGM

A. Manufacturer:

1. Ashcroft Type 101.
2. Ametek, Mansfield and Green Division, Type SG.
3. Chemline Plastics
4. Or Equal.

B. Requirements:

1. Lower Housing Material:Unless otherwise noted, type 316 Stainless Steel with flushing connections.
2. Diaphragm Material: Unless otherwise noted, type 316 Stainless Steel.
3. Upper Housing Material: Steel with bleed screw.
4. Connections: Threaded Female NPT.
5. Filling Fluid:Silicone (Temperature Range: -40° to 600°F).
6. Volumetric displacement of the seal must be greater than the attached instrument.
7. Unit shall be pressure-sensing suitable for measuring dirty or corrosive fluids.
8. Unit shall be arranged and designed to directly transmit the process pressure by means of the fluid through an opening in the lower housing to a pressure-sensing device attached and sealed to the upper housing by a drilled and threaded boss.
9. Seal shall be suitable for fluid pressures to 500 psig.
10. Unit shall have fill connections and other features required permitting refill of the seal volume and calibration of unit in the field.
11. Unit shall be suitable of for temperature of media monitored.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install and wire in accordance with equipment/instrument manufacturer's written instructions, approved submittals, applicable requirements of the NEC, NEIS, and recognized industry practices.

B. Instrumentation transmitters, displays, and other indicators shall be orientated such that they are easily readable and accessible from operating locations.

3.02 IDENTIFICATION

A. Provide Type 316 stainless steel tag permanently affixed to each unit (where sensor and transmitter separately mounted).

B. Engrave with process application as listed in Specifications.

C. Include Engineer tag number as listed in Specifications and on Drawings.

3.03 TRAINING

A. Provide training as specified in Section 40 61 26.

END OF SECTION

SECTION 40 78 00
PANEL MOUNTED INSTRUMENTS

PART 1 – GENERAL

1.01 SUMMARY

A. Items specified in this Section shall conform to general requirements of Section 40 61 13.

B. Section includes control panel devices for Process Instrumentation and Control Systems.

1.02 SUBMITTALS

A. General:

1. Submit Product Data in sufficient detail to confirm compliance with requirements of this Section.
2. Submit Product Data and Shop Drawings in one complete submittal package.
3. Partial submittals are not acceptable.

B. Product Data:

1. Catalog cuts and product specifications for devices specified.

C. Shop Drawings:

1. Installation and assembly drawings and specifically prepared technical data for control devices specified.
2. Submit in accordance with Section 01 33 00.

D. Operation and Maintenance (O&M) Data:

1. Operating instructions and maintenance data for materials and products for inclusion in O&M Manual.
2. Manufacturer's written instructions for periodic test/calibration/cleaning for instrumentation and controls in service.
3. Submit in accordance with Section 01 78 23.

1.03 QUALITY ASSURANCE

A. Manufacturer Qualifications: Firms experienced in manufacturing instrumentation of types and capacities indicated that have record of successful in-service performance.

B. Devices shall be latest and most modern design at time of bidding.

C. As much as possible devices shall be products of one manufacturer to achieve standardization for maintenance, spare parts, operation, and service.

PART 2 – PRODUCTS

2.01 PILOT DEVICES

A. Manufacturer:

1. Allen Bradley 800T/800H.
2. Square D Class 9001, Type K.

3. Or Equal.

B. Construction:

1. Heavy duty.
2. Watertight.
3. Oil-tight.
4. Flush panel mounting.
5. Size to mount in 30.5-mm diameter cutout.
6. Match NEMA rating of device with the installed location environmental classification.

C. Pushbuttons:

1. Flush head unless specified elsewhere.
2. Contact Blocks:

    a. Double break silver contacts.
    b. Ac Ratings: 7,200 va make, 720 va break.
    c. Single pole, single throw.
    d. Up to six tandem blocks.

3. Momentary contact unless specified elsewhere.
4. Non-illuminated.
5. Legend plates, as required, for type of operation or as specified elsewhere.

D. Emergency Stop:

1. Jumbo red mushroom head.
2. Contact Blocks:

    a. Double break silver contacts.
    b. Ac Ratings: 7,200va make, 720va break.
    c. Single pole, single throw.
    d. Up to six tandem blocks.

3. Push/pull.
4. Maintained contact.
5. Non-illuminated.
6. Legend plates:

    a. Extra large.
    b. Yellow.
    c. Round.

E. Selector Switches:

1. Maintained position unless specified elsewhere.
2. Contact Blocks:

    a. Double break silver contacts.
    b. Ac Ratings: 7,200va make, 720va break.
    c. Single pole, double throw or double pole, single throw.
    d. Up to six tandem blocks.

3. Operators:

a. Number of positions as specified elsewhere.
b. Standard knob type unless specified elsewhere.

4. Field mounted Local/Remote selector switches shall be provided with extra contact blocks for monitoring of “Remote” mode at the PLC.
5. Legend plates as required for type of operation or specified elsewhere.

F. Pilot Lights:

1. LED Lamp.
2. Transformer type.
3. Bayonet, 6Vac bulb.
4. Colored lens as specified elsewhere.
5. Interchangeable lenses.
6. Transformer rated for 120Vac
7. Push to test.
8. Legend plates as specified elsewhere.

G. Potentiometers:

1. Three-terminal potentiometer.
2. Resistance: 10 kOhm.
3. Power Rating: 2 watt, 50V ac/dc.
4. Resolution: 1 percent.
5. Linearity: +/- 5 percent.

2.02 MOTOR STARTER CONTROL RELAYS

A. Manufacturer:

1. Square D.
2. Cutler-Hammer.
3. Or Equal.

B. Construction:

1. Industrial type.
2. 300Vac rated.
3. Ac operation.
4. Used for operation of large motor starter coils or other 120Vac loads whose current requirements (continuous or inrush) exceed capacity of control relays listed below.

C. Operating data:

1. Pickup time: 11 ms maximum.
2. Dropout time: 6 ms maximum.

D. Coil:

1. Molded construction.
2. 120Vac, 60Hz.
3. Continuous rated.
4. 155va inrush, maximum.
5. 22va sealed, maximum.

E. Contacts:

1. Double break.
2. Silver alloy.
3. Convertible.
4. Color-coded to indicate status.
5. 60 amp make, 6 amp break (120Vac inductive).

F. DIN rail-mounting capability.

G. Accessories:

1. Add-on pole attachment.

a. 4 NO and 4 NC contacts.
b. Add-on to 0 to 4-pole relay.

2. Latch attachment.

2.03 CONTROL RELAYS

A. Manufacturer:

1. Allen Bradley
2. Potter and Brumfield.
3. Idec.
4. Magnecraft.
5. Or Equal.

B. Operating Data:

1. Pickup Time: 13 ms maximum.
2. Dropout Time: 10 ms maximum.
3. Operating Temperature: -45°F to 150°F.

C. ac Coil:

1. 120Vac.
2. Continuous rated.
3. 3.5va inrush maximum.
4. 1.2va sealed, maximum.
5. 50-60 Hz.
6. Light to indicate energization.
7. Minimum Dropout Voltage: 10% of coil rated voltage.

D. dc Coil:

1. 24Vdc.
2. Continuous rated.
3. Light to indicate energization.
4. Minimum Coil Resistance:

a. 24Vdc: 450 Ω.

E. Contacts:

1. Gold flashed fine silver, gold diffused for 1 amp or less resistive load.

2. Silver cadmium oxide.
3. 3 form C.
4. 300Vac.
5. 10 amp make, 1.5 amp break, (inductive).

F. Rated at 10 million operations.

G. 11 pin, square socket.

H. DIN rail mountable.

I. Enclosed and protected by polycarbonate cover.

J. Visible indication of energized coil.

K. Provide relay-retaining clips.

2.04 TERMINAL BLOCKS

A. Manufacturer:

1. Phoenix Contact.
2. Weidmuller.
3. Or Equal.

B. 300 v rating for 120 v circuits and below, 600 v rating for 480 v circuits.

C. Clamping screw type.

D. Isolating end caps for each terminal.

E. Identification on both terminals.

F. Clip-mounted on DIN rail.

G. Accepts AWG 12 to 22.

H. Feed-Through Terminals:

1. 20 Amp rating

I. Switched Terminals:

1. Knife disconnect with test sockets.
2. 10 Amp rating.

J. Fused Terminals:

1. Hinged fuse removal/disconnect.
2. 10 Amp rating.
3. Include blown fuse indication.

2.05 DC POWER SUPPLIES

A. Manufacturer:

1. Phoenix Contact
2. Sola/Hevi-Duty
3. Or Equal.

B. General:

1. Power supply shall be fully enclosed, and provide screw terminations. All wiring points and plug connections shall be "touch safe" with no live voltages that can make contact with a misplaced finger in accordance with IEC 529. Housing shall be at IP20 or equal minimum.
2. Power Supplies shall have an efficiency of at least 80% with high efficiency models (~90%) available
3. The power shall have an MTBF (Mean Time Between Failures) greater than 500,000 hours according to IEC 1709.
4. The power supply shall be able to withstand shock of 30G in all space directions according to IEC 68-2-27 and vibration up to 2.3G 90 min. (<15hz, amplitude = +/-2.5mm/15-150hz) according to IEC 68-2-6.
5. Power supplies shall be UL-508A listed to allow the use of the power supply at full rated output amperage with no "de-rating".

C. Mounting:

1. All power supplies shall have integral metal mounting foot to attach to 35mm DIN-rail conforming to DIN EN50022.

D. Wire Connections:

1. Attach wires to the power supplies by means of a cable-clamping terminal block activated by a screw. Connections shall be gas-tight, and the terminal block shall be fabricated with non-ferrous, non-corrosive materials.
2. Wire connection for currents less than 20A shall use pluggable terminals on both input and output ends.
3. Pluggable terminals shall accept wire sizes 24 through 14 AWG.

E. Equipment:

1. Nominal current rating to be based on an operating temperature of 60°C or higher
2. Power supplies shall have a visible "DC Power OK" indicator. This indicator will flash when the output drops below 10% of the adjusted output voltage.
3. Ambient temperature range for operation shall be at least -25°C to +70°C
4. Residual ripple shall not exceed 100 mV peak to peak at nominal current values
5. Integral "fine" surge suppression shall be incorporated into the power supply
6. Power supplies shall conform to CE electromagnetic compatibility as described in EN61000-6-2 and EN 50081-2.
7. Power supplies shall have means of limiting DC current in case of short circuit or an overload and shall automatically reset themselves when the fault is corrected.
8. Power supplies when wired in parallel will not require external circuitry.
9. Power supplies shall have a voltage monitoring relay contact and signaling output.
10. Input must auto-range between 85 to 264VAC and 90 to 350VDC for 1 phase power supplies with no manual intervention.
11. Input must auto-range between 320 to 575VAC and 450 to 800VDC for 3 phase power supplies with no manual intervention.
12. Power supplies shall have a power factor of at least 0.6, with higher power factor models available as described by EN61000-3-2.

2.06 ELECTRONIC CURRENT ISOLATOR

A. Manufacturer:

1. Phoenix Contact Model MCR Series.
2. PR Electronics.
3. Or Equal.

B. Solid state instrument to electrically isolate one instrument loop from another instrument loop. Converter to accept 4-20 mAdc input signal and provide equal but isolated and power-boosted output.

C. Mounting: DIN Rail.

D. Temperature compensated, calibration-free.

E. Input: 4-20 mAdc into 50 ohms.

F. Output: 4-20 mAdc into output load up to 500 ohms.

G. Isolation: Common mode up to 700Vac between input and output.

H. Accuracy: 0.5% of span.

I. Provide power supply specific to isolator.

2.07 DATA OUTLET – FRONT OF PANEL

A. Manufacturer:

1. Grace Port
2. Hubbel
3. Automation Direct Zipport Series
4. Or equal

B. Features:

1. NEMA Rating to match panel
2. Flush Mount
3. Polycarbonate hinged cover
4. GFI outlet wired to convienace outlets in panel
5. RJ-style plug for each Vlan on network minimum
6. Include padlock provision

2.08 SURGE PROTECTORS

A. Manufacturer:

1. Islatrol - IE-100 series
2. SOLA STFE Elite Series.
3. Or Equal.

B. High frequency noise filter/surge protector to protect control panel incoming power supply.

C. Wire to protect specified microprocessor based process control system devices including:

1. PLC
2. OIT

3. Any other microprocessor based equipment located in or powered from PLC Panel.

D. Input power:

1. 120 or 240Vac, model dependant.
2. 47-63 Hz.

E. Peak surge current: Minimum 10,000 amp line-neutral, line to ground, and neutral to ground.

F. Frequency response:

1. Normal mode: 90 dB max, 100 kHz to 50 MHz.
2. Common mode: 60 dB max, 5 MHz to 50 MHz.

G. Response time:

1. < 0.5 ns normal mode.
2. <5 ns common mode.

H. Transient protection per IEEE C62.41:

1. Category A Ringwave (6kV, 200A, 100 MHz): < 60 V peak.
2. Category B Ringwave (6kV, 500A, 100 MHz): < 100 V peak.

I. LED status indicator.

J. Form C contact for remote status indication.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install and wire in accordance with equipment/instrument manufacturer's written instructions, approved submittals, applicable requirements of the NEC, NEIS, and recognized industry practices.

3.02 IDENTIFICATION

A. Provide Type 316 stainless steel tag permanently affixed adjacent to each device that has Engineer tag number referenced on Drawings.

B. Engrave Engineer tag number as listed in Specifications and on Drawings.

END OF SECTION

DIVISION 43

PROCESS GAS AND LIQUID HANDLING EQUIPMENT

SECTION 43 23 31
VERTICAL TURBINE PUMPS

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Backwash Pump No. 2 (FLTR-P-330)

1.02 REFERENCES

A. ANSI: American National Standards Institute.

B. ASTM: American Society of Testing and Materials.

C. AWWA: American Water Works Association.

D. NEC: National Electrical Code.

E. NEMA: National Electrical Manufacturers Association.

F. NSF: National Sanitation Foundation / NSF International

1.03 SYSTEM DESCRIPTION

A. General

1. Pumps that are supplied under this specification shall be vertical turbine open lineshaft design with water flush, including a bowl assembly, column assembly, discharge head and driver. The discharge head shall be designed to carry the entire weight of the bowl and column assembly along with the specified driver without excessive vibration or noise.

B. Design and Performance Requirements:

1. Pumping equipment shall comply with Vertical Turbine Pump Schedule(s) of this Section.
2. Equipment shall be suitable for intended installation.
3. Equipment shall be suitable for pumping materials indicated in Vertical Turbine Pump Schedule(s).
4. Pumps shall be NSF/ANSI 61 certified for potable water. Entire pump assembly, with materials as specified in part 2.02, shall carry NSF 61 certification.
5. Equipment shall be suitable for pumping potable water with a free chlorine concentration of up to 4 mg/L.
6. Equipment shall be suitable for continuous operation at all operating speeds and operating points specified.
7. Equipment shall be suitable for continuous operation at maximum fluid temperature of 104 degrees Fahrenheit (F) at all operating speeds specified and without external cooling fluid.
8. Motor horsepower of each pump shall be non-overloading throughout entire pump performance curve.
9. Equipment shall be free from shock, vibration, cavitation, overheating, and noise while operating at specified conditions.
10. Motor housing shall be weather protected Type I (WPI).
11. Equipment shall be continuous operation without damage while operating under load.
12. Design equipment so parts are readily accessible for inspection and repair, easily duplicated and replaced, and suitable for service specified.

13. All vertical turbine pumps shall conform to ANSI/AWWA E103-15 and to the most current edition of Hydraulic Institute Standards.
14. Pump and all major components including bowls, discharge head assembly, and column shall be manufactured at named manufacturer's factory facility.
15. Certification NSF/ANSI 61 and NSF/ANSI 372.

1.04 SUBMITTALS

A. General:

1. Submit Product Data and Shop Drawings in sufficient detail to confirm compliance with requirements of this Section. Submit Product Data and Shop Drawings in one complete submittal package. Partial submittals are unacceptable.

B. Shop Drawings and Product Data:

1. Submit shop drawings and product data of all system components. Shop drawings and product data shall include the following features:

a. Manufacturer's specification data and descriptive literature.
b. Performance data.
c. Equipment weight.
d. Head, capacity, horsepower demand, and pump efficiency curves from shut-off to maximum capacity of pump. Curves shall clearly indicate the limits of the Allowable Operating Range (AOR).
e. Head, capacity, horsepower demand, and pump efficiency for points specified in the Pump Schedule.
f. Proposed coating system. Submit in accordance with Section 09 96 00.
g. Motor shall be in accordance with Section 26 05 84. The following data shall be submitted for each motor:

1) Designation
2) Horsepower
3) Phases
4) Voltage
5) Load amperes
6) Service factor
7) Frequency
8) Motor Code
9) Thermal protection
10) Documentation confirming inverter duty rating of motors

h. Wiring diagrams: Show power and control connections and distinguish between factory-installed and field-installed wiring.
i. Recommended procedures for job site storage, handling, installation, and start-up.
j. Detailed layout and other drawings required for proper installation including manufacturer recommended anchor bolt sizes and types.
k. Procedures for proper installation.
l. Quantity and type of spare parts being supplied. Spare parts shall be that needed to maintain the equipment in service for a period of 2 years. Include a list of special tools required for checking, testing, parts replacement, and maintenance.
m. Location of parts-supply facilities, service crews, and repair facilities.

C. Submit in accordance with Section 01 33 00.

D. Operation and Maintenance (O&M) Data:

1. Operating instructions and maintenance data for materials and products for inclusion in O&M Manual.
2. Manufacturer's written instructions for periodic tests of equipment in service.
3. Submit in accordance with Section 01 78 23.

E. Test Results:

1. Submit factory certified performance curves, detailed in Paragraph 2.05 of this Section. Certified curves shall be signed and stamped by an Indiana Professional Engineer.
2. Submit factory certified results of hydrostatic test, detailed in Paragraph 2.05 of this Section..
3. Do not ship pumps to site until factory test results approved.

F. Instructional Services Documentation

1. Submit in accordance with Section 01 79 30.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Firms experienced in manufacturing equipment of types and capacities indicated that have record of successful in-service performance.

1. Emergency Service: System manufacturer or manufacturer representative maintains service center capable of providing training, parts, and emergency maintenance and repairs at Project site with 72 hours maximum response time.
2. Pressure containing fabrications shall be welded only by those who are qualified on ASME code section IX. Welder certification shall be provided with the submittal package.

B. Single-Source Responsibility: Obtain vertical turbine pumping equipment system components from single manufacturer with responsibility for entire system. Unit shall be representative product built from components that have proven compatibility and reliability and are coordinated to operate as unit as evidenced by records of prototype testing.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver vertical turbine pumps and system components to their final locations in protective wrappings, containers, and other protection that will exclude dirt and moisture and prevent damage from construction operations. Remove protection only after equipment is made safe from such hazards.

B. Store vertical turbine pumping equipment in clean, dry location.

C. Manufacturer shall define the requirements to properly protect the equipment and parts shipped to the job site.

1.07 MAINTENANCE

A. Extra Materials:

1. Furnish extra materials matching products installed, as described below, packaged with protective covering for storage, and identified with labels describing contents.

a. One set of bowl bearings for each pump model.
b. One set of lineshaft bearings for each pump model.
c. One stuffing box bearing set for each pump model.
d. One set of all lineshaft couplings for each pump model.

2. Provide special tools required for checking, testing, parts replacement, and maintenance.
3. Spare parts shall be suitably packaged and labeled with the name and number of the equipment to which they belong.

1.08 WARRANTY

A. The pump manufacturer shall furnish a minimum one (1) year warranty from the date of substantial completion unless the manufacturer standard warranty is greater.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Peerless Pump.

2.02 MATERIALS

A. The vertical turbine lineshaft pump shall conform to the materials of construction for open lineshaft design.

B. Suitable for application specified in Vertical Turbine Pump Schedule(s) of this Section and as specified below:

1. Bowl: Cast Iron
2. Impeller: Aluminum Bronze C952
3. Bowl bearing: Standard (Bronze) ASTM B144-932
4. Bowl shaft: 416 Stainless Steel
5. Bowl wear ring: Aluminum Bronze Wear Ring ASTM B144-932
6. Column: Steel
7. Lineshaft: 416 Stainless Steel
8. Bearing retainer: Fabricated Steel
9. Lineshaft bearing: Standard (Rubber)
10. Discharge head: Fabricated Steel
11. Sole Plate: Steel

2.03 PUMP FABRICATION

A. General:

1. Provide metal-to-metal contact machined surfaces.
2. Machine and fit mating surfaces with O-rings where watertight sealing is required.
3. Rectangular cross sectioned gaskets, elliptical O-rings, grease, or secondary sealing compounds are not acceptable.
4. Non-reversing ratchet to keep pump from spinning backwards.

B. Bowl Assembly

1. The suction bell shall be designed to provide conservative entrance velocities and direct the flow to the first stage impeller. The inner surface of the suction bell shall be smooth and free of sharp projections which could cause turbulence or cavitation. The suction casing shall be designed to house the suction bell bearing by means of four vanes. The suction bell shall be machined and drilled for a 6-inch ANSI bolt hole pattern. Suction bell face shall be machined flush to accept mating of an ANSI full face gasket.
2. The bowls shall be smooth and free of sharp projections and shall have register fits for alignment and be connected by flanged and bolted construction.

3. The impellers shall be machined and finished smooth to insure proper performance. They are to be balanced prior to assembly. The impellers shall be connected to the bowl shaft by means of collet design.

C. Column Assembly and Suction Pipe

1. The column shall include threaded connections and shall be of open design with water flush. Column pipe size shall be such that the friction loss will not exceed five (5) feet per 100 feet based on rated pump capacity.
2. Bearing spacing shall not exceed 10 feet.
3. The lineshaft shall be of adequate size to transmit the full power of the pump without slip, excessive vibration or elongation, and shall have threaded joints. Lineshaft lengths shall not exceed 5 feet. The lineshaft shall have left hand threads that tighten during pump operation.

D. Discharge Head Assembly

1. The discharge head shall be fabricated of carbon steel materials using ASTM A181 flange, ASTM A53 Grade B body pipe and ASTM A36 Steel plate. The head shall be fitted with a discharge flange of the size as depicted on the Drawings. The discharge head shall be capable of containing maximum pressure developed by pump. The discharge flange shall be fitted with a 150 Lbs. ANSI raised face flange with bolt holes straddling discharge centerline. Flange pressure ratings must be specified for higher operating pressures. A 3/4- inch NPT pressure gauge connection shall be supplied on the discharge pipe.
2. The discharge flange assembly of the head shall utilize a three-segmented arrangement. This arrangement shall offer the least amount of friction loss through the head.
3. The discharge head shall be supplied with adequate integral motor stand height to accept the sealing arrangement required. The top of the head shall be machined to accept a standard NEMA P base, WP-1 type driver.

E. Sole Plate

1. A sole plate of adequate thickness shall be supplied with the pump. The sole plate shall be constructed of A36 steel. Plate shall be of proper size to support and anchor the motor and discharge pedestal. It shall be milled and machined to allow for a smooth level mating surface to the head.
2. The sole plate shall be positioned and leveled with the pump weight resting on the plate. Plate shall be level to within 0.001 thousands of an inch in any direction. Upon shimming, plate shall be grouted in place with non-shrink grout. Grout shall cure for 48-hours prior to re-installing pump and or motor.

F. Stuffing Box Assembly

1. The high pressure cast iron stuffing box shall be rated for a minimum of 400 lbs. The seal housing shall be fitted with a balanced cartridge mechanical seal. Seal faces shall be carbon vs. tungsten carbide rotating element. All associated components shall be 316 stainless steel and fitted with viton O-rings. The stuffing box shall be fitted with a throttle bearing. The throttle bearing shall be of bronze construction.
2. Stuffing box is to be fitted with a by-pass port to relieve pressure through the housing to the station sump. This shall be a watertight seal. This port can also be utilized as a potable water flush to quench the seal during operation. Sealing between the stuffing box and the discharge head shall be accomplished by means of an O-ring.

G. Motor

1. The motor will be a solid shaft design electric motor. The driver and any related equipment will ship unmounted from the pump.

2. Horsepower as specified in Vertical Turbine Pump Schedule(s) of this Section.
3. 480 v, 3-ph, 60 Hz.
4. Minimum motor efficiency of 95 percent at 100 percent of full load.
5. 1.15 minimum service factor per NEMA Standards.
6. Inverter duty rated, NEMA MG 1, Part 31.
7. Moisture resistant, Class H insulation rated for 180 degrees Celsius (C).
8. Use trickle impregnation method using Class F monomer-free polyester to fill voids in windings. Shall meet 95 percent fill factor. Multiple step dip and bake-type stator insulation process is not acceptable.
9. Suitable for continuous operation at 40 degrees C over ambient temperature.
10. Conform to the requirements of Section 26 05 84.
11. Internal thermal overload protection for motors:

    a. Protection automatically opens control circuit arranged for external connection.
    b. Protection operates when winding temperature exceeds safe value calibrated to temperature rating of motor insulation.

12. Cooling system: Provide motor cooling to comply with design and performance requirements.

2.04 COATINGS

A. Manufacturer is responsible for surface preparation, priming, and finish coating of equipment prior to shipment.

B. Provide in accordance with Section 09 96 00.

C. Stainless steel, bronze, and nonmetallic surfaces shall not be coated.

D. Coat machined or bearing surfaces and holes with protective grease.

2.05 SOURCE QUALITY CONTROL

A. All factory testing shall conform to the most current edition of the Hydraulic Institute Standards. All pump performance testing shall be performed at the manufacturer's facility.

B. Factory certified performance testing shall be non-witnessed and may be performed using factory (shop) VFD and motor. Pump motor shall be factory tested in accordance with Section 26 05 84.

C. Factory Certified Performance Test(s):

1. Perform on each pump in accordance with test requirements of Hydraulic Institute (HI) 14.6. Pumps shall meet performance acceptance grade 1U requirements for all Design Operating Points in Schedules to this section.
2. Determine capacity, head, brake horsepower and hydraulic efficiency.
3. Test each pump at minimum of six (6) points for each variable speed performance curve passing through the specified operating points, including shutoff, operating point specified, and at flow rate greater than operating point specified in Vertical Turbine Pump Schedule(s).
4. Prepare and submit certified performance curves for each speed required to demonstrate performance at the points specified. At least one point shall be taken as near as possible to each specified condition.
5. Test actual assembled pumps to be provided. Results of prior tests on similar or identical pumps are not acceptable.

D. Factory Certified Hydrostatic Test(s):

1. Perform on each pump.

2. Minimum test pressure shall be 1.5 times pump shutoff head.
3. Prepare and submit report of results.
4. Test actual assembled pumps to be provided. Results of prior tests on similar or identical pumps are not acceptable.

E. Certified copies of the Hydrostatic and Performance Test Report shall be supplied for approval prior to shipment.

F. Field/functional testing will be performed by the Contractor to ensure proper mechanical operation at the jobsite.

G. Motor tests and test reports shall be provided as required in accordance with Section 26 05 84.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install equipment in accordance with manufacturer's written instructions and approved submittals.

3.02 IDENTIFICATION

A. Provide equipment identification marker complete with equipment name and tag number in accordance with Section 10 14 10. Coordinate field location with Engineer.

3.03 FIELD QUALITY CONTROL

A. Manufacturer's Field Services:

1. Supplier's or manufacturer's representative for equipment specified herein shall be present at jobsite or classroom designated by Owner for workdays indicated, travel time excluded, for assistance during plant construction, plant startup, and training of Owner's personnel for plant operation. At a minimum, include:

a. 1 workday for Installation Services
b. 1/2 workday for Instructional Services
c. 1 workday for Post Startup Services

2. In addition to the services specified above, provide manufacturer's services as required to successfully complete systems demonstration as specified in Section 01 79 10.

VERTICAL TURBINE PUMP SCHEDULE 1	
Name of Pump(s)	Backwash Pump No. 2
Tag Number(s)	FLTR-P-330
Number of Pumps	One
Fluid Pumped	Filter Effluent
Stages	1
Motor Horsepower	60
Motor RPM	1,800
Constant or Variable Frequency	Constant Speed
Pump Installation Classification	Non-rated area
Discharge	16 inch
Column Diameter	16 inch
Column Length Design Conditions	
Discharge Head Base Elevation	754.00
Suction Pipe Centerline Elevation	733.75
Design Maximum Operating Point (1U Guarantee)	
Capacity (gpm)	4200
Head (ft)	44
Minimum Pump Efficiency (%)	78
Minimum Shutoff Head (at full speed)	
Head (ft)	62
rpm = revolutions per minute gpm = gallons per minute ft = feet	

END OF SECTION

SECTION 43 41 45
FIBERGLASS REINFORCED PLASTIC TANKS

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Sodium Hypochlorite Day Tank T-4 and T-5 (NAOC-T-4 and -5).
2. Flex Connectors.

1.02 SYSTEM DESCRIPTION

A. Tanks shall meet or exceed the following standards:

1. ASTM D-3299 – Filament Wound Glass-Fiber Reinforced Thermoset Resign Chemical-Resistant Tanks.
2. ASTM D-4097 – Contact Molded Glass-Fiber Reinforced Thermoset Resign Chemical-Resistant Tanks.

B. Provide storage tanks constructed of materials suitable for the chemical contained.

C. Tanks shall have sufficient sidewall and hoop strength to minimize tank deflections between full and empty conditions.

D. Hardware used for fittings shall be suitable for chemical contained.

E. Chemical tank equipment pad construction shall be as recommended by manufacturer.

F. Provide flex connectors suitable for connection to chemical storage tank, compatible with media stored within tank, with vertical and horizontal movement characteristics per chemical tank manufacturer's recommendations.

G. Flanges shall be protected from damage. All openings shall be covered to prevent entrance of dirt and debris.

1.03 DESIGN REQUIREMENTS

A. Sidewall - The minimum required wall thickness of the cylindrical straight shell at any fluid level shall be determined by using the following formula, but shall not be less than 1/4".

$t = .036 \times \gamma \times H \times D / 2 \times Sh$

Where:
t = Wall thickness in inches.
H = Fluid head in inches.
Sh = Allowable hoop stress in psi.
γ = Product specific gravity.
D = Tank nominal diameter in inches.

1. Allowable stress shall be determined using the following formula:

$Sh = Et \times Z$

Where:
ET = Tensile Modulus of laminate in hoop direction.

Z = Allowable strain (maximum allowable strain of the tank shall not exceed 0.001 inch/inch).

a. Allowable hoop stress (Sh) shall not exceed 1/10 of hoop tensile strength.

B. Top Head - The minimum allowable head thickness shall be 1/4". The top head shall be designed for personnel to walk on top it without damage.

C. Flat Bottom Head - Flat bottom heads shall be molded integrally with the straight shell portion of the tank. The perimeter of the tank bottom shall not have any variations from a flat plane that would prevent uniform contact with a properly prepared flat tank support pad when filled with liquid. The sidewall to bottom knuckle radius shall be not less than 1" for tanks 4' diameter & smaller and not less than 1 1/2" for tanks larger than 4' diameter.

1. Thickness and Reinforcement - The minimum thickness for a fully supported flat bottom head shall be 1/4" for 12' diameter and smaller and 3/8" for greater than 12' and up to 14' diameter and shall include no less than 1 layer of woven roving reinforcement. The minimum thickness of the sidewall to bottom knuckle radius shall be equal to the combined thickness of the sidewall and bottom. The reinforcement of the knuckle radius area shall not extend beyond the tangent line of the radius and flat bottom, and shall extend up the tank sidewall a minimum of 8" for tanks less than 4' diameter and 12" for tanks larger than 4' diameter. The reinforcement will then taper into the sidewall for an additional length of 3" to 4".

D. Sloped Tank Bottoms - Shall conform to the requirements above with the exception that the sloped bottom may be molded separately from the straight shell.

E. Elevated Dished Bottom Head - Elevated dished bottom heads may be either molded integrally with the straight shell portion of the tank or molded separately using a bell and spigot joint for attachment to shell. The dished bottom head shall have a radius of curvature that is equal to or less than the tank nominal inside diameter. Thickness shall not be less than 1/4-inch.

F. Elevated Cone Bottom Head - Elevated cone bottom heads will be molded separately using a bell and spigot joint for attachment to shell. Thickness shall not be less than 1/4-inch.

G. Joints between sidewall sections and for attachment of top heads or bottom heads shall conform to the width and thicknesses as specified in ASTM D-3299 or ASTM D-4097 as a minimum.

1.04 SUBMITTALS

A. General:

1. Submit Product Data in sufficient detail to confirm compliance with requirements of this Section. Submit Product Data and Shop Drawings in one complete submittal package. Partial submittals are unacceptable.

B. Product Data:

1. Catalog cuts and product specifications for tanks, fittings, and hardware supplied.
2. Statement certifying that the tank resin used and fittings and hardware supplied are suitable for intended chemical service.
3. Recommended procedures for job site storage, handling, installation, and start-up.

C. Shop Drawings:

1. Drawings for each tank identifying tank dimensions, tank volume, and location and elevation of all accessories and connections supplied.
2. Drawings for each tank restraint system.

D. Test Results:

1. Upon completion of the tank provide manufacturer's inspection report for each tank containing:

a. Visual inspection.
b. Hardness testing.
c. Hydrostatic test.
d. Verification of fitting placement.
e. Verification of materials.

E. Submit in accordance with Section 01 33 00.

F. Operation and Maintenance (O&M) Data:

1. Operating instructions and maintenance data for materials and products for inclusion in O&M Manual.
2. Manufacturer's written instructions for periodic tests of submersible centrifugal equipment in service.
3. Submit in accordance with Section 01 78 23.

G. Submit Instructional Services information in accordance with Section 01 79 30.

1.05 QUALITY ASSURANCE

A. The tank furnished under this Section shall be supplied by a manufacturer who has been regularly engaged in the design and manufacturing of fiberglass reinforced plastic chemical storage tanks for over ten years.

B. Dimensions and Tolerances

1. All dimensions will be taken with the tank in the vertical position, unfilled. Tank dimensions will represent the exterior measurements.
2. The tolerance for fitting placements shall be +/- 0.25 inches in linear distance and 1 degree alignment for nozzles up 8 inch diameter, and 0.5 degrees for nozzles greater than 8 inches in diameter at ambient temperature.

C. Visual Inspection and Workmanship:

1. Tanks shall be uniform in color. On pigmented tanks, color of matting on joints and fittings shall be matched as close as possible to the color of the tank exterior.
2. Joints and matting ground fittings shall not be whited out from over catalyzation.
3. There shall be no burrs or sharp edges on tanks, no knots in the filament winding, and all cut or ground edges shall be coated with paraffinated resin.
4. Visual Inspection Criteria (Refer to ASTM C-582, Section 9, Table 5):

DEFECT	SURFACE INSPECTED	
	CORROSION BARRIER	STRUCTURAL LAMINATE
Cracks	None	None

Crazing (fine surface cracks)	None	Maximum dimension 1". Maximum density 5/ft^2. [A]
Blisters (rounded elevations of the laminate surface over bubbles)	None	Maximum 1/4" diameter x 1/8" high, maximum 2/ft^2. [A]
Wrinkles & solid blisters	Maximum deviation, 20% of wall thickness, but not exceeding 1/8".[A]	Maximum deviation, 20% of wall thickness, but not exceeding 3/16". [A]
Pits (craters in the laminate surface)	Maximum dimensions, 1/8" dia. x 1/32" deep. Maximum number, 10/ft^2 [A]	Maximum dimension 1/8" diameter x 1/16" deep. Maximum density 10/ft^2. [A]
Surface porosity (pinholes or pores in the laminate)	Maximum dimensions, 1/16" diameter x 1/32" deep. Maximum number 20/ft^2 by 1/16 in. Must be resin-rich. [A]	Maximum dimension 1/16" diameter x 1/16" deep. Maximum number 20/ft^2. Must be resin-rich. [A]
Chips (small piece broken from edge or surface)	Maximum dimensions, 1/8" diameter x 1/32" deep. Maximum number 1/ft^2. [A]	Maximum dimension 1/4" diameter by 1/16" deep. Maximum number 5/ft^2. [A]
Dry Spot (non-wetted reinforcing)	None	Maximum dimension, 2 in.^{2}. [A]
Entrapped air (bubbles, voids or delaminations in laminate)	Maximum diameter 1/16", 10/in.^{2} maximum density. Maximum diameter 1/8", 2/in.^{2} maximum density. Maximum depth of 1/32 in. [A,B]	Maximum diameter 1/16" 10/in.^{2} maximum density. Maximum diameter 1/8", 2/in.^{2} maximum density. Maximum diameter 3/16", 2/ft^2 maximum density. [A,B]
Exposed glass	None	None
Burned areas	None	None
Exposure of cut edges	None [C]	None [C]
Scratches	None over 0.005 in. deep and 4 in. long	Maximum length 12". Maximum depth 0.010" 2/ft^2, maximum density. [A]
Foreign matter	None	1/8" diameter, maximum density 1/ft^2. 3/16" diameter, maximum density 1/ft^2. [A,D]

[A] Maximum 5% of total surface area affected.
[B] Entrapped air or bubbles described are allowed, provided the surface cannot easily be broken with a pointed object, such as a knife blade.
[C] Maximum 5% of total surface area affected.
[D] Maximum 5% of total surface area affected.

D. Barcol Hardness Test

1. All tanks shall have Barcol hardness readings taken and recorded on test report.
2. Ten readings shall be taken on the clean, resin rich surface of the tank.
3. The two high and the two low readings will be disregarded.
4. The average of the remaining readings shall be reported as the Barcol hardness of the tank.
5. A Barcol hardness result of 90% or better of the resin manufacturer's specified Barcol hardness for resin used shall be considered satisfactory.

E. Hydrostatic Water Test

1. The hydrostatic water test shall consist of filling the tank to full capacity.

2. Drying off all water spilled pr splashed onto the tank and surrounding area.
3. And leaving the tank standing full for a minimum of four hours before conducting a visual inspection for leaks and verifying no loss of water.

1.06 WARRANTY

A. Tanks, fittings, and accessories shall be warranted for one year from Substantial Completion in regard to defects in materials and workmanship.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver tanks and accessories to their final locations in protective wrappings, containers, and other protection to exclude dirt and moisture and prevent damage from construction operations. Remove protection only after equipment is made safe from such hazards.

B. Store tanks in a clean, dry location on a padded surface with minimal exposure to ultraviolet radiation (sunlight).

C. Manufacturer shall define the requirements to properly protect the equipment and parts shipped to the job site.

D. Carefully follow Manufacturer's instructions for moving tanks into final position. Remove all rocks and debris from path of travel and final tank resting place.

E. Tanks damaged beyond repair shall be replaced with undamaged tanks.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Belding Tank Technologies.

B. Design Tanks

2.02 SERVICE CONDITIONS

A. Tanks shall suitable for the conditions shown in the Schedule(s) at the end of this Section:

2.03 TANK CLASSIFICATION

A. Tanks shall be classified according to type as follows:

1. Type I – Atmospheric pressure tanks vented directly to the atmosphere, designed for pressure no greater or lower than atmospheric.
2. Type II - Atmospheric pressure tanks vented directly into a fume conservation system and designed to withstand the specified positive and negative pressure given in the Schedule(s) of this section. Pressure shall not exceed 14 inches of water when all tie-down lugs are properly secured.
3. Grade 1 - (Premium) Tanks manufactured using a vinyl ester resin throughout.
4. Grade 2 - (Standard) Tanks manufactured using a vinyl ester resin in the corrosion barrier laminate and an isophthalic polyester resin the in structural laminate.
5. Grade 3 - (Economy) Tanks manufactured using an isophthalic polyester resin throughout.

2.04 MATERIALS

A. Resin

1. The resins used shall be a corrosion resistant vinyl ester or isophthalic polyester thermoset resin that has been determined by previous documented service to be acceptable for the specified service conditions.
2. The resin shall contain no pigments, colorants, or fillers unless specified in the Schedule(s) at the end of this Section.
3. An ultraviolet absorber shall be added to the exterior resin layer.
4. 3-5% Antimony Trioxide may be added to halogenated resin in the structural laminate only, to increase the ignition resistance of the resin.

B. Reinforcement

1. The inner surface reinforcement shall consist of either a synthetic fiber veil or a chemical resistant glass veil. The surfacing veil shall contain a coupling agent or binder that is compatible with the corrosion barrier resin. Veil thickness shall be 10 mil. minimum.
2. Chopped strand mat or gun applied chopped strands shall be constructed from single-end type E-glass strands 1/2" minimum to 2" maximum length. The coupling agent or binder shall be compatible with the resin used.
3. Continuous roving filament winding shall be a single-end type E-glass reinforcement with 250 yards/pound yield. The coupling agent or binder shall be compatible with the resin used.
4. Woven roving shall be minimum 24 ounces/square yard and compatible with the resin used.

2.05 LAMINATE CONSTRUCTION

A. Structural Tank - The laminate comprising the structural tank (bottom head, sidewall, and top head) shall consist of four separate layers. These are the inner surface and the interior layer which make up the corrosion barrier, the structural layer, and exterior surface.

1. Inner Surface - The inner surface exposed to the chemical environment shall be a resin rich layer 0.010 to 0.020 inch thick, reinforced with a surfacing veil. The glass content shall be 10% by weight maximum in this layer.
2. Interior Layer - The interior layer shall consist of a resin rich laminate reinforced with chopped strands.

    a. Corrosion Barrier - The glass content of the inner surface and the interior layer combined shall be 27% +/- 5% by weight. The combined thickness of the inner surface and the interior layer shall not be less than 0.100 inch.

3. Structural Layer

    a. Contact Molded Structural Layer - Subsequent reinforcement shall be comprised of alternating layers of chopped strands and such additional number of plies of woven roving to a thickness as required to meet the physical properties that are used for the design. Each successive ply or pass of reinforcement shall be well rolled prior to the application of additional reinforcement. All woven shall be overlapped 1". Laps in subsequent layers shall be staggered at least 3" from laps in the preceding layer. All woven roving shall be followed by chopped strands without exception.
    b. Filament Wound Structural Layer - Subsequent reinforcement shall be continuous strand roving. Glass content of the filament wound structural layer shall be 50% to 80% by weight. The thickness of the filament wound portion of the tank shell will vary with tank height (tapered wall construction). If additional axial strength is required, the use of chopped strands or unidirectional glass strands interspersed between wind

layers is acceptable.

4. Exterior Surface - The outer surface shall be coated with a resin rich layer for spill protection. Where air inhibited resin is exposed to air during cure, a full surface cure shall be obtained by coating the surface with a coat of resin containing 0.2% to 0.6% paraffin wax surfacing agent and ultraviolet absorbers. This layer may contain pigments, or fire-retardant additives if specified.

2.06 JOINTS

A. The cured resin surfaces of parts to be joined shall be ground to expose the glass fiber reinforcement. The ground area shall extend beyond the lay-up areas so that no reinforcement is applied to an unprepared surface. The surface shall be clean and dry before lay-up. The entire ground area shall be coated with paraffinated resin after joint overlay is made.

B. The gap between bell and spigot joints shall be filled with a resin pour to eliminate any air pockets between the two pieces to be joined.

C. Highly filled resin putty shall be spread over the crevices and irregular shapes between joined pieces, leaving a smooth surface for lay-up.

D. The width of the first layer of joint overlay shall be 6” minimum. Successive layers shall increase 1” width minimum, to form a smooth contour laminate that is centered on the joint +/- 1/2 inch.

2.07 FITTINGS AND ACCESSORIES

A. The surfaces of fittings and accessories exposed to product shall have the same corrosion barrier laminate as specified above.

B. The cut edges of all laminates exposed to the product shall be sealed with the corrosion barrier laminate as specified above. Where shape, thickness, or other restrictions preclude covering the edges with the corrosion barrier laminate, the edges shall be coated with paraffinated resin.

C. Nozzle and manway installation shall follow the requirements of ASTM D-3299 or D-4097 for minimum installation standards.

D. Nozzle and manway cutout reinforcement, where a tank sidewall or head is cut in an area bearing hydrostatic pressure, the cutout reinforcing laminate shall not be less than two times the nominal nozzle diameter. For nozzles less than 6” diameter, the reinforcement diameter shall be the nozzle size plus 6”.

2.08 TANK FITTINGS

A. Flanged Nozzles - Dimensions for flanged nozzles shall be per chart. The nozzle shall be of hand lay-up construction. Press molded flanges attached to pipe with adhesive are not acceptable.

Flange Size	Flange Face O.D. (Max.)	Bolt Circle	Bolt Hole Size	Flange Face Thickness	PSI Rating	Bolts (Qty) Size
1”	4-3/4”	3-1/8”	5/8”	11/16”	150	(4) - 1/2
1-1/2”	5-1/2”	3-7/8”	5/8”	11/16”	150	(4) - 1/2
2”	6-1/2”	4-3/4”	3/4”	3/4”	150	(4) - 5/8
2-1/2”	7-1/2”	5-1/2”	3/4”	3/4”	150	(4) - 5/8

3”	8”	6”	3/4”	7/8”	150	(4) - 5/8
4”	9-1/2”	7-1/2”	3/4”	1”	150	(8) - 5/8
6”	11-1/2”	9-1/2”	7/8”	1”	100	(8) - 3/4
8”	14”	11-3/4”	7/8”	13/16”	50	(8) - 3/4
10”	16-1/2”	14-1/4”	1”	15/16”	50	(12) - 7/8
12”	19-1/2”	17”	1”	1-1/16”	50	(12) - 7/8

B. Outlet Fittings:

1. Siphon Drain Flange – Flanged outlet connection at the base of tank with integral section of piping extending from connection point to near base of tank interior.

C. Couplings, nipples, pipe stubs shall be of filament wound or contact molded construction. Press molded fittings are not acceptable.

D. Top and side manways shall be constructed per manufacturer’s standards using hand lay-up construction and of the same materials as the tank they are installed in. Prefabricated press molded flat plate side manhole covers are not acceptable.

E. Hold down lugs or plates shall be installed on all tanks. The size and number of hold down lugs shall depend on wind, seismic, and other loads the tank will be subjected to during normal operation.

F. Lifting lugs shall be installed on tanks over 200 pounds weight unless otherwise specified.

2.09 TANK ACCESSORIES

A. Flexible Connections:

1. Provide flex connectors suitable for connection to chemical storage tank, compatible with media stored within tank, with vertical and horizontal movement characteristics per chemical tank manufacturer’s recommendations. Flex connectors shall be one of following:

a. FKM expansion joints, Ethylene Flexijoint or equal, for each tank connection location. Expansion joints shall have a minimum of 3 convolutions, stainless steel limit cables, and FRP composite flanges. Expansion joints shall have the following minimum performance requirements:

1) Axial Compression ≥ 0.67”
2) Axial Extension ≥ 0.67”
3) Lateral Deflection ≥ 0.51”
4) Angular Deflection ≥ 14º
5) Torsional Rotation ≥ 4º

b. Hose connections:

1) Provide Ultra High Molecular Weight (UHMWPE) hose with two King nipples (barbed) and mechanically attached with double stainless steel bands securing hose to nipples.
2) Flex connector size per tank connection.
3) Flanged connections.
4) Fasteners shall be compatible for media stored in tank.

B. Flanged Lips:

1. Flanged lips shall be constructed as an integral part of the tank wall.
2. Lip shall be supplied without bolt holes unless tank is equipped with a bolt down lid or otherwise specified.

C. Manways:

1. Bolted Manways

a. Manways shall be 24-inch in diameter.
b. Manway cover shall be constructed of the same fiberglass reinforced plastic material as the tank.
c. Manway bolts shall be polyethylene, nylon or a compatible plastic material.
d. Manways shall be fume tight.

D. Fill/Down Pipe:

1. Provide fill piping, diameter as specified in Table(s) in this Section and/or as shown on the Drawings to extend down into tank within 1 foot of tank bottom.
2. Pipe shall be supported maximum 5 foot intervals with support structures.
3. Provide two 3/8-inch holes in the fill pipe inside the tank above the overflow elevation to prevent formation of a siphon at completion of filling operations.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install tanks in accordance with manufacturer's written instructions.

B. Flat and sloped bottom tanks shall be installed on a smooth, flat surface free from foreign objects and debris. Contractor shall provide, at a minimum, two layers of 30-pound roofing felt between the tank and installation surface.

3.02 IDENTIFICATION

A. Provide equipment identification marker complete with equipment name and tag number in accordance with Section 10 14 10. Equipment identification markers molded into the exterior tank resin are not acceptable. Coordinate field location with Engineer.

3.03 FIELD QUALITY CONTROL

A. Manufacturer's Field Services:

1. Supplier's or manufacturer's representative for equipment specified herein shall be present at jobsite or classroom designated by Owner for man-days indicated, travel time excluded, for assistance during plant construction, plant startup, and training of Owner's personnel for plant operation. Include:

a. 1 workday for Installation Services.

2. Supplier or manufacturer shall direct services to system and equipment operation, maintenance, troubleshooting, and equipment and system-related areas other than wastewater treatment process. See Section 01 61 00.
3. In addition to the services specified above, provide manufacturer’s services as required to successfully complete systems demonstration as specified in Section 01 79 10.

3.04 DEMONSTRATION

A. Testing:

1. After completion of field installation, fill tanks with water and allow to stand full for 48 hours. During testing, nozzles may be plugged by installation of temporary blind flanges on outside of tank.
2. Leaks or indications of leaks in tank or accessory connections may be repaired where permitted by Engineer, in manner recommended by manufacturer. Evidence of leakage may be cause for rejecting tank.
3. Repeat test after leaks are repaired.

Section 43 41 43
Schedule 1 – Tank Schedule

Tank	Chemical Stored	Conc. / Specific Gravity	Location Interior / Exterior	Nominal Capacity	Maximum Diameter/ Height	Tank Type	Tank Resin	Color	Gasket Material	Bolt Material
Sodium Hypochlorite Day Tank T-4 NAOC-T-4	Sodium Hypochlorite	12.5% 1.2 SG	Interior	1,000 gallons	5'-4" D 7'-2" H	Type 1	Grade 1	White	Viton	Titanium
Sodium Hypochlorite Day Tank T-5 NAOC-T-5	Sodium Hypochlorite	12.5% 1.2 SG	Interior	1,000 gallons	5'-4" D 7'-2" H	Type 1	Grade 1	White	Viton	Titanium

Section 43 41 43
Schedule 2 – Tank Fitting and Accessory Schedule

Tank	Sodium Hypochlorite Day Tank T-4 NAOC-T-4	Sodium Hypochlorite Day Tank T-5 NAOC-T-5
Inlet / Fill	2-inch, side	2-inch, side
Outlet	1-inch, bottom	1-inch, bottom
Overflow	2-inch, side	2-inch, side
Vent	2-inch, top	2-inch, top
Level Sensor	6-inch, top	6-inch, top
Manway	Bolted	Bolted
Float Switch	6-inch, top	6-inch, top

END OF SECTION

DIVISION 46

WATER AND WASTEWATER EQUIPMENT

SECTION 46 33 00
CHEMICAL FEED SYSTEMS

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Sodium Hypochlorite Metering Skid 1 (NAOC-M-1)

a. Sodium Hypochlorite Metering Pump P-3, P-4, P-5, and P-6 (NAOC-P-3, -4, -5, and -6)
b. Wiring junction box (NAOC-JBX-1).
c. Outlet box (NAOC-JBX-2).
d. Disconnect switch.
e. Piping, tubing, pressure relief valves, ball valves, pulsation dampeners, pressure gauges, etc. pre-mounted on pump skids.
f. Two (2) duplex skids shall be piped so they can be connected to produce a four (4) pump skid assembly.

2. Aqua Ammonia Metering Skid 1 (NHOH-M-1)

a. Aqua Ammonia Metering Pump P-1 and P-2 (NHOH-P-1 and NHOH-P-2)
b. Wiring junction box (NHOH-JBX-1).
c. Outlet box (NHOH-JBX-2).
d. Disconnect switch.
e. Piping, tubing, pressure relief valves, ball valves, pulsation dampeners, pressure gauges, etc. pre-mounted on pump skid.

3. Sodium Hydroxide Metering Skid 1 (NAOH-M-1)

a. Sodium Hydroxide Metering Pump P-1, P-2, and P-3 (NAOH-P-1, -2, and -3)
b. Wiring junction box (NAOH-JBX-1).
c. Outlet box (NAOH-JBX-2).
d. Disconnect switch.
e. Piping, tubing, pressure relief valves, ball valves, pulsation dampeners, pressure gauges, etc. pre-mounted on pump skid.

1.02 SYSTEM DESCRIPTION

A. Performance Requirements:

1. Pumping equipment shall comply with Chemical Feed System Schedule(s).
2. Equipment shall be suitable for continuous operation at maximum fluid temperature of 104 degrees F at all operating speeds specified.
3. Equipment shall be free from shock, vibration, cavitation, overheating, and noise while operating at specified conditions.
4. Design equipment so parts readily accessible for inspection and repair, easily duplicated and replaced, and suitable for service specified.

1.03 SUBMITTALS

A. General:

1. Submit Product Data in sufficient detail to confirm compliance with requirements of this Section. Submit Product Data and Shop Drawings in one complete submittal package. Partial submittals are unacceptable.

B. Product Data:

1. Catalog cuts and product specifications for chemical feed equipment specified.
2. Motor data. Submit in accordance with Section 26 05 84.
3. Coating systems to comply with Manufacturer's recommendation for chemicals used.

C. Shop Drawings:

1. Installation and assembly drawings and specifically prepared technical data for chemical feed equipment.
2. Wiring Diagrams: Show power and control connections and distinguish between factory-installed and field-installed wiring.
3. Equipment weights.

D. Submit in accordance with Section 01 33 00.

E. Operation and Maintenance (O&M) Data:

1. Operating instructions and maintenance data for materials and products for inclusion in O&M Manual.
2. Manufacturer's written instructions for periodic tests of equipment in service.
3. Submit in accordance with Section 01 78 23.

F. Submit Instructional Services information in accordance with Section 01 79 30.

1.04 DELIVERY, STORAGE, AND HANDLING

A. All equipment and parts shipped to the job site shall be properly protected from the elements so that no damage or deterioration occurs from the time of delivery to the time when the installation is complete and the units are placed into operation.

B. Manufacturer shall define the requirements to properly protect the equipment and parts shipped to the job site, during storage, and during installation.

1.05 MAINTENANCE

A. Furnish extra materials matching products installed, as described below, packaged with protective covering for storage, and identified with labels describing contents.

1. Supply four spare tube elements of the specified size per pump.

1.06 WARRANTY

A. The chemical feed skid manufacturer shall furnish a minimum two (2) year warranty after substantial completion for all components of the skid.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Valmet.

B. Watson-Marlow.

2.02 MATERIALS

A. Suitable for application specified in the Chemical Feed System Schedule(s).

2.03 CHEMICAL METERING PUMPS

A. Pumps shall be positive displacement, peristaltic type type tubing with brushless variable speed motor, non spring loaded rotor assembly located in the pump head, integral tube failure detection system, and flexible tubing with attached connection fittings. There shall be no valves, diaphragms, springs or dynamic seals in the fluid path. Process fluid shall contact the pump tubing assembly and connection fittings only. Pumps shall be capable of self-priming at the rated maximum pressure of 125 PSI and shall be capable of running dry without damage. Pump rollers shall be capable of operation in either direction at the maximum rated pump pressure. Suction lift shall be up to 30 feet of water.

B. Peristaltic pumping action is created by the compression of the flexible tube between the pumphead rollers and track, induced forward fluid displacement within the tube by the rotation of the pump rotor, and subsequent vacuum-creating restitution of the tube.

C. Pump shall not use check valves or diaphragms and shall not require dynamic seals in contact with the pumped fluid. Process fluid shall be contained within pump tubing and shall not directly contact any rotary or metallic components.

D. Flow shall be in the direction of the rotor rotation, which can be reversed and shall be proportional to rotor speed.

2.04 PUMP CONSTRUCTION

A. Pump:

1. General:

a. Horizontal, Positive displacement, peristaltic tube pump.
b. Capable of operating in either direction without flow variation.
c. Capable of running dry without damage to pump or tube.
d. Capable of pulling 95% of full vacuum
e. Repeatability: + 1% accuracy
f. Valveless/Glandless design. No seals in contact with the pumped product.

2. Pump Head

a. Pump head to consist of a fixed track with a thumb screw guard door and plunger type safety interlock, cartridge roller assembly and non-contact capacitance hose leak detection system.
b. Serviceable split cartridge rotor assembly made of chemical resistant polymer equipped with two self-lubrication compression rollers and two guide rollers and shall not contain metallic spring-loaded arms or guide pins.
c. Compression rollers shall be located 180 degrees apart for compression of the tube against the track twice per rotor revolution.
d. One compression roller will be fully engaged all the time with the tube providing complete compression to prevent backflow or siphoning.
e. Tube occlusion to be factory set.
f. The cartridge roller rotor assembly to be axially secured to the self-locating ‘D’ shaped

output shaft of the drive gear motor and held in place by the guard door allowing rapid exchange of the assembly without the use of tools.

g. Pump head track to be secured to pump casing.

3. Pump Tube Assembly

   a. Tube material shall be as noted in the Chemical Feed System Schedules.
   b. Tube size shall comply with flow rate requirement as stated in the Chemical Feed System Schedules.
   c. Pump tubing in contact with the inside diameter of the track housing through an angle of 180 degrees and held in place on the suction and discharge by the track housing and self-locating tube ends.
   d. The replacement of the tube element shall be achieved without the disassembly of the pump head and without the use of tools.
   e. Pump shall readily accept multiple tube sizes without pump adjustment or replacement.

4. Materials of Construction

   a. Pump Housing: pressure cast grade 413 aluminum with polyester powder coating.
   b. Cover: clear acrylic with pressed in stainless steel sealed ball bearing for shaft support.
   c. Pump rotor: serviceable split rotor, Polybutylene Terephthalate (PBT).
   d. Track: single piece PBT 30% glass filled.
   e. Pump head to consist of a fixed track with a thumb screw guard door and plunger type safety interlock, cartridge roller rotor assembly and non-contact capacitance hose leak detection system.
   f. Serviceable split cartridge rotor assembly made of chemical resistant polymer equipped with two self-lubrication compression rollers and two guide rollers.
   g. Compression rollers shall be located 180 degrees apart for compression of the tube against the track twice per rotor revolution.
   h. One compression roller will be fully engaged all the time with the tube providing complete compression to prevent backflow or siphoning.
   i. The pump head cover shall be clear, acrylic thermoplastic with an integral ball bearing fitted to support the load of the motor shaft.
   j. Cover shall be positively secured to the pump head using a minimum of four thumb screws. Tools shall not be required to remove the pump head cover.

5. Connectors

   a. Suction and discharge connection size shall be be 3/8-inch tubed connections, 1/2-inch barbed or 1/2-inch MNPT connections as approved by NSF.
   b. Suction and discharge nozzles shall by Kynar PVDF.
   c. Connection fittings shall be permanently affixed to the tubing by direct over-molding of the plastic fitting
   d. In order to prevent tubing misalignment and ensure accuracy, fittings shall insert into keyed slots located in the pump head and secured in place by the pump head cover

6. Leak Detector

   a. Non capacitance hose leak detector located behind the pump head. The head will not have any intrusive holes drilled or pins for leak detection.
   b. Leak detector system shall trigger relay (6 amp) and/or four(0.5-2 amp) contact closure outputs to communicate to external devices.

2.05 PUMP DRIVE SYSTEM

A. Servo permanent magnet DC with integral gearbox.

B. Zero maintenance brushless DC motor.

C. Drive speed: Infinitely variable within a 5000:1 speed control range.

D. Maximum motor speed shall be 175 RPM.

2.06 SYSTEM COMPONENTS

A. Calibration Columns:

1. Supply Calibration Column made of clear PVC or Acrylic cylinder materials, sealed on both ends with appropriately sized NPT threaded ports both top and bottom. Graduation markings shall be in fractions of gallons or milliliters in proportion to the size of the column.
2. Column shall be sized to allow a minimum 30-second draw down at maximum pump speed.

B. Pressure Relief Valve:

1. Supply pressure relief valve with CPVC body and PTFE/EPDM diaphragm. For the NHOH and NAOH system, pressure relief valves shall be 304SS construction.
2. Relief pressure shall be adjustable from 0-150 psi.
3. Connections shall be designed with unions & socket welded.

C. Discharge Gauge with Diaphragm Seal:

1. Discharge pressure gauge shall have a 3.5” dial with a liquid filled case, stainless steel tube and socket with a pressure range of 0-160 psig
2. Discharge gauge shall be assembled to a diaphragm seal with a Teflon diaphragm and 1/2” NPT PVC process connection. For the NAOH and NHOH system, process connection shall be 304SS construction.

D. Chemical Metering Skid

1. The chemical metering skid shall be constructed from Polyethylene, 100% UV stabilized. Metallic and or thermoplastic welded skids are not acceptable.
2. The skid shall be of a rotationally molded construction. Bolted or screwed construction is not acceptable.
3. The design of the skid shall be of single piece construction to include a solid base, back panel and side panels integrally molded with an open front and top to ensure ease of access to all components.

    a. A minimum 1-3/4-inch lip shall be provided on the base of the skid to offer a spill containment basin.
    b. A drain plug is to be provided for wash down purposes.
    c. Single Wall thickness of 1/4” with 1/2” double wall construction.
    d. Containment bases that are not integral to the construction of the skid are not acceptable.
    e. Construction that incorporates weld seems are not acceptable.
    f. The skid shall sit on a FRP strut table to prevent any equipment from touching the ground. The lift kit shall be provided by the same manufacturer as the skid itself.

4. In order to provide a four (4) pump system, two (2) duplex skids shall be piped together to meet the requirements.

E. Isolation Valves:

1. All Ball Valves, sizes 1/2" to 4", shall be of true union design with two-way blocking capability. All O-rings shall be EPDM or FPM based on chemical being pumped. Seats shall have elastomeric backing cushion of the same material as the valve seals. Stem shall have double O-rings and be of blowout-proof design. The SCH 80 PVC & CPVC ball valves shall have a pressure rating of 250 psi for sizes 1/2" to 2" and 235 psi for 2-1/2" to 4" at 70 º F. For the NAOH and NHOH system, ball valves shall be 304SS construction.

F. Piping:

1. Chlorinated Polyvinylchloride (CPVC) Pipe and fittings shall be manufactured of Rigid CPVC schedule 80. Fittings shall be heavy-duty Schedule 80 molded fittings. For the NAOH and NHOH system, all piping shall be 304SS construction.

G. Junction Boxes

1. Junction boxes shall be NEMA 4X and supplied with weatherproof outlets.

H. Controls For Variable Speed Operation:

1. Control circuitry shall be integral to the pump and capable of adjusting the pump motor speed from 0.02% to 100.00% in 0.01% increments (5000:1 turndown ratio).
2. The pump output shall be capable of being manually controlled via front panel user touchpad controls. The pump motor speed shall be adjustable from 0.02% to 100.00% in 0.01% increments.
3. The pump output shall be capable of being remotely control via 4-20mA analog input. The input resolution shall be 0.01 of input value and capable of adjusting the pump motor speed from 0% to 100.0% motor speed in 0.1% increments. Four values shall be user configurable to define the low and high points on the output slope; a low input value, the required pump percentage of motor speed at the low input value, a high input value, the required pump percentage of motor speed at the high input value.
4. Drives shall be provide the following signals to the plant Process Control System:

    a. 4-20 mA analog output signals:

        1) Pump Speed

    b. 120 VAC discrete output contacts:

        1) Pump Running
        2) Common Alarm
        3) Common Fail
        4) Pump in Auto

5. Drives shall recieve the following signals to the plant Process Control System:

    a. 4-20 mA analog input signals:

        1) Pump Speed Command

    b. 120 VAC discrete input contacts:

        1) Pump Required

2.07 COATINGS

A. Provide in accordance with Section 09 96 00 unless specified otherwise in this Section.

B. Manufacturer is responsible for surface preparation, prime coat, and second coat of equipment in the factory prior to shipment unless otherwise noted.

C. Manufacturer is responsible for the surface preparation and all motor coatings in the factory prior to shipment.

D. Contractor shall provide final third finish coat for equipment in the field and be responsible for touchup and any additional specified coatings.

E. Stainless steel, bronze, and nonmetallic surfaces shall not be coated.

F. Coat machined or bearing surfaces and holes with protective grease.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install chemical feed equipment in accordance with manufacturer's written instructions.

3.02 IDENTIFICATION

A. Provide equipment identification marker complete with equipment name and tag number in accordance with Section 10 14 10. Coordinate field location with Engineer.

3.03 FIELD QUALITY CONTROL

A. Manufacturer's Field Services:

1. Supplier's or manufacturer's representative for equipment specified herein shall be present at jobsite or classroom designated by Owner for workdays indicated, travel time excluded, for assistance during plant construction, plant startup, and training of Owner's personnel for plant operation. Include:

   a. 3 workdays for Installation Services.
   b. 3 workdays for Instructional Services.
   c. 1 workday for Post Startup Services.

2. In addition to the services specified above, provide manufacturer’s services as required to successfully complete systems demonstration as specified in Section 01 79 10.

CHEMICAL FEED SYSTEM SCHEDULE 1	
System	Sodium Hypochlorite Metering Skid 1
Pumps	Sodium Hypochlorite Metering Pump P-3, P-4, P-5, and P-6 (NAOC-P-3, -4, -5, and -6)
Number of Pumps	4
Configuration	Tri-discharge
Fluid Pumped	Sodium Hypochlorite
Concentration (Percent by Volume)	12.5%
Specific Gravity	1.2
Tube Material	FKM
Piping and Valve Material	CPVC
Maximum Suction Lift (ft)	4
Motor Horsepower	1/2
Motor Voltage	460
Constant or Variable Speed	Variable Speed
Tube Connection, M/NPT	1/2
Installation	Table Mount
Design Operating Point	
Capacity (gph)	40
Total Dynamic Head (psi)	50
rpm = revolutions per minute gph = gallons per hour psi = pound per square inch ft = feet	

CHEMICAL FEED SYSTEM SCHEDULE 2	
System	Aqua Ammonia Metering Skid 1 (NHOH-M-1)
Pumps	Aqua Ammonia Metering Pump P-1 and P-2 (NHOH-P-1 and NHOH-P-2)
Number of Pumps	2
Configuration	Single Discharge
Fluid Pumped	Aqua Ammonia
Concentration (Percent by Volume)	19.5%
Specific Gravity	0.90
Tube Material	EPDM
Piping and Valve Material	304SS
Maximum Suction Lift (ft)	5
Motor Horsepower	1/2
Motor Voltage	460
Constant or Variable Speed	Variable Speed
Tube Connection, M/NPT	1/2"
Installation	Table Mount
Design Operating Point	
Capacity (gph)	12
Total Dynamic Head (psi)	50
rpm = revolutions per minute gph = gallons per hour psi = pound per square inch ft = feet	

CHEMICAL FEED SYSTEM SCHEDULE 3	
System	Sodium Hydroxide Metering Skid 1 (NAOH-M-1)
Pumps	Sodium Hydroxide Metering Pump P-1, P-2, and P-3 (NAOH-P-1, -2, and -3)
Number of Pumps	3
Configuration	Dual Discharge
Fluid Pumped	Sodium Hydroxide
Concentration (Percent by Volume)	50%
Specific Gravity	1.3
Tube Material	EPDM
Piping and Valve Material	304SS
Maximum Suction Lift (ft)	4
Motor Horsepower	1/2
Motor Voltage	460
Constant or Variable Speed	Variable Speed
Tube Connection, M/NPT	1/2-inch
Installation	Table Mount
Design Operating Point	
Capacity (gph)	12
Total Dynamic Head (psi)	50
rpm = revolutions per minute gph = gallons per hour psi = pound per square inch ft = feet	

END OF SECTION

APPENDIX

APPENDIX

TABLE OF CONTENTS

Contractor's Application for Payment

Owner:		**Owner's Project No.:**	
Engineer:		**Engineer's Project No.:**	
Contractor:		**Contractor's Project No.:**	
Project:			
Contract:			
Application No.:		**Application Date:**	
Application Period:	**From**	**to**	

1. Original Contract Price			$ -
2. Net change by Change Orders			$ -
3. Current Contract Price (Line 1 + Line 2)			$ -
4. Total Work completed and materials stored to date (Sum of Column G Lump Sum Total and Column J Unit Price Total)			$ -
5. Retainage			
a. _____ X	$ -	Work Completed	$ -
b. _____ X	$ -	Stored Materials	$ -
c. Total Retainage (Line 5.a + Line 5.b)			$ -
6. Amount eligible to date (Line 4 - Line 5.c)			$ -
7. Less previous payments (Line 6 from prior application)			
8. Amount due this application			$ -
9. Balance to finish, including retainage (Line 3 - Line 4 + Line 5c)			$ -

Contractor's Certification

The undersigned Contractor certifies, to the best of its knowledge, the following:
(1) All previous progress payments received from Owner on account of Work done under the Contract have been applied on account to discharge Contractor's legitimate obligations incurred in connection with the Work covered by prior Applications for Payment;
(2) Title to all Work, materials and equipment incorporated in said Work, or otherwise listed in or covered by this Application for Payment, will pass to Owner at time of payment free and clear of all liens, security interests, and encumbrances (except such as are covered by a bond acceptable to Owner indemnifying Owner against any such liens, security interest, or encumbrances); and
(3) All the Work covered by this Application for Payment is in accordance with the Contract Documents and is not defective.

Contractor: _____

Signature: _____ **Date:** _____

Recommended by Engineer	**Approved by Owner**
By:	**By:**
Title:	**Title:**
Date:	**Date:**
Approved by Funding Agency	
By:	**By:**
Title:	**Title:**
Date:	**Date:**

Progress Estimate - Lump Sum Work | **Contractor's Application for Payment**

Owner: ____________________ **Owner's Project No.:** __________
Engineer: ____________________ **Engineer's Project No.:** __________
Contractor: ____________________ **Contractor's Project No.:** __________
Project: ____________________
Contract: ____________________

Application No.: __________ **Application Period:** **From** __________ **to** __________ **Application Date:** __________

A	B	C	D	E	F	G	H	I
			Work Completed					
Item No.	Description	Scheduled Value ($)	(D + E) From Previous Application ($)	This Period ($)	Materials Currently Stored (not in D or E) ($)	Work Completed and Materials Stored to Date (D + E + F) ($)	% of Scheduled Value (G / C) (%)	Balance to Finish (C - G) ($)
			Original Contract					
			-			-		-
						-		-
						-		-
						-		-
						-		-
						-		-
						-		-
						-		-
						-		-
						-		-
						-		-
						-		-
						-		-
						-		-
						-		-
						-		-
						-		-
						-		-
						-		-
						-		-
	Original Contract Totals	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**		**$ -**

Progress Estimate - Lump Sum Work

Contractor's Application for Payment

Owner: ____________________

Engineer: ____________________

Contractor: ____________________

Project: ____________________

Contract: ____________________

Owner's Project No.: ____________

Engineer's Project No.: ____________

Contractor's Project No.: ____________

Application No.: ____________ **Application Period:** From ____________ to ____________ **Application Date:** ____________

A	B	C	D	E	F	G	H	I
			Work Completed					
Item No.	Description	Scheduled Value ($)	(D + E) From Previous Application ($)	This Period ($)	Materials Currently Stored (not in D or E) ($)	Work Completed and Materials Stored to Date (D + E + F) ($)	% of Scheduled Value (G / C) (%)	Balance to Finish (C - G) ($)
			Change Orders					
						-		-
						-		-
						-		-
						-		-
						-		-
						-		-
						-		-
						-		-
						-		-
						-		-
						-		-
						-		-
						-		-
						-		-
						-		-
						-		-
						-		-
						-		-
						-		-
						-		-
	Change Order Totals	$ -	$ -	$ -	$ -	$ -		$ -
			Original Contract and Change Orders					
	Project Totals	$ -	$ -	$ -	$ -	$ -		$ -

Progress Estimate - Unit Price Work

Contractor's Application for Payment

Owner: ______________________
Engineer: ______________________
Contractor: ______________________
Project: ______________________
Contract: ______________________

Owner's Project No.: __________
Engineer's Project No.: __________
Contractor's Project No.: __________

Application No.: __________ **Application Period:** From __________ to __________ **Application Date:** __________

A	B	C	D	E	F	G	H	I	J	K	L
		Contract Information				Work Completed					
Bid Item No.	Description	Item Quantity	Units	Unit Price ($)	Value of Bid Item (C X E) ($)	Estimated Quantity Incorporated in the Work	Value of Work Completed to Date (E X G) ($)	Materials Currently Stored (not in G) ($)	Work Completed and Materials Stored to Date (H + I) ($)	% of Value of Item (J / F) (%)	Balance to Finish (F - J) ($)
Original Contract											
					-		-		-		-
					-		-		-		-
					-		-		-		-
					-		-		-		-
					-		-		-		-
					-		-		-		-
					-		-		-		-
					-		-		-		-
					-		-		-		-
					-		-		-		-
					-		-		-		-
					-		-		-		-
					-		-		-		-
					-		-		-		-
					-		-		-		-
					-		-		-		-
					-		-		-		-
					-		-		-		-
					-		-		-		-
					-		-		-		-
Original Contract Totals					$ -		$ -	$ -	$ -		$ -

Progress Estimate - Unit Price Work

Contractor's Application for Payment

Owner: ______________________ **Owner's Project No.:** ____________

Engineer: ______________________ **Engineer's Project No.:** ____________

Contractor: ______________________ **Contractor's Project No.:** ____________

Project: ______________________

Contract: ______________________

Application No.: ____________ **Application Period:** From ____________ to ____________ **Application Date:** ____________

A	B	C	D	E	F	G	H	I	J	K	L
		Contract Information				Work Completed					
Bid Item No.	Description	Item Quantity	Units	Unit Price ($)	Value of Bid Item (C X E) ($)	Estimated Quantity Incorporated in the Work	Value of Work Completed to Date (E X G) ($)	Materials Currently Stored (not in G) ($)	Work Completed and Materials Stored to Date (H + I) ($)	% of Value of Item (J / F) (%)	Balance to Finish (F - J) ($)
Change Orders											
					-		-		-		-
					-		-		-		-
					-		-		-		-
					-		-		-		-
					-		-		-		-
					-		-		-		-
					-		-		-		-
					-		-		-		-
					-		-		-		-
					-		-		-		-
					-		-		-		-
					-		-		-		-
					-		-		-		-
					-		-		-		-
					-		-		-		-
					-		-		-		-
					-		-		-		-
					-		-		-		-
					-		-		-		-
					-		-		-		-
				Change Order Totals	$ -		$ -	$ -	$ -		$ -
Original Contract and Change Orders											
				Project Totals	$ -		$ -	$ -	$ -		$ -

Stored Materials Summary

Contractor's Application for Payment

Owner: _____
Engineer: _____
Contractor: _____
Project: _____
Contract: _____

Owner's Project No.: _____
Engineer's Project No.: _____
Contractor's Project No.: _____

Application No.: _____ **Application Period:** From _____ to _____ **Application Date:** _____

A	B	C	D	E	F	G	H	I	J	K	L	M
						Materials Stored			Incorporated in Work			
Item No. (Lump Sum Tab) or Bid Item No. (Unit Price Tab)	Supplier Invoice No.	Submittal No. (with Specification Section No.)	Description of Materials or Equipment Stored	Storage Location	Application No. When Materials Placed in Storage	Previous Amount Stored ($)	Amount Stored this Period ($)	Amount Stored to Date (G+H) ($)	Amount Previously Incorporated in the Work ($)	Amount Incorporated in the Work this Period ($)	Total Amount Incorporated in the Work (J+K) ($)	Materials Remaining in Storage (I-L) ($)
								-			-	-
								-			-	-
								-			-	-
								-			-	-
								-			-	-
								-			-	-
								-			-	-
								-			-	-
								-			-	-
								-			-	-
								-			-	-
								-			-	-
								-			-	-
								-			-	-
								-			-	-
								-			-	-
								-			-	-
								-			-	-
								-			-	-
					Totals	$ -	$ -	$ -	$ -	$ -	$ -	$ -

CERTIFICATE OF SUBSTANTIAL COMPLETION

Owner:
Engineer:
Contractor:
Project:
Contract Name:

Owner's Project No.:
Engineer's Project No.:
Contractor's Project No.:

This ☐ Preliminary ☐ Final Certificate of Substantial Completion applies to:

☐ All Work ☐ The following specified portions of the Work:

[Describe the portion of the work for which Certificate of Substantial Completion is issued]

Date of Substantial Completion: **[Enter date, as determined by Engineer]**

The Work to which this Certificate applies has been inspected by authorized representatives of Owner, Contractor, and Engineer, and found to be substantially complete. The Date of Substantial Completion of the Work or portion thereof designated above is hereby established, subject to the provisions of the Contract pertaining to Substantial Completion. The date of Substantial Completion in the final Certificate of Substantial Completion marks the commencement of the contractual correction period and applicable warranties required by the Contract.

A punch list of items to be completed or corrected is attached to this Certificate. This list may not be all-inclusive, and the failure to include any items on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

Amendments of contractual responsibilities recorded in this Certificate should be the product of mutual agreement of Owner and Contractor; see Paragraph 15.03.D of the General Conditions.

The responsibilities between Owner and Contractor for security, operation, safety, maintenance, heat, utilities, insurance, and warranties upon Owner's use or occupancy of the Work must be as provided in the Contract, except as amended as follows:

Amendments to Owner's Responsibilities: ☐ None ☐ As follows:

[List amendments to Owner's Responsibilities]

Amendments to Contractor's Responsibilities: ☐ None ☐ As follows:

[List amendments to Contractor's Responsibilities]

The following documents are attached to and made a part of this Certificate:

[List attachments such as punch list; other documents]

This Certificate does not constitute an acceptance of Work not in accordance with the Contract Documents, nor is it a release of Contractor's obligation to complete the Work in accordance with the Contract Documents.

ISSUED BY ENGINEER:	AUTHORIZED BY OWNER:	ACKNOWLEDGED BY CONTRACTOR:
By: _____	By: _____	By: _____
(Authorized signature)	Owner (Authorized Signature)	Contractor (Authorized Signature)
Title: _____	Title: _____	Title: _____
Date: _____	Date: _____	Date: _____

WORK CHANGE DIRECTIVE NO.: [Number of Work Change Directive]

Owner: Owner's Project No.:
Engineer: Engineer's Project No.:
Contractor: Contractor's Project No.:
Project:
Contract Name:
Date Issued: Effective Date of Work Change Directive:

Contractor is directed to proceed promptly with the following change(s):

Description:

[Description of the change to the Work]

Attachments:

[List documents related to the change to the Work]

Purpose for the Work Change Directive:

[Describe the purpose for the change to the Work]

Directive to proceed promptly with the Work described herein, prior to agreeing to change in Contract Price and Contract Time, is issued due to:

Notes to User—Check one or both of the following

☐ Non-agreement on pricing of proposed change. ☐ Necessity to proceed for schedule or other reasons.

Estimated Change in Contract Price and Contract Times (non-binding, preliminary):

Contract Price: $ _____ **[increase] [decrease] [not yet estimated]**.

Contract Time: _____ days **[increase] [decrease] [not yet estimated]**.

Basis of estimated change in Contract Price:

☐ Lump Sum ☐ Unit Price ☐ Cost of the Work ☐ Other

	Recommended by Engineer	Authorized by Owner
By:		
Title:		
Date:		

FIELD ORDER NO.: [Number of Field Order]

Owner:	Owner's Project No.:
Engineer:	Engineer's Project No.:
Contractor:	Contractor's Project No.:
Project:	
Contract Name:	
Date Issued:	Effective Date of Field Order:

Contractor is hereby directed to promptly perform the Work described in this Field Order, issued in accordance with Paragraph 11.04 of the General Conditions, for minor changes in the Work without changes in Contract Price or Contract Times. If Contractor considers that a change in Contract Price or Contract Times is required, submit a Change Proposal before proceeding with this Work.

Reference:

Specification Section(s):

Drawing(s) / Details (s):

Description:

[Description of the change to the Work]

Attachments:

[List documents supporting change]

Issued by Engineer

By: _____ *(signature)*

Title: _____ *(printed name)*

Date: _____

CERTIFICATE OF INSTALLATION SERVICES

Project

Equipment

Specification Section

Contract

I hereby certify the equipment supplier/manufacturer has inspected this equipment and that it has been properly installed, adjusted, and calibrated. I further certify this equipment may now be operated for test purposes and/or normal use.

MANUFACTURER'S REPRESENTATIVE

Signature	Date

Name (print)

Title

Representing

CONTRACTOR

Signature	Date

Name (print)

Title

Comments:

This form shall be completed and submitted to ENGINEER prior to training of OWNER'S personnel in accordance with Section 01 61 00.

CERTIFICATE OF INSTRUCTIONAL SERVICES

Project

Equipment

Specification Section

Contract

I hereby certify the equipment supplier/manufacturer has instructed OWNER'S personnel in the startup, operation, and maintenance of this equipment as required in the Specifications.

CONTRACTOR

Signature	Date

Name (print)

Title

I hereby certify that my operating personnel received _____ days instruction from

_____

for startup, operation, and maintenance of this equipment.

OWNER

Signature	Date

Name (print)

Title

Comments:

This form shall be completed and submitted to ENGINEER after training of OWNER'S personnel in accordance with Section 01 61 00.

CERTIFICATE OF POST STARTUP SERVICES

Project

Equipment

Specification Section

Contract

I hereby certify the equipment supplier/manufacturer has inspected this equipment, made adjustments and calibrations, and that it is operating in conformance with the design, Specification, and manufacturer's requirements. Notation of improper operation shall be detailed and recommendations made and attached to this form.

MANUFACTURER'S REPRESENTATIVE

Signature | Date

Name (print)

Title

Representing

CONTRACTOR

Signature | Date

Name (print)

Title

OWNER

Signature | Date

Name (print)

Title

Comments:

This form shall be completed and submitted to OWNER upon completion of the POST STARTUP SERVICES as required by the Specifications.

CHANGE ORDER NO. ____

CHANGE ORDER DATE OF ISSUANCE _____

COMMENCEMENT OF CONTRACT TIME _____

OWNER _____

CONTRACTOR _____

PROJECT _____ CONTRACT NO. _____

ENGINEER _____

YOU ARE DIRECTED TO MAKE THE FOLLOWING CHANGES IN THE CONTRACT DOCUMENTS:

DESCRIPTION:

REASON FOR CHANGE ORDER:

ATTACHMENTS:

CHANGE IN CONTRACT PRICE
Original Contract Price: $_____
Net increase (decrease) from previous Change Orders: $_____
Net increase (decrease) of this Change Order: $_____
Revised Contract Price: $_____

CHANGE IN CONTRACT TIMES
Original Contract Times: *(days or dates)* Substantial Completion: _____ Ready for Final Payment: _____
Net increase (decrease) from previous Change Orders: *(days)* Substantial Completion: _____ Ready for Final Payment: _____
Net increase (decrease) of this Change Order: *(days)* Substantial Completion: _____ Ready for Final Payment: _____
Revised Contract Times: *(days or dates)* Substantial Completion: _____ Ready for Final Payment: _____

CONTRACTOR agrees that this Change Order includes any and all costs associated with or resulting from the change ordered herein, including all impacts, delays, and accelerated costs. Other than the dollar amount and time allowance listed above, there shall be no other dollar or time compensation as a result of this Change Order.

THIS DOCUMENT SHALL BECOME AN AMENDMENT TO THE CONTRACT AND ALL STIPULATIONS AND COVENANTS OF THE CONTRACT SHALL APPLY HERETO.

RECOMMENDED:	APPROVED:	ACCEPTED:
By: _____	By: _____	By: _____
ENGINEER *(signature)*	OWNER *(signature)*	CONTRACTOR *(signature)*
_____	_____	_____
ENGINEER *(printed name)*	OWNER *(printed name)*	CONTRACTOR *(printed name)*
Date: _____	Date: _____	Date: _____

CONTRACTOR'S REQUEST FOR SUBSTITUTION

(Include With Submittal)

Provisions requiring submittal of this form are described in Specification Sections 01 33 00 and 01 61 00 and paragraph 6.05 of the General and Supplementary Conditions.

Substitution Request No.: _____

Project: _____

Contract: _____

We hereby apply for consideration of _____
(*Proposed Substitute Manufacturer*)
as a substitute manufacturer to the manufacturer(s) named in Specification Section _____

Paragraph/Drawing No. _____ for the following reasons. (*Check one or more.*)

_____ The specified equipment or material is unavailable or the time of delivery will substantially delay the construction of the project, but not as result of CONTRACTOR'S failure to pursue Work promptly or coordinate various activities. (*Provide supporting information.)*

_____ The proposed equipment or material will provide for packaging and coordination with other equipment from a single source supplier. *(Submit name of source supplier and other equipment to be packaged.)*

_____ The proposed equipment or material is a "Substitute Item" to that specified and the CONTRACTOR will provide the OWNER with a credit of $_____ if the equipment or material is accepted.

We certify that the proposed substitute will perform adequately the functions and achieve the results called for by the general design, be similar in substance to the specified, be suited to the same use as that specified, and will not prejudice CONTRACTOR'S achievement of Substantial Completion on time.

Contractor: _____

Signature: _____ Date: _____

Name (print): _____

Title: _____

NOTE: ENGINEER may require CONTRACTOR to furnish, at CONTRACTOR'S expense, additional data about the proposed substitute including but not limited to, an analysis by CONTRACTOR of the equivalency of the proposed substitute to the named item.

A. Physical Characteristics of Proposed Substitute (if applicable).

Operating Weight:_____ Height:_____ Width:_____ Depth:_____

Voltage:_____ Hertz:_____ KW or HP:_____

B. Will acceptance of the proposed substitute by the OWNER:

1. Require a change in the Drawings or Specifications: Yes_____ No_____
   If yes, attach an explanation and detailed drawings or specifications.

2. Require payment of any license fee or royalty: Yes_____ No_____
   If yes, attach an explanation.

3. Result in a change of contract time: Yes_____ No_____
   If yes, attach an explanation.

C. Variations of proposed substitute from specified material, equipment, methods or procedures include: *(If none, state none. Attach separate listing if more space is needed.)*

1. _____

2. _____

3. _____

4. _____

D. Service Source (Maintenance, Repair, and Replacement) Availability:

1. Name of Business:_____

   Address:_____

   Years in Business:_____ Factory Authorized: Yes_____ No_____

   Parts Stocked: Major: Yes_____ No_____ Minor: Yes_____ No_____

   Field Service Staff Available: Yes_____ No____

2. Name of Business:_____

   Address:_____

   Years in Business:_____ Factory Authorized: Yes_____ No_____

   Parts Stocked: Major: Yes_____ No_____ Minor: Yes_____ No_____

   Field Service Staff Available: Yes_____ No_____

E. Identify costs, direct or indirect, if any, associated with acceptance of this proposed substitute.
   (If none, state none.)

_____

_____

INSTALLATION LIST

Location:_____ Telephone No.:_____

Date Installed:_____ Date Started Up:_____

Owner's Representative to be Contacted:_____

Engineer's Representative to be Contacted:_____

Firm's Name:_____ Telephone No.:_____

*****

Location:_____ Telephone No.:_____

Date Installed:_____ Date Started Up:_____

Owner's Representative to be Contacted:_____

Engineer's Representative to be Contacted:_____

Firm's Name:_____ Telephone No.:_____

*****

Location:_____ Telephone No.:_____

Date Installed:_____ Date Started Up:_____

Owner's Representative to be Contacted:_____

Engineer's Representative to be Contacted:_____

Firm's Name:_____ Telephone No.:_____

*****

Location:_____ Telephone No.:_____

Date Installed:_____ Date Started Up:_____

Owner's Representative to be Contacted:_____

Engineer's Representative to be Contacted:_____

Firm's Name:_____ Telephone No.:_____

REQUEST FOR INFORMATION

Request No.	Date:
Contractor:	Specification Section / Drawing No.:
Project:	
Contract:	
This is a request for a information on the following:	
Prepared By:	Date Response Needed:
Response:	
Prepared By:	Date:
Response Returned to Contractor On:	
cc: Owner:_____ Resident Project Representative:_____	

CONTRACTOR'S SUBMITTAL TRANSMITTAL

CONTRACT: _____

DONOHUE	

To:
 	
//Donohue Shop Drawing Coordinator//
Donohue & Associates, Inc.
//3311 Weeden Creek Road//
//Sheboygan, WI 53081//
Phone: //920-803-7358//
Email: //person@donohue-associates.com//
	From:
	
	//INSERT CONTRACTOR NAME, ADDRESS, PHONE NUMBER, AND EMAIL//

Specification Section:	<<Section Number>> (same as selected in eCommunication database)
Donohue Title:	<<Section Title from TOC>> (same as selected in eCommunication database)
Description:	Xxxx xxxx xxxx (same as entered in eCommunication database)
Type:	(same as selected in eCommunication database)

Applicable Contract Clarification / Interpretation Request(s) were submitted and response(s) received:

_X_ No ___ Yes If Yes, List RFI Numbers:_____

Submittal includes variations from the requirements of the Contract Documents:

_X_ No ___ Yes If Yes, Variations are identified below and in accordance with paragraph 7.16 of the General Conditions:

Variations are as follows:

1. <<None>>

Contractor certifies that this submittal has been prepared in accordance with paragraph 7.16 of the General Conditions and Contractor has reviewed and approved this submittal in accordance with paragraph 7.16 of the General Conditions:

_X_ Yes ___ No

Contractor:	
Signature:	Date:
Name *(print):*	
Title:	

Terracon GeoReport

Geotechnical Engineering Report

Monroe WTP Feed Line Replacement
Bloomington, Indiana

December 28, 2022
Terracon Project No. CJ225329

Prepared for:
Donohue & Associates, Inc.
Indianapolis, Indiana

Prepared by:
Terracon Consultants, Inc.
Indianapolis, Indiana

December 28, 2022

Donohue & Associates, Inc. (Donohue)
8440 Allison Pointe Blvd, Suite 200
Indianapolis, IN 46250

Attn: Mr. Trent Montemayor, P.E., BCEE
P: (616) 201 2828
E: tmontemayor@donohue-associates.com

Re: Geotechnical Engineering Report
Monroe WTP Feed Line Replacement
Bloomington, Indiana
Terracon Project No. CJ225329

Dear Mr. Montemayor:

In accordance with your request, we have completed our Geotechnical Engineering services for the above referenced project. This study was performed in general accordance with Terracon Proposal No. PCJ225329. This report presents the findings of the subsurface exploration and provides geotechnical recommendations concerning earthwork and the design and construction of the proposed chemical feed lines for the proposed project.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report, or if we may be of further service, feel free to contact us.

Sincerely,
Terracon Consultants, Inc.

Matt JW Mickelson, E.I.
Staff Engineer

Richard D. Olson, P.E.
Principal Engineer

REPORT TOPICS

ATTACHMENTS

Note: Refer to each individual Attachment for a listing of contents.

Geotechnical Engineering Report

Monroe WTP Feed Line Replacement
7470 S Shields Ridge Road
Bloomington, Indiana

Terracon Project No. CJ225329
December 28, 2022

INTRODUCTION

This report presents the results of our subsurface exploration and geotechnical engineering services performed for the proposed Monroe WTP Improvements at 7470 S Shields Ridge Road in Bloomington, Indiana. The purpose of these services is to provide information and geotechnical engineering recommendations relative to:

- Subsurface soil conditions
- Groundwater conditions
- Site preparation and earthwork
- Dewatering considerations
- Feedline construction considerations
- Excavation considerations

The geotechnical engineering Scope of Services for this project included the advancement of two test borings to depths ranging from approximately 19 ft below existing site grades. Boring B-01 was performed at a later date and further north than previously proposed due to the unverifiable location and depth of the existing feed lines and the potential dangers posed if encountered.

Maps showing the site and boring locations are shown in the **Site Location** and **Exploration Plan**. The results of the laboratory testing performed on soil samples obtained from the site during the field exploration are included on the boring logs and as graphs in the **Exploration Results** section of this report.

SITE CONDITIONS

The following description of site conditions is derived from our site visit in association with the field exploration and our review of publicly available aerial and topographic maps.

Item	Description
Parcel Information	Approximate center of project area is located near: ○ Latitude: 39.0725 ○ Longitude: -86.4623 See **Site Location**

Item	Description
Existing Improvements	The project is located at an existing water treatment plant.
Current Ground Cover	Asphalt
Existing Topography	Based on topographic information provided by Donohue, the ground surface in the areas of the proposed feed lines ranged from about El. 751 to 753 ft.

PROJECT DESCRIPTION

Our understanding of the project conditions is as follows:

Item	Description
Information Provided	Information for the project was provided by Donohue via email and telephone correspondence and included: ■ Scope of Work ■ Boring Location Plan ■ Updated Boring Location ■ Proposed feed line alignment ■ Additional project information
Project Description	We understand new underground chemical feed lines and three associated access hatches (i.e., manholes) are planned to be constructed at the existing Monroe Water Treatment Plant. The feed lines are planned to be contained in a 3-ft wide by 4-ft deep "concrete chemical feed chase". These improvements are planned to be established at depths ranging from about 4 to 10 ft below the existing ground surface.
Estimated Start of Construction	The construction schedule was not available at the time of this report.

GEOTECHNICAL CHARACTERIZATION

GeoModel

We have developed a general characterization of the subsurface conditions based upon our review of the subsurface exploration, laboratory data, geologic setting and our understanding of the project. This characterization, termed GeoModel, forms the basis of our geotechnical calculations and evaluation of site preparation and construction considerations. Conditions encountered at each exploration point are indicated on the individual logs. The individual logs can be found in the **Exploration Results** section and the GeoModel can be found in the **Figures** section of this report.

As part of our analyses, we identified the following model layers within the subsurface profile. For a more detailed view of the model layer depths at each boring location, refer to the GeoModel and Boring Logs.

Model Layer	Layer Name	General Description
	Surficial Conditions	Asphalt pavement ranging from approximately 5 to 10 in. underlain by 10 in of granular subbase at Boring B-01.
1	**Lean Clay**	Varying amounts of sand; stiff to very stiff; brown
2	**Fat Clay**	Varying amounts of sand; stiff to hard; brown/red brown
3	**Silt**	Varying amounts of sand; stiff to hard; brown
4	**Weathered Shale**	Gray

It should be noted that organic matter was observed at Borings B-01 and B-02. Based on loss on ignition tests performed on these samples, the organic content ranged from about 1.1 to 3.8 percent. Fat clays were observed at both borings overlaying silt soils. Additionally, fill soils were noted at Boring B-02 extending to a depth of about 2 ft.

Groundwater level observations were made during and at completion of the sampling process. Groundwater was not noted at either boring. A review of the *Soil Survey of Monroe County, Indiana* indicates that the soils are prone to a seasonal high-water level (i.e., perched) as shallow as 1½ ft below the ground surface.

It should be recognized that groundwater levels will fluctuate due to changes in precipitation, infiltration, surface run-off, and other hydrogeological factors. Therefore, groundwater levels during construction or at other times in the life of the structures may be higher or lower than the levels indicated on the boring logs. The possibility of groundwater level fluctuations should be considered when developing the design and construction plans for the project.

GEOTECHNICAL OVERVIEW

In general, the subsurface conditions observed at the boring locations consisted of stiff to hard cohesive soils overlying silt. In our opinion, these soils are generally suitable for support of the proposed elements provided the subgrade is prepared as discussed herein. The proposed elements are typically anticipated to be established in the observed fat clays. Silts were observed underlying the fat clay. Silts are moisture sensitive and will lose strength in the presence of water. Where fat clays or silts are observed undercutting may be required. However, this will require judgement in the field. The condition of the subgrade and the performance of the improvements will be, in part, a function of the care and workmanship of the contractor in protecting the subgrade

from water. It should also be noted that the test borings represent the soils conditions at those locations only. Significant changes in the conditions may occur between the boring locations.

DEWATERING AND EXCAVATION

Dewatering

Based on observations of groundwater levels during and at the completion of the sampling process, dewatering in not expected to be necessary to facilitate construction. However, if surface water run-off or trapped/perched water enters foundation excavations, we anticipate that removal of the water can likely be performed by using a pump and filtered sump.

Excavations

Considering the anticipated element inverts and the proximity of existing infrastructure, we anticipate that the use of excavation support will be necessary in some areas. The type of excavation support utilized will be based on the contractor's means and methods. Excavation support is anticipated to include trench boxes or temporary sheeting. Due to the presence of stiff to hard cohesive soils observed below the planned invert elevations the ability to drive sheeting may be limited in some areas. In our opinion, boxes and sheeting should be placed in a manner not to disturb the embedment material. All excavations should comply with OSHA standards. Stockpiled soil should not be placed adjacent to the excavation. Furthermore, proper site drainage is recommended to help minimize unwanted surface water runoff into excavations during the construction process.

FEED LINE CHASE AND MANHOLE CONSIDERATIONS

Subgrade Considerations

Proposed inverts are typically anticipated to be established at depths in the range of 4 to 10 ft below the existing grade. Based on information obtained at the boring locations, the subgrade at the inverts is generally anticipated to consist of fat clays with consistencies ranging from stiff to hard. However, silts may also be encountered, especially in areas of over excavation. If the cohesive soils or silts are exposed to additional moisture, they will degrade and require undercutting as described below.

Where soft/unsuitable soil is present at the proposed inverts or if stiff conditions degrade due to exposure to moisture, we recommend the subgrades generally be undercut up to a depth of 2 ft and grade be reestablished by placing compacted granular fill, such as INDOT No. 8 stone, possibly in conjunction with a geotextile. We recommend that fill placed for this purpose be compacted via several passes with a vibratory plate compactor. To reduce the potential for softening of the subgrade soils and additional undercutting, it is recommended that the

construction activities be scheduled such that the subgrade is undercut, then reestablished as soon as practical. This will require having all backfill materials present during excavation activities. We recommend that the Geotechnical Engineer observe the subgrade prior to the placement of the bedding layer to confirm the presence of a suitable bearing stratum.

Provided the subgrade is prepared as discussed above, we anticipate the subgrade to be suitable for support of the planned structures. If perched or surface water is present at the time of construction, we recommend that consideration be given to placing a mud mat as soon as practical after excavation to the subgrade elevation to preserve the integrity of the subgrade. Construction of the proposed elements is not anticipated to induce significant settlement of the underlying soils (i.e., the net load on the supporting conditions is anticipated to be nominal [possibly less than the overburden]). If needed, foundations can be designed considering a net allowable bearing pressure of 2,000 lbs/sq ft (psf). Based on these recommendations, total and differential settlements are not anticipated to exceed 1 in.

In addition to downward forces, the effects of buoyancy should also be considered for design. Due to the possibility of perched groundwater conditions, we recommend using a groundwater level at or near the ground surface for buoyancy design. The weight of the structures in addition to the weight of the soils above the “lip” of the base of the structures should be considered to provide the necessary resistance to the uplift forces. We recommend that a buoyant unit weight of the soil of 60 pcf be utilized for this purpose.

Bedding and Backfill

Considering that the feed lines will be beneath existing driveways/parking areas (settlement sensitive areas), granular soils are recommended for backfill. This is because of their ease of compaction as compared to cohesive soils which reduces the risk of settlement. In addition, periodic field density tests and observations by the Geotechnical Engineer are recommended during backfill placement to verify the adequacy of compactive effort. We recommend the following material properties and compaction requirements for the bedding material and soils used for structural backfill surrounding the elements:

Item	Recommendation
Soil Type[1]	Granular soil satisfying a USCS symbol of GP, SP, SW, SW-SM, SP-SM[2]
Maximum Lift Thickness	6 in. in loose thickness
Minimum Compaction Requirements	95 percent of the modified Proctor density (ASMT D 1557) at the base of the excavation, for bedding material, and soils used for structural backfill surrounding the elements.

1. The use of cohesive soils for backfill above the feed lines is not recommended due to the confined nature of the project.

In addition, we recommend that the "chase" manufacturer be contacted to discuss special bedding and backfill requirements.

Lateral Earth Pressures

The walls for the below-grade structures should be designed to resist both hydrostatic and lateral earth pressures. Based on the nature of the structure, relatively rigid conditions are anticipated such that an at-rest condition will develop. For these conditions, we recommend the parameters provided in the table below.

Earth Pressure Condition	Backfill Type[1]	Maximum Unit Weight (pcf)	Angle of Internal Friction (ϕ') (deg.)	Equivalent Fluid Pressure (pcf) [2]
At-Rest (K_o)	Clean well-graded granular soil	125	30	90

1. These values assume uniform horizontal backfill, compacted to at least 95 percent of the modified Proctor density in areas where the backfill will be required to support structures (e.g., drives, sidewalks, etc..). We recommend backfill behind walls be placed in loose lift thickness not exceeding 4 in.
2. No factor of safety is included in this value.

In addition to the lateral earth pressures, surcharges from temporary loads during construction (if any) or adjacent foundations should be taken into account in the wall design. Additionally, for the equivalent fluid pressure value of the granular soil provided in the table above to be valid, we recommend that clean well-graded granular backfill extend horizontally behind the wall a distance of at least ½ of the depth of the wall below grade. If this cannot be achieved, we recommend that an equivalent fluid pressure of 105 pcf be used for design. Compaction of backfill within 3 ft of the walls should be performed with a hand guided compactor to avoid over-stressing the walls.

GENERAL COMMENTS

Our analysis and opinions are based upon our understanding of the project, the geotechnical conditions in the area, and the data obtained from our site exploration. Natural variations will occur between exploration point locations or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. Terracon should be retained as the Geotechnical Engineer, where noted in this report, to provide observation and testing services during pertinent construction phases. If variations appear, we can provide further evaluation and supplemental recommendations. If variations are noted in the absence of our observation and testing services on-site, we should be immediately notified so that we can provide evaluation and supplemental recommendations.

Our Scope of Services does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for

such contamination or pollution, other studies should be undertaken. PID readings are provided on the boring logs for use by others.

Our services and any correspondence or collaboration through this system are intended for the sole benefit and exclusive use of our client for specific application to the project discussed and are accomplished in accordance with generally accepted geotechnical engineering practices with no third-party beneficiaries intended. Any third-party access to services or correspondence is solely for information purposes to support the services provided by Terracon to our client. Reliance upon the services and any work product is limited to our client and is not intended for third parties. Any use or reliance of the provided information by third parties is done solely at their own risk. No warranties, either express or implied, are intended or made.

Site characteristics as provided are for design purposes and not to estimate excavation cost. Any use of our report in that regard is done at the sole risk of the excavating cost estimator as there may be variations on the site that are not apparent in the data that could significantly impact excavation cost. Any parties charged with estimating excavation costs should seek their own site characterization for specific purposes to obtain the specific level of detail necessary for costing. Site safety, and cost estimating including, excavation support, and dewatering requirements/design are the responsibility of others. If changes in the nature, design, or location of the project are planned, our conclusions and recommendations shall not be considered valid unless we review the changes and either verify or modify our conclusions in writing.

FIGURES

Content:

GEOMODEL

Monroe WTP Feed Line Replacement ■ Bloomington, Indiana
Terracon Project No. CJ225329

This is not a cross section. This is intended to display the Geotechnical Model only. See individual logs for more detailed conditions.

Model Layer	Layer Name	General Description
1	Lean Clay	Varying amounts of sand; stiff to very stiff; brown
2	Fat Clay	Varying amounts of sand; stiff to hard; brown/redbrown
3	Silt	Varying amounts of sand; stiff to hard; brown
4	Weathered Shale	Gray

LEGEND

- Asphalt
- Fill
- Lean Clay
- Fat Clay
- Silt
- Shale
- Lean Clay with Sand
- Fat Clay with Sand
- Silt with Sand

NOTES:
Layering shown on this figure has been developed by the geotechnical engineer for purposes of modeling the subsurface conditions as required for the subsequent geotechnical engineering for this project. Numbers adjacent to soil column indicate depth below ground surface.

ATTACHMENTS

EXPLORATION AND TESTING PROCEDURES

Field Exploration

Boring Nos.	Boring Depth (feet)	Planned Area
B-01 and B-02	19	Chemical Feed Lines and Manholes

Boring Layout and Elevations: The boring locations were marked in the field by Terracon personnel using handheld GPS equipment with a horizontal accuracy of about 15 feet based on the coordinates obtained by overlaying the conceptual site plan provided by Donohue onto Google Earth Pro™. Furthermore, ground surface elevations at the boring locations were estimated using topographic information provided on the plans.

Subsurface Exploration Procedures: We advanced the borings with ATV and truck-mounted equipment and hollow stem augers. Samples were obtained at 2½-foot intervals throughout the boring depth. In the split-barrel sampling procedure, a standard 2-inch outer diameter split-barrel sampling spoon is driven into the ground by a 140-pound automatic hammer falling a distance of 30 inches. The number of blows required to advance the sampling spoon the last 12 inches of a normal 18-inch penetration is recorded as the Standard Penetration Test (SPT) resistance value. The SPT resistance values, also referred to as N-values, are indicated on the boring logs at the test depths. We observed and recorded groundwater levels during drilling and sampling. Following the completion of our exploratory activities, the boreholes were backfilled with auger cuttings and a bentonite chip plug near the surface. In addition, pavement surfaces were restored with a concrete patch where appropriate.

The sampling depths, penetration distances, and other sampling information were recorded on the field boring logs. The samples were placed in appropriate containers and taken to our soil laboratory for testing and classification. Our exploration team prepared field boring logs as part of the drilling operations. These field logs included visual classifications of the materials encountered during drilling and our interpretation of the subsurface conditions between samples. Final boring logs were prepared from the field logs.

Laboratory Testing

The project engineer reviewed the field data and assigned laboratory tests to understand the engineering properties of the various soil strata, as necessary, for this project. Soil classifications on the boring logs are in general accordance with the Unified Soil Classification System (USCS). Further details regarding the classification system are provided in **Supporting Information**. After classifying the samples, the following laboratory testing program was performed:

- Hand penetrometer readings (i.e., q_p, which provide an indication of the shear strength characteristics of cohesive-type soils);
- Natural moisture content tests (W%);
- Atterberg limit determinations (LL, PL); and
- Loss on ignition (LOI; Organic content).

Upon completion of our laboratory testing program, boring logs were prepared and are provided in the **Exploration Results** section of this report. The boring logs present approximate boundaries between soil types; the in-situ transitions may be more gradual.

SITE LOCATION AND EXPLORATION PLAN

Contents:

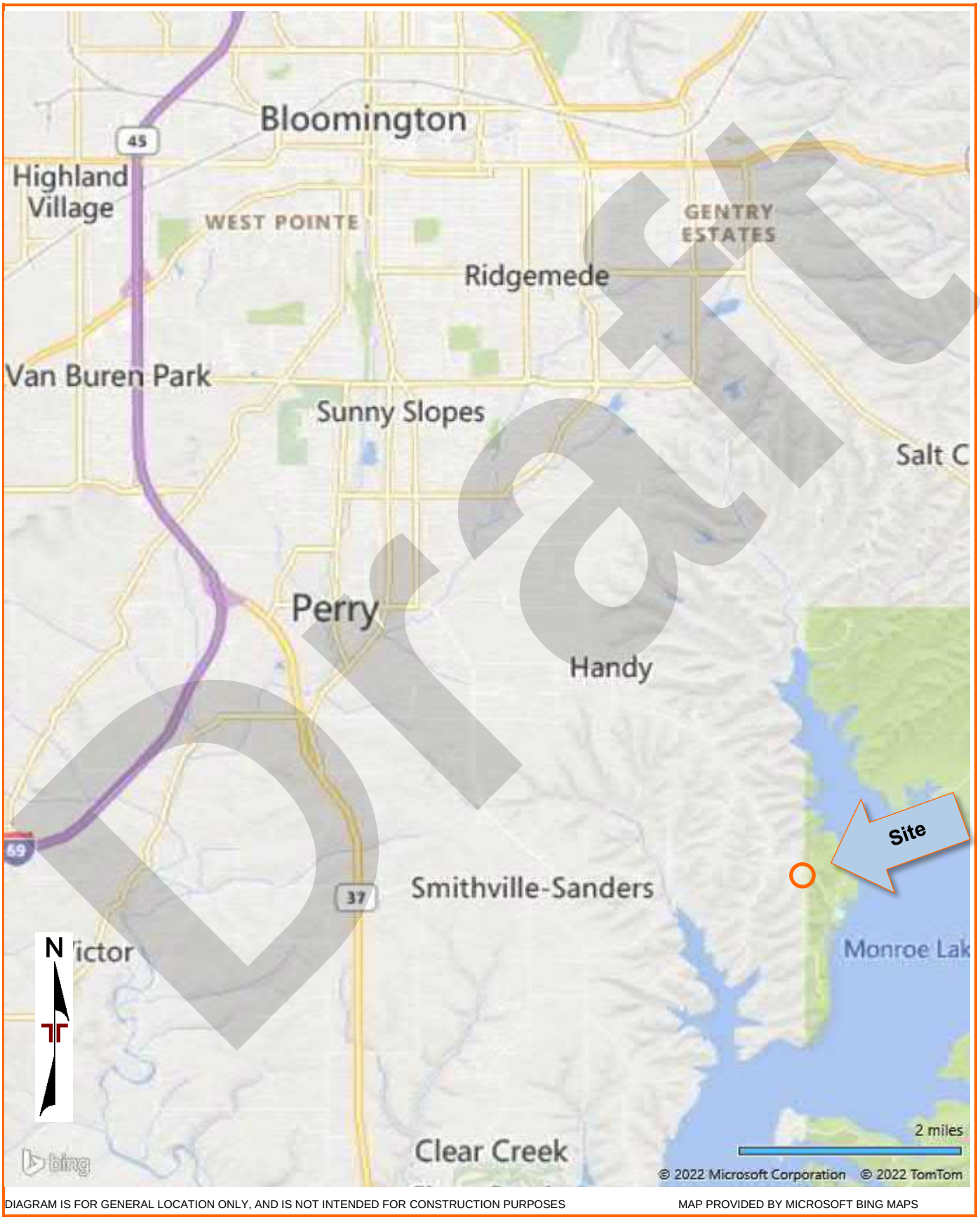


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

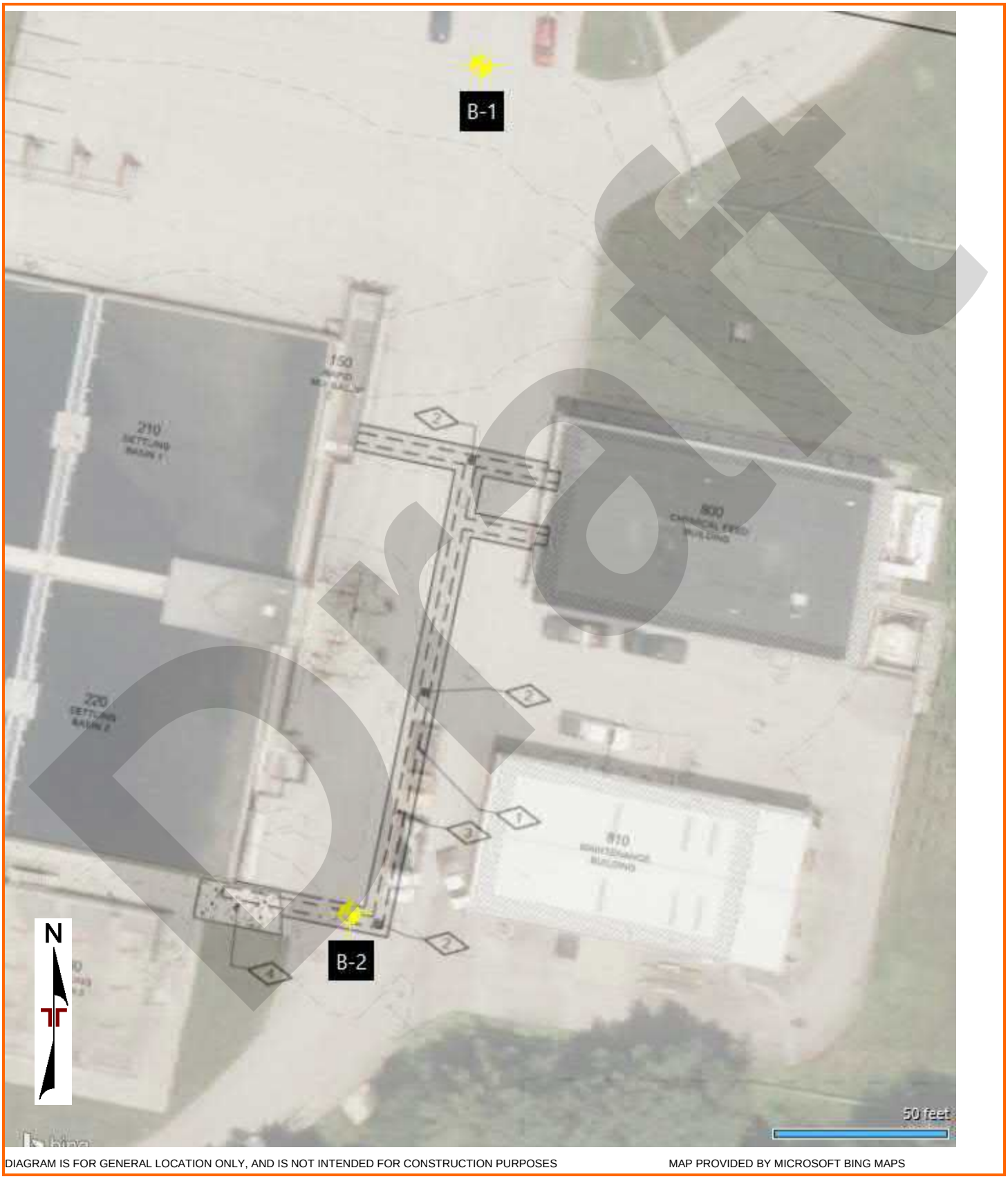


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

EXPLORATION RESULTS

Contents:

BORING LOG NO. B-01

PROJECT: Monroe WTP Feed Line Replacement

CLIENT: Donohue & Associates, Inc.
Indianapolis, Indiana

SITE: 7470 S Shields Ridge Rd
Bloomington, Indiana

LOCATION See Exploration Plan

Latitude: 39.0730° Longitude: -86.4623°

Surface Elev.: 748 (Ft.)

MODEL LAYER	GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	ORGANIC CONTENT (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI
		0.4 **ASPHALT**	747.6									
		1.2 **GRANULAR SUBBASE**	746.8									
1		**LEAN CLAY (CL)**, trace gravel, trace sand, brown, stiff to very stiff					5	2-5-7 N=12		2.25 (HP)	17.7	
		3.0	745									
2		**FAT CLAY (CH)**, trace gravel, trace sand, brown, stiff to very stiff		5			8	4-6-8 N=14		3.25 (HP)	32.4	
							12	3-6-8 N=14		3.0 (HP)	34.9	85-28-57
				10			18	2-5-4 N=9		1.0 (HP)	42.6	
		11.0	737									
3		**SILT (ML)**, trace gravel, trace sand, brown, moist, stiff, trace organic matter near 12 ft, with boulder near 15 ft					14	6-6-10 N=16	1.1	1.75 (HP)	26.2	48-31-17
							12	9-32-50 N=82		1.0 (HP)	18.8	
		15.0	733	15								
4		**WEATHERED SHALE**, gray, soft					1	50/5"				
		18.8	729.2				1	50/3"				
		Boring Terminated at 18.8 Feet										

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3¼" HSA

Abandonment Method:
Backfilled with auger cuttings, a bentonite chip plug and a concrete patch near the surface.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No water observed while drilling

No water observed at completion of drilling

Cave-in at 11.5 ft

Terracon
7770 W New York St
Indianapolis, IN

Boring Started: 11-10-2022 | Boring Completed: 11-10-2022

Drill Rig: CME 75 | Driller: J.M.

Project No.: CJ225329

BORING LOG NO. B-02

PROJECT: Monroe WTP Feed Line Replacement

CLIENT: Donohue & Associates, Inc.
Indianapolis, Indiana

SITE: 7470 S Shields Ridge Rd
Bloomington, Indiana

LOCATION See Exploration Plan

Latitude: 39.0723° Longitude: -86.4624°

Approximate Surface Elev.: 752 (Ft.) +/-

MODEL LAYER	DEPTH	ELEVATION (Ft.)	
	0.8	751.2+/-	**ASPHALT**
1	5.0	747+/-	**LEAN CLAY WITH SAND (CL)**, trace gravel, brown, stiff to very stiff, with plastic debris near 2 ft, trace organic matter near 5 ft and (fill to 2 ft)
2	17.0	735+/-	**FAT CLAY WITH SAND (CH)**, trace gravel, red brown, stiff to hard, with trace organic matter near 12 ft
3	18.9	733.1+/-	**SILT WITH SAND (ML)**, trace gravel, brown, moist, very stiff to hard, with residual soil near 19 ft
			Auger Refusal at 18.9 Feet

DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	ORGANIC CONTENT (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI
			6	2-4-4 N=8		1.0 (HP)	18.3	
			14	3-5-5 N=10	3.0	3.75 (HP)	24.0	43-23-20
5			15	5-8-9 N=17		4.5+ (HP)	32.1	
			16	8-7-8 N=15		4.0 (HP)	35.1	
10			18	5-5-6 N=11	3.8	2.5 (HP)	44.8	93-30-63
			16	1-2-2 N=4		1.0 (HP)	55.9	
15			16	5-10-21 N=31		4.5 (HP)	21.4	
	▨		5	50/5"		2.5 (HP)	12.3	

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3¼" HSA

Abandonment Method:
Backfilled with auger cuttings, a bentonite chip plug and a concrete patch near the surface.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No water observed while drilling

No water observed at completion of drilling

▨ *Cave-in at 18 ft*

Terracon
7770 W New York St
Indianapolis, IN

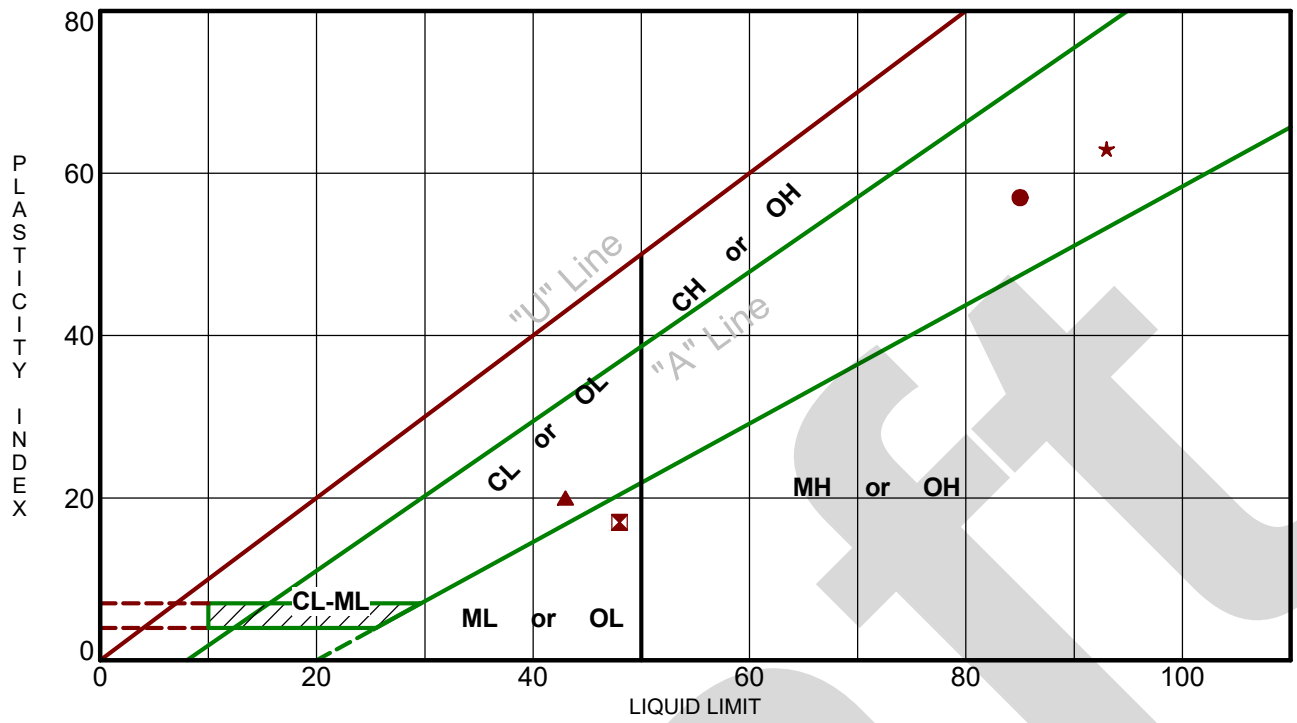
Boring Started: 09-16-2022 | Boring Completed: 09-16-2022

Drill Rig: B-57 Track | Driller: J.R.

Project No.: CJ225329

ATTERBERG LIMITS RESULTS

ASTM D4318



Boring ID		Depth (Ft)	LL	PL	PI	Fines	USCS	Description
●	B-01	6 - 7.5	85	28	57		CH	FAT CLAY
⊠	B-01	11 - 12.5	48	31	17		ML	SILT
▲	B-02	3.5 - 5	43	23	20		CL	LEAN CLAY
★	B-02	11 - 12.5	93	30	63		CH	FAT CLAY

PROJECT: Monroe WTP Feed Line Replacement

PROJECT NUMBER: CJ225329

SITE: 7470 S Shields Ridge Rd
Bloomington, Indiana

Terracon
7770 W New York St
Indianapolis, IN

CLIENT: Donohue & Associates, Inc.
Indianapolis, Indiana

SUPPORTING INFORMATION

Contents:

Note: All attachments are one page unless noted above.

GENERAL NOTES

DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

SAMPLING

WATER LEVEL

Water Initially Encountered

Water Level After a Specified Period of Time

Water Level After a Specified Period of Time

Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.

FIELD TESTS

N	**Standard Penetration Test Resistance (Blows/Ft.)**
(HP)	**Hand Penetrometer**
(T)	**Torvane**
(DCP)	**Dynamic Cone Penetrometer**
(PID)	**Photo-Ionization Detector**
(OVA)	**Organic Vapor Analyzer**

DESCRIPTIVE SOIL CLASSIFICATION

Soil classification is based on the Unified Soil Classification System. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; their principal descriptors are: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are principally described as clays if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.

LOCATION AND ELEVATION NOTES

Unless otherwise noted, Latitude and Longitude are approximately determined using a hand-held GPS device. The accuracy of such devices is variable. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

STRENGTH TERMS

RELATIVE DENSITY OF COARSE-GRAINED SOILS (More than 50% retained on No. 200 sieve.) Density determined by Standard Penetration Resistance		**CONSISTENCY OF FINE-GRAINED SOILS** (50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance		
Descriptive Term (Density)	**Standard Penetration or N-Value Blows/Ft.**	**Descriptive Term (Consistency)**	**Unconfined Compressive Strength Qu, (tsf)**	**Standard Penetration or N-Value Blows/Ft.**
Very Loose	0 - 3	Very Soft	less than 0.25	0 - 1
Loose	4 - 9	Soft	0.25 to 0.50	2 - 4
Medium Dense	10 - 29	Medium Stiff	0.50 to 1.00	4 - 8
Dense	30 - 50	Stiff	1.00 to 2.00	8 - 15
Very Dense	> 50	Very Stiff	2.00 to 4.00	15 - 30
		Hard	> 4.00	> 30

RELATIVE PROPORTIONS OF SAND AND GRAVEL

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 15
With	15 - 29
Modifier	> 30

GRAIN SIZE TERMINOLOGY

Major Component of Sample	Particle Size
Boulders	Over 12 in. (300 mm)
Cobbles	12 in. to 3 in. (300mm to 75mm)
Gravel	3 in. to #4 sieve (75mm to 4.75 mm)
Sand	#4 to #200 sieve (4.75mm to 0.075mm
Silt or Clay	Passing #200 sieve (0.075mm)

RELATIVE PROPORTIONS OF FINES

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 5
With	5 - 12
Modifier	> 12

PLASTICITY DESCRIPTION

Term	Plasticity Index
Non-plastic	0
Low	1 - 10
Medium	11 - 30
High	> 30

UNIFIED SOIL CLASSIFICATION SYSTEM

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [A]					Soil Classification	
					Group Symbol	Group Name [B]
Coarse-Grained Soils: More than 50% retained on No. 200 sieve	**Gravels:** More than 50% of coarse fraction retained on No. 4 sieve	**Clean Gravels:** Less than 5% fines [C]	$Cu \geq 4$ and $1 \leq Cc \leq 3$ [E]		GW	Well-graded gravel [F]
			$Cu < 4$ and/or [Cc<1 or Cc>3.0] [E]		GP	Poorly graded gravel [F]
		Gravels with Fines: More than 12% fines [C]	Fines classify as ML or MH		GM	Silty gravel [F, G, H]
			Fines classify as CL or CH		GC	Clayey gravel [F, G, H]
	Sands: 50% or more of coarse fraction passes No. 4 sieve	**Clean Sands:** Less than 5% fines [D]	$Cu \geq 6$ and $1 \leq Cc \leq 3$ [E]		SW	Well-graded sand [I]
			$Cu < 6$ and/or [Cc<1 or Cc>3.0] [E]		SP	Poorly graded sand [I]
		Sands with Fines: More than 12% fines [D]	Fines classify as ML or MH		SM	Silty sand [G, H, I]
			Fines classify as CL or CH		SC	Clayey sand [G, H, I]
Fine-Grained Soils: 50% or more passes the No. 200 sieve	**Silts and Clays:** Liquid limit less than 50	**Inorganic:**	PI > 7 and plots on or above "A"		CL	Lean clay [K, L, M]
			PI < 4 or plots below "A" line [J]		ML	Silt [K, L, M]
		Organic:	Liquid limit - oven dried	< 0.75	OL	Organic clay [K, L, M, N]
			Liquid limit - not dried			Organic silt [K, L, M, O]
	Silts and Clays: Liquid limit 50 or more	**Inorganic:**	PI plots on or above "A" line		CH	Fat clay [K, L, M]
			PI plots below "A" line		MH	Elastic Silt [K, L, M]
		Organic:	Liquid limit - oven dried	< 0.75	OH	Organic clay [K, L, M, P]
			Liquid limit - not dried			Organic silt [K, L, M, Q]
Highly organic soils:	Primarily organic matter, dark in color, and organic odor				PT	Peat

[A] Based on the material passing the 3-inch (75-mm) sieve.

[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay.

[E] $Cu = D_{60}/D_{10}$ $\quad Cc = \dfrac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains ≥ 15% sand, add "with sand" to group name.

[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H] If fines are organic, add "with organic fines" to group name.

[I] If soil contains ≥ 15% gravel, add "with gravel" to group name.

[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

[L] If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.

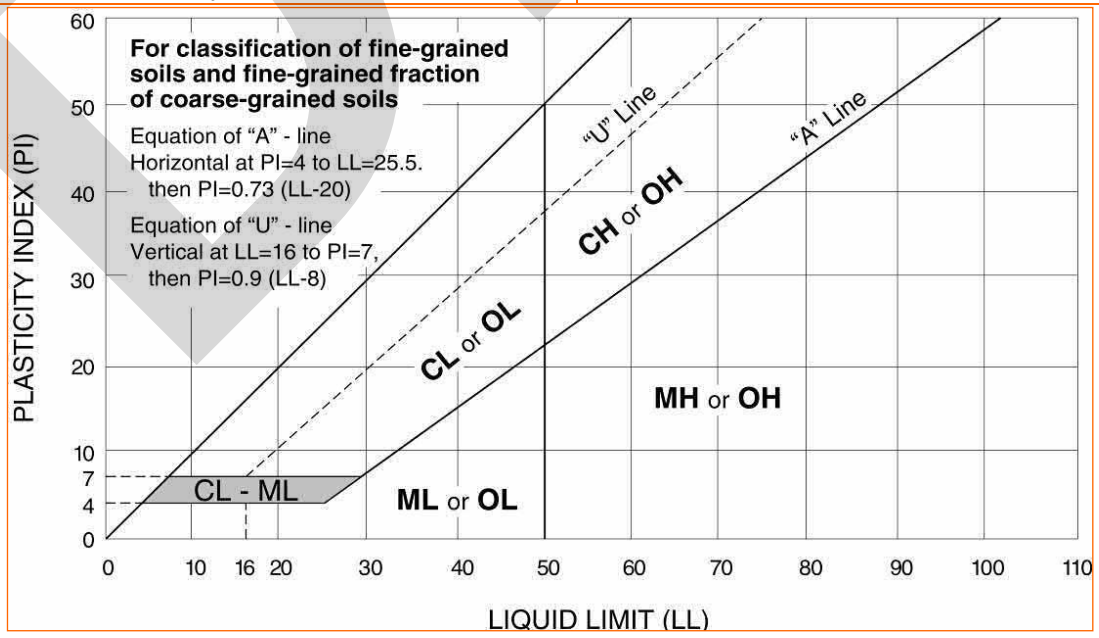
[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.

[N] PI ≥ 4 and plots on or above "A" line.

[O] PI < 4 or plots below "A" line.

[P] PI plots on or above "A" line.

[Q] PI plots below "A" line.



DESCRIPTION OF ROCK PROPERTIES

WEATHERING	
Fresh	Rock fresh, crystals bright, few joints may show slight staining. Rock rings under hammer if crystalline.
Very slight	Rock generally fresh, joints stained, some joints may show thin clay coatings, crystals in broken face show bright. Rock rings under hammer if crystalline.
Slight	Rock generally fresh, joints stained, and discoloration extends into rock up to 1 in. Joints may contain clay. In granitoid rocks some occasional feldspar crystals are dull and discolored. Crystalline rocks ring under hammer.
Moderate	Significant portions of rock show discoloration and weathering effects. In granitoid rocks, most feldspars are dull and discolored; some show clayey. Rock has dull sound under hammer and shows significant loss of strength as compared with fresh rock.
Moderately severe	All rock except quartz discolored or stained. In granitoid rocks, all feldspars dull and discolored and majority show kaolinization. Rock shows severe loss of strength and can be excavated with geologist's pick.
Severe	All rock except quartz discolored or stained. Rock "fabric" clear and evident, but reduced in strength to strong soil. In granitoid rocks, all feldspars kaolinized to some extent. Some fragments of strong rock usually left.
Very severe	All rock except quartz discolored or stained. Rock "fabric" discernible, but mass effectively reduced to "soil" with only fragments of strong rock remaining.
Complete	Rock reduced to "soil". Rock "fabric" no discernible or discernible only in small, scattered locations. Quartz may be present as dikes or stringers.

HARDNESS (for engineering description of rock – not to be confused with Moh's scale for minerals)	
Very hard	Cannot be scratched with knife or sharp pick. Breaking of hand specimens requires several hard blows of geologist's pick.
Hard	Can be scratched with knife or pick only with difficulty. Hard blow of hammer required to detach hand specimen.
Moderately hard	Can be scratched with knife or pick. Gouges or grooves to ¼ in. deep can be excavated by hard blow of point of a geologist's pick. Hand specimens can be detached by moderate blow.
Medium	Can be grooved or gouged 1/16 in. deep by firm pressure on knife or pick point. Can be excavated in small chips to pieces about 1-in. maximum size by hard blows of the point of a geologist's pick.
Soft	Can be gouged or grooved readily with knife or pick point. Can be excavated in chips to pieces several inches in size by moderate blows of a pick point. Small thin pieces can be broken by finger pressure.
Very soft	Can be carved with knife. Can be excavated readily with point of pick. Pieces 1-in. or more in thickness can be broken with finger pressure. Can be scratched readily by fingernail.

Joint, Bedding, and Foliation Spacing in Rock [1]

Spacing	Joints	Bedding/Foliation
Less than 2 in.	Very close	Very thin
2 in. – 1 ft.	Close	Thin
1 ft. – 3 ft.	Moderately close	Medium
3 ft. – 10 ft.	Wide	Thick
More than 10 ft.	Very wide	Very thick

1. Spacing refers to the distance normal to the planes, of the described feature, which are parallel to each other or nearly so.

Rock Quality Designator (RQD) [1]

RQD, as a percentage	Diagnostic description
Exceeding 90	Excellent
90 – 75	Good
75 – 50	Fair
50 – 25	Poor
Less than 25	Very poor

1. RQD (given as a percentage) = length of core in pieces 4 inches and longer / length of run

Joint Openness Descriptors

Openness	Descriptor
No Visible Separation	Tight
Less than 1/32 in.	Slightly Open
1/32 to 1/8 in.	Moderately Open
1/8 to 3/8 in.	Open
3/8 in. to 0.1 ft.	Moderately Wide
Greater than 0.1 ft.	Wide

References: American Society of Civil Engineers. Manuals and Reports on Engineering Practice - No. 56. Subsurface Investigation for Design and Construction of Foundations of Buildings. New York: American Society of Civil Engineers, 1976. U.S. Department of the Interior, Bureau of Reclamation, Engineering Geology Field Manual.

JOHN HAMILTON
MAYOR

CITY OF BLOOMINGTON CONTROLLER'S OFFICE

401 N Morton St
Post Office Box 100
Bloomington IN 47402

p 812.349.3412
f 812.349.3456
controller@bloomington.in.gov

SUBSTITUTE W-9 & BANK/EFT FORM

REQUEST FOR TAXPAYER IDENTIFICATION NUMBER AND CERTIFICATION: SUBSTITUTE W-9

Name (as shown on your tax return):

Business Name/DBA (if different than above):

Check appropriate box for federal tax classification:

❑ Individual/sole proprietor ❑ C Corporation ❑ S Corporation ❑ Partnership ❑ Trust/estate

❑ Limited liability company. **Enter the tax classification** (C=C corporation, S=S corporation, P=Partnership)► _____

❑ Other ► _____

Exemptions:
Exempt payee code (if any)_____
Exemption from FATCA reporting code (if any)
_____

Address (number, street, and apt. or suite no.):

City, State, and ZIP code:

Telephone number:	**Fax number:**	**Email**:

Check all that apply:

❑ State or Local Government ❑ City Employee ❑ Contractual Employee ❑ Farmer's Market Vendor ❑ Not for Profit - 501(c)

List city department(s) you are doing business with (Parks, Fire, Utilities etc.):	**Commodities or Services provided:**	
	Primary NAICS Code:	**DUNS #:**

Taxpayer Identification Number (TIN)

Enter your TIN in the appropriate box. The TIN provided must match the name given on the "Name" line To avoid backup withhold. For individuals, this is your social security number (SSN). However, for a Resident alien, sole proprietor, or disregarded entity, see the Part 1 instructions on page 3 of IRS Form W-9. For other entities, it is your employer identification number (EIN). If you do not have a number, see *How to get a TIN* on page 3 of IRS Form W-9

Note: If the account is in more than one name, see the instructions for line 1 and the chart on page 4.

Social security number

			-			-			

Employer identification number

		-			-				

Certification

Under penalties of perjury, I certify that:

1. The number shown on this form is my correct taxpayer identification number (or I am waiting for a number to be issued to me), and
2. I am not subject to backup withholding because: (a) I am exempt from backup withholding, or (b) I have not been notified by the Internal Revenue Service (IRS) that I am subject to backup withholding as a result of a failure to report all interest or dividends, or (c) the IRS has notified me that I am no longer subject to backup withholding, and
3. I am a U.S. person or other U.S. person (defined below), and
4. The FATCA codes(s) entered on this form (if any) indicating that I am exempt from FATCA reporting is correct.

Certification Instructions

You must cross out item 2 above if you have been notified by the IRS that you are currently subject to backup withholding because you have failed to report all interest and dividends on your tax return. For real estate transactions, item 2 does not apply. For mortgage interest paid, acquisition or abandonment of secured property, cancellation of debt, contributions to an individual retirement arrangement (IRA), and generally, payments other than interest and dividends, you are not required to sign the certification, but you must provide your correct TIN. See the instructions on page 3 of the IRS Form W-9.

Please mail or fax this complete form as soon as possible to the Controller's Office using the contact information above.
NO PAYMENTS WILL BE SENT UNTIL THIS FORM IS RECEIVED.

SIGN HERE	Signature of U.S. person ►	Date ►

CITY OF BLOOMINGTON ELECTRONIC FUNDS TRANSFER FORM (EFT)

THE CITY'S REQUIRED METHOD OF PAYMENT IS EFT
(Electronic Funds Transfer)
PLEASE COMPLETE THE SECTION BELOW TO ENROLL

EFT INFORMATION

Bank Name:	
Type of Account:	❑ Checking ❑ Savings
Routing Number:	
Account Number:	
Name of Account:	
Email for Payment Notification:	

REFERENCES FOR SOLE PROPRIETORS & PARTNERSHIPS

Name:	Address:
Phone:	Email:

Name:	Address:
Phone:	Email:

Name:	Address:
Phone:	Email:

BILLING INFORMATION

Payment Remittance		
Address (PO Box)		
Address (Physical)		
City	State	Zip
Person to Contact		
Email		
Phone		

WYN INDUSTRIES INC

FIBERGLASS SOLUTIONS & SERVICE

6210 S Indianapolis Rd
Whitestown, IN 46075

P: 317-769-3455
F: 317-588-3595

WYNINDUSTRIES.COM

Quotation

To:
City of Bloomington

Monroe Water Treatment Plant

Date: 10/24/2024
Quote #: 3316

Reference
FRP Tank Reline

Quantity	Description	Price	Amount
	Provide Materials, Labor & Equipment to Repair & Reline the Following Tank, Utilizing 1-1/2 oz Fiberglass Mat, Nexus Veil and Premium Vinyl Ester Resin		
1	12' Dia x 12' Tall FRP Sodium Hypochlorite Bulk Tank		$ 69,100.00
	**Lid and Guardrail on Top of Tank to be Removed [By Others]		
	Includes: 1. Tank Cleaning & Neutralization, Disposal of Hazards 2. Scaffolding 3. Standard Dust Control & Air Filtration 4. General Sweeping and Cleaning of Area Around Tanks		
	Notes: 1. All piping, valves, manways to be disconnected and reconnected [by others] 2. Water testing [by others] 3. No warranties or guarantees due to age and condition of existing tanks		
	Exclusions: 1. Field Measurements 3. Taxes 2. Installation 4. Any Item Not Listed	**Total**	**$ 69,100.00**

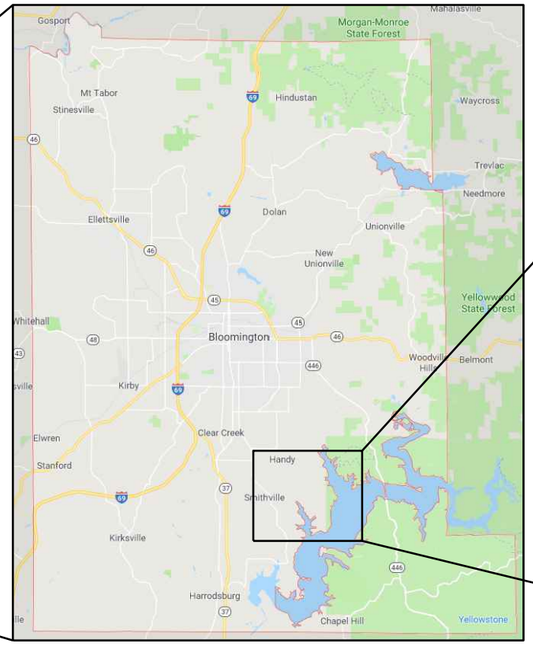
Terms	FOB	Freight	Shipping
Net 30		N/A	Scheduling: 6 - 8 Weeks Out Project Duration: 2 - 3 Weeks

THIS QUOTE IS GOOD FOR 30 DAYS

CITY OF BLOOMINGTON UTILITIES
MONROE WTP IMPROVEMENTS: CHEMICAL FEED LINE REPLACEMENT, BACKWASH SYSTEM PUMP ADDITION AND TANK REHABILITATION

BLOOMINGTON, IN
JANUARY 2025

INDIANA



PROJECT LOCATION MAP

PROJECT SITE MAP

MONROE WTP
7470 S SHIELDS RIDGE RD
BLOOMINGTON, IN
47401

PREPARED FOR

CITY OF BLOOMINGTON UTILITIES

600 E. MILLER DRIVE
BLOOMINGTON, IN 47401

TRENT M. MONTEMAYOR
REGISTERED
No. PE11200215
STATE OF INDIANA
PROFESSIONAL ENGINEER
01/06/2025

PREPARED BY

DONOHUE

101 WEST OHIO STREET, SUITE 1650
INDIANAPOLIS, IN 46204
317-267-8200

DRAWING INDEX

SHEET NUMBER	DRAWING NUMBER	DRAWING DESCRIPTION
001 - GENERAL		
1	001-G-0	COVER
2	001-G-1	DRAWING INDEX
3	001-G-2	GENERAL LEGEND, SYMBOLS AND ABBREVIATIONS
4	001-G-3	CIVIL LEGEND AND GENERAL NOTES
5	001-G-4	PLUMBING LEGEND/HVAC LEGEND/ELECTRICAL LEGEND
6	001-G-5	INSTRUMENTATION AND CONTROL STANDARD LEGEND
7	001-G-6	INSTRUMENTATION AND CONTROL STANDARD SYMBOLOGY
8	001-G-7	SPACE ENVIRONMENT AND HAZARDOUS RATINGS SCHEDULE
002 - SITE DEVELOPMENT		
9	002-CK-1	OVERALL KEY PLAN
10	002-CSE-1	EROSION CONTROL NOTES
11	002-CSE-2	STAGING AND EROSION CONTROL PLAN
12	002-CR-1	REMOVAL PLAN
13	002-CF-1	FACILITY PLAN
14	002-CPEN-1	PIPING PLAN AND ELECTRICAL/CONTROLS PLAN
15	002-CPR-1	TRENCH AND STORM PROFILES
16	002-CPR-2	TRENCH PROFILES
17	002-CG-1	GRADING PLAN
007 - ELECTRICAL DISTRIBUTION		
18	007-E-1	FILTER BUILDING REMOVAL ONE-LINE DIAGRAM
19	007-E-2	FILTER BUILDING ONE-LINE DIAGRAM
20	007-E-3	FILTER BUILDING ONE-LINE DIAGRAM AND ELEVATION
21	007-E-4	FILTER AND CHEMICAL BUILDING PANEL SCHEDULES
008 - NETWORK DIAGRAM		
22	008-I-1	NETWORK DIAGRAM
009 - PROCESS & INSTRUMENTATION DIAGRAM		
23	009-N-1	SODIUM HYPOCHLORITE SYSTEM
24	009-N-2	AQUA AMMONIA SYSTEM
25	009-N-3	SODIUM HYDROXIDE SYSTEM
26	009-N-4	HYDROFLUOROSILICIC ACID SYSTEM
27	009-N-5	BACKWASH PUMPING
220 - SETTLING BASIN 2		
STRUCTURAL & PROCESS-MECHANICAL & ELECTRICAL & INSTRUMENTATION		
28	220-SMEN-1	PLAN, DETAIL AND PHOTO
300 - FILTER BUILDING		
REMOVAL		
29	300-R-1	LOWER REMOVAL PLAN AND PHOTO
30	300-R-2	LOWER REMOVAL PLAN
31	300-R-3	LOWER REMOVAL PLAN
32	300-R-4	GRADE REMOVAL PLAN
33	300-R-5	REMOVAL PHOTOS
34	300-R-6	REMOVAL SECTION
STRUCTURAL & PROCESS-MECHANICAL		
35	300-SM-1	PARTIAL BELOW GRATING PLAN
36	300-SM-2	PARTIAL LOWER PLAN
37	300-SM-3	PARTIAL LOWER PLAN
38	300-SM-4	PARTIAL GRADE PLAN
39	300-SM-5	SECTIONS
40	300-SM-6	SECTION AND PHOTO
ELECTRICAL & INSTRUMENTATION		
41	300-EN-1	PARTIAL LOWER PLAN
42	300-EN-2	PARTIAL LOWER PLAN
43	300-EN-3	PARTIAL GRADE PLAN
44	300-EN-4	PARTIAL GRADE PLAN
45	300-EN-5	PARTIAL GRADE PLAN
800 - CHEMICAL BUILDING		
REMOVAL		
46	800-R-1	GRADE REMOVAL PLAN
47	800-R-2	GRADE REMOVAL PLAN
48	800-R-3	GRADE REMOVAL PLAN
49	800-R-4	GRADE REMOVAL PLAN
50	800-R-5	REMOVAL PHOTOS
51	800-R-6	REMOVAL PHOTOS
52	800-R-7	REMOVAL PHOTOS
53	800-R-8	REMOVAL PHOTOS
STRUCTURAL & PROCESS-MECHANICAL		
54	800-SM-1	PARTIAL GRADE PLAN
55	800-SM-2	PARTIAL GRADE PLAN
56	800-SM-3	PARTIAL GRADE PLAN
57	800-SM-4	PARTIAL GRADE PLAN
ELECTRICAL & INSTRUMENTATION		
58	800-EN-1	PARTIAL GRADE PLAN
59	800-EN-2	PARTIAL GRADE PLAN
60	800-EN-3	PARTIAL GRADE PLAN
61	800-EN-4	PARTIAL GRADE PLAN
900 - BACKWASH TANK		
SHEET NUMBER	DRAWING NUMBER	DRAWING DESCRIPTION
STRUCTURAL & PROCESS-MECHANICAL		
62	900-SM-1	PLAN AND SECTION
999 - GENERAL NOTES AND SCHEDULES AND STANDARD DETAILS		
CIVIL		
63	999-C-1	CIVIL
64	999-C-2	CIVIL
STRUCTURAL		
65	999-S-1	DOOR SCHEDULE AND STRUCTURAL DETAILS
66	999-S-2	STRUCTURAL
PROCESS-MECHANICAL		
67	999-M-1	PROCESS-MECHANICAL
ELECTRICAL		
68	999-E-1	ELECTRICAL
INSTRUMENTATION		
69	999-N-1	INSTRUMENTATION AND CONTROL
70	999-N-2	INSTRUMENTATION AND CONTROL

TRENT M. MONTEMAYOR REGISTERED No. PE11200215 STATE OF INDIANA PROFESSIONAL ENGINEER

01/06/2025

Revision Number	Revision Description	Drawn By	Checked By	Date

Designed By	KAR
Drawn By	KAR
Checked By	SPG
Approved By	TMM
Filename	001G2INDX.DWG
Project No.	14144
Project Date	JAN 2025

CITY OF BLOOMINGTON UTILITIES
MONROE WTP IMPROVEMENTS: CHEMICAL FEED LINE REPLACEMENT AND BACKWASH SYSTEM PUMP ADDITION AND TANK REHABILITATION - BLOOMINGTON, IN

GENERAL
DRAWING INDEX

DONOHUE

Sheet No. 2

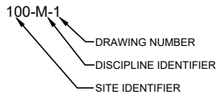
Drawing No. 001-G-1

GENERAL LEGEND

DISCIPLINE IDENTIFIER

DISCIPLINE	DISCIPLINE IDENTIFIER
GENERAL	G
CIVIL KEY	CK
CIVIL NOTES	CN
CIVIL REMOVAL	CR
CIVIL FACILITIES	CF
CIVIL GRADING	CG
CIVIL EROSION CONTROL	CE
CIVIL PIPING	CP
REMOVALS	R
ARCHITECTURAL	A
STRUCTURAL FOUNDATION	SF
STRUCTURAL	S
PROCESS-MECHANICAL	M
PLUMBING	P
HVAC	H
ELECTRICAL	E
ELECTRICAL LIGHTING	L
INSTRUMENTATION AND CONTROL	N

DRAWING NUMBER DESIGNATION



PLAN NOTE DESIGNATION

PLAN NOTE. SEE NOTES ON SAME DRAWING.

STANDARD DETAIL DESIGNATION

ON DRAWING WHERE DETAIL IS TAKEN

ON DRAWING WHERE DETAIL IS SHOWN

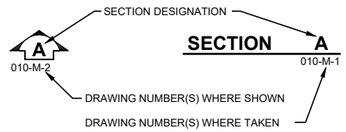
NOTE:
STANDARD DETAILS ARE LOCATED ON DRAWINGS THAT HAVE BEEN ASSIGNED A SITE IDENTIFIER OF 999 FOLLOWED BY A DISCIPLINE IDENTIFIER. THESE DRAWINGS ARE PLACED LAST IN THE DRAWING SET.

EXAMPLE: 999-M-1

SECTION DESIGNATION

ON DRAWING WHERE SECTION IS TAKEN

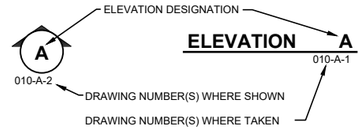
ON DRAWING WHERE SECTION IS SHOWN



CASEWORK ELEVATION DESIGNATION

ON DRAWING WHERE SECTION IS TAKEN

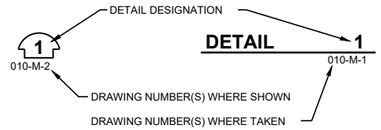
ON DRAWING WHERE SECTION IS SHOWN



DETAIL DESIGNATION

ON DRAWING WHERE DETAIL IS TAKEN

ON DRAWING WHERE DETAIL IS SHOWN



AREA DESIGNATION

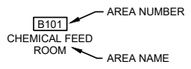
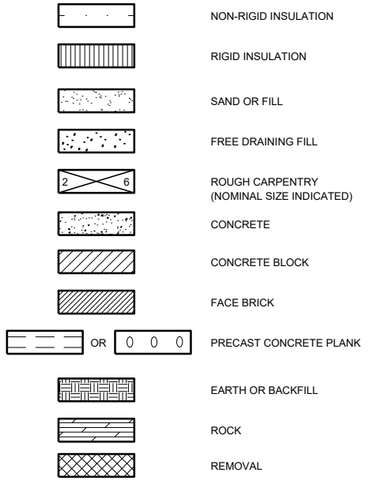
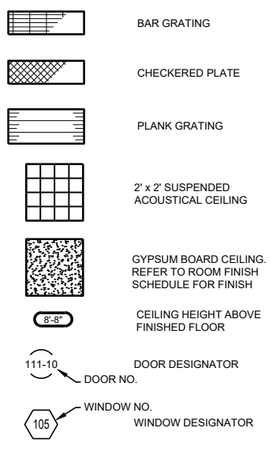


PHOTO DESIGNATION

SYMBOLS



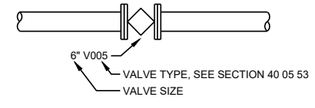


INSTRUMENT IDENTIFICATION

SAME AS SHOWN ON P&ID LEGEND.
EXCEPTION: COMPONENT DESIGNATORS NOT USED ON PROCESS MECHANICAL DRAWINGS

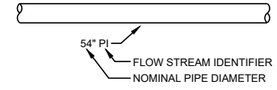
VALVE IDENTIFICATION

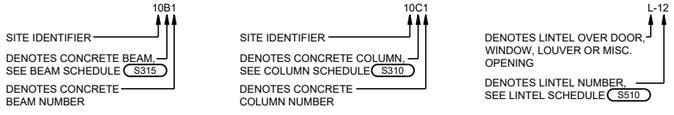
EXAMPLE:



PIPE IDENTIFICATION

EXAMPLE:





ABBREVIATIONS

ACT	ACOUSTICAL TILE
AD	ACCESS DOOR
ADDL	ADDITIONAL
AFF	ABOVE FINISHED FLOOR
AL	ALUMINUM
ALT	ALTERNATE
APPROX	APPROXIMATE
ARCH	ARCHITECTURAL
AVG	AVERAGE
B	BOTTOM
B/	BOTTOM OF
BF	BLIND FLANGE
BFP	BACKFLOW PREVENTER
BLDG	BUILDING
BLK	BLOCK
BLKG	BLOCKING
BM	BEAM
BOB	BOTTOM OF BEAM
BOT	BOTTOM
BRD	BOARD
CL	CENTERLINE
CEM	CEMENT
CH	CEILING HEIGHT
CJ or CJT	CONTROL JOINT
CLG or CEIL	CEILING
CLO	CLOSET
CLR	CLEAR
CMU	CONCRETE MASONRY UNIT
CO	CLEAN OUT
COL	COLUMN
COMPO	COMPOSITION
CONC	CONCRETE
CONF	CONFERENCE
CONN	CONNECTION
CONST	CONSTRUCTION
CONT	CONTINUOUS
CONTR	CONTRACT/CONTRACTOR
CONTR JT	CONTRACTION JOINT
CORR	CORRIDOR
C.T.	CERAMIC TILE
CPVC	CHLORINATED POLYVINYL CHLORIDE
CSK	COUNTERSINK
CTR	CENTER
DBL	DOUBLE
DEG	DEGREE
DEG	DEGREES (ANGULAR)
DET	DETAIL
DIA	DIAMETER
DIAG	DIAGONAL
DIM	DIMENSION
DIP	DUCTILE IRON PIPE
DIR	DIRECTION
DN	DOWN
DWG	DRAWING
EA	EACH
ECC	ECCENTRIC
EF	EACH FACE
EJ	EXPANSION JOINT
EL	ELEVATION
ELEC	ELECTRICAL
ELEV or EL	ELEVATION
ELL	ELBOW
ELEV	ELEVATOR
EQ	EQUAL
EQUIP	EQUIPMENT
EW	EACH WAY
EWC	ELECTRICAL WATER COOLER
EXIST or (X)	EXISTING
EXP	EXPANSION
EXP JT	EXPANSION JOINT
EXT	EXTERIOR
F/	FACE OF
FCA	FLANGED COUPLING ADAPTOR
FD	FLOOR DRAIN
FE	FIRE EXTINGUISHER
FEC	FIRE EXTINGUISHER CABINET
FF	FINISH FLOOR
FFE	FINISH FLOOR ELEVATION
FH	FULL HEIGHT
FHC	FIRE HOSE CABINET
FIN	FINISH
FL or FLR	FLOOR
FLG	FLANGE
FO	FINISHED OPENING
FOC	FACE OF CONCRETE
FOS	FACE OF STUD
FOUND	FOUNDATION
FOW	FACE OF WALL
FRP	FIBER REINFORCED PLASTIC
FS	FLOOR SINK
FS	FULL SIZE
FSD	FULL SIZE DETAIL
FT	FEET
FTG	FOOTING
FV	FIELD VERIFY
GA	GAUGE
GALV	GALVANIZED
G.B.	GRAB BAR
GCMU	GLAZED CONCRETE MASONRY UNIT
GL	GLASS
GR	GRADE
GYP BD	GYPSUM BOARD
H	HIGH
HB	HOSE BIB
H/C	HANDICAPPED
HDWD	HARDWOOD
HDWR	HARDWARE
HM	HOLLOW METAL
HORZ	HORIZONTAL
HP	HIGH POINT
HT	HEIGHT
HWL	HIGH WATER LEVEL
ID	INSIDE DIAMETER
INSUL	INSULATION
INT	INTERIOR
INV	INVERT
JAN	JANITOR
KITCH	KITCHEN
LAV	LAVATORY
LEV	LEVEL
LIG	LAY-IN-GRID CEILING
LLH	LONG LEG HORIZONTAL
LLV	LONG LEG VERTICAL
LP	LOW POINT
LR	LONG RADIUS
LTG	LIGHTING
LTWT	LIGHT WEIGHT
LWL	LOW WATER LEVEL
MAINT	MAINTENANCE
MAT'L	MATERIAL
MAX	MAXIMUM
MB	MACHINE BOLT
MECH	MECHANICAL
MET	METAL
MEZZ	MEZZANINE
MFR	MANUFACTURER
MH	MANHOLE
MIN	MINIMUM
MISC	MISCELLANEOUS
MJ	MECHANICAL JOINT
MO	MASONRY OPENING
MULL	MULLION
N	NEW
NIC	NOT IN CONTRACT
NO. or #	NUMBER
NOM	NOMINAL
NR	NON-RATED
NTS	NOT TO SCALE
OC	ON CENTER
OD	OUTSIDE DIAMETER
OFI	OWNER FURNISHED ITEM
OFOI	OWNER FURNISHED OWNER INSTALLED
OPNG or OPN'G	OPENING
OPPO	OPPOSITE
P&ID	PROCESS AND INSTRUMENTATION DIAGRAM
P. LAM.	PLASTIC LAMINATE
PC	PORTLAND CEMENT
PCP	PRE-STRESSED CONCRETE PIPE
PIPE	
PJF	PREFORMED JOINT FILLER
PL	PLATE
PLAS	PLASTIC
PLYWD	PLYWOOD
PR	PAIR
PREP	PREPARATION
PROJ	PROJECTION
PT	PAINT
PVC	POLYVINYL CHLORIDE
QT	QUARRY TILE
R	RISER
R or RAD	RADIUS
RC	ROOF CONDUCTOR
RCP	REINFORCED CONCRETE PIPE
RCP	REFLECTED CEILING PLAN
RD	ROOF DRAIN
REC	RECESSED
RED	REDUCER
REDW'D	REDWOOD
REF	REFERENCE
REFL	REFLECTED
REINF	REINFORCE/REINFORCING
REQ'D	REQUIRED
RES	RESILIENT
REV	REVISION/REVISED
RM	ROOM
RO	ROUGH OPENING
SCHED	SCHEDULE
SD	SUMP DISCHARGE
SECT	SECTION
SHT	SHEET
SIM	SIMILAR
SPA	SPACE OR SPACING
SPECS	SPECIFICATIONS
SQ	SQUARE
SR	SHORT RADIUS
SS or SST	STAINLESS STEEL
STD	STANDARD
STL	STEEL
STRUCT	STRUCTURAL
SUSP	SUSPENDED
SV	STAIN AND VARNISH
T	TOP
T	TREAD
T/	TOP OF
T/S	TOP OF STEEL
T&B	TOP AND BOTTOM
T & G	TONGUE & GROOVE
TDC	TRAFFIC DECK COVERING
TEMP	TEMPERED
THK	THICK
TOC	TOP OF CONCRETE or CURB
TOP	TOP OF PARAPET
TOS	TOP OF STEEL
TOW	TOP OF WALL
TYP	TYPICAL
UNO	UNLESS NOTED OTHERWISE
VB	VINYL BASE
VCT	VINYL COMPOSITION TILE
VER	VERIFY
VERT	VERTICAL
VIF	VERIFY IN FIELD
W	WIDE
W/	WITH
WC	WATER CLOSET
WD	WOOD
WL	WATER LEVEL
WO	WITHOUT
WP	WATERPROOFING
WS	WATERSTOP
WWF	WELDED WIRE FABRIC
YR	YEAR

NOTE:

1. THIS IS STANDARD LEGEND. NOT ALL OF THE INFORMATION SHOWN ON THIS LEGEND IS NEEDED IN THESE CONTRACT DRAWINGS.
2. WORK IN THIS CONTRACT SHOWN FULL-TONE UNLESS OTHERWISE NOTED.

FLOW STREAM IDENTIFIERS

ALP	AIR (LOW PRESSURE)
AHP	AIR (HIGH PRESSURE)
BD	BASIN DRAIN
BW	BACKWASH
CEN	CENTRATE
CFE	COMBINED FILTER EFFLUENT
CGR	COOLING GLYCOL RETURN
CGS	COOLING GYLCOL SUPPLY
CH	CHEMICAL
D	DRAIN
DCT	DECANT
DG	DIGESTER GAS
DSC	DIGESTED SLUDGE CIRCULATED
DS	DIGESTED SLUDGE
DSH	DIGESTED SLUDGE HEATED
DSL	DIGESTED SLUDGE LOADOUT
DSM	DIGESTED SLUDGE MIXING
DST	DIGESTED SLUDGE TRANSFER
EXH	EXHAUST
FE	FINAL EFFLUENT
FECL	FERRIC CHLORIDE
FLT	FILTRATE
GRS	GRIT SLURRY
GRT	GRIT
H2S	HYDROGEN SULFIDE
HFSA	HYDROFLUOSILICIC ACID
HGR	HEATING GLYCOL RETURN
HGS	HEATING GLYCOL SUPPLY
HWR	HEATING WATER RETURN
HWS	HEATING WATER SUPPLY
LPO	LIQUID POLYMER
ML	MIXED LIQUOR
NAOCL	SODIUM HYPOCHLORITE
NAOH	SODIUM HYDROXIDE
NG	NATURAL GAS
NHOH	AQUA AMMONIA
OA	ODOROUS AIR
OF	OVERFLOW
PE	PRIMARY EFFLUENT
PI	PRIMARY INFLUENT
PO	POLYMER
PSD	PRIMARY SLUDGE
PSM	PRIMARY SCUM
RAS	RETURN ACTIVATED SLUDGE
RCY	RECYCLE
RWW	RAW WASTEWATER
SA	SAMPLE
SAN	SANITARY SEWER
SBS	SODIUM BISULFITE
SCN	SCREENINGS
SE	SECONDARY EFFLUENT
SI	SECONDARY INFLUENT
SHC	SODIUM HYPOCHLORITE
SSM	SECONDARY SCUM
SUP	SUPERNATANT
TDSD	THICKENED DIGESTED SLUDGE
TPSD	THICKENED PRIMARY SLUDGE
TS	THICKENED SLUDGE
TWAS	THICKENED WASTE ACTIVATED SLUDGE
V	VENT
WAS	WASTE ACTIVATED SLUDGE
W1	POTABLE CITY WATER
W2	NON-POTABLE CITY WATER
W3	PLANT EFFLUENT WATER (NON-POTABLE)
WW	WASHWATER

Designed By	KAR
Drawn By	KAR
Checked By	SPG
Approved By	TMM
Filename	001-LEGENDS.DWG
Project No.	14144
Project Date	JAN 2025

Date | Checked By | Drawn By | Revision Description | Revision Number

CITY OF BLOOMINGTON UTILITIES
MONROE WTP IMPROVEMENTS: CHEMICAL FEED LINE REPLACEMENT AND BACKWASH SYSTEM PUMP ADDITION AND TANK REHABILITATION - BLOOMINGTON, IN

GENERAL
GENERAL LEGEND, SYMBOLS AND ABBREVIATIONS

DONOHUE

Sheet No. 3

Drawing No. 001-G-2

LEGEND

EXISTING	PROPOSED	
		BENCHMARK
		CATCH BASIN
		CULVERT
		CULVERT OVER 24" (SHOWN ACTUAL SIZE)
		GAS VALVE
		GUY WIRE
		HAY BALES
		HEADWALL
		HYDRANT
		INLET
I.P.		IRON PIPE
		MANHOLE
		MARSH
M	M	METER
		UTILITY POLE
		UTILITY POLE WITH LIGHT
		SECTION CORNER
		SIGN
400.00	400.00	SPOT ELEVATION
		SOIL BORING
		STREET LIGHT
		SURVEY CONTROL POINT
		TELEPHONE PEDESTAL
		TREE CONIFEROUS, DECIDIOUS
		TREE REMOVAL
		TREE/SHRUB LINE
		VALVE
		WATER VALVE

LINE TYPE IDENTIFICATION

EXISTING	PROPOSED	
		CENTERLINE OF ROAD
400	400	CONTOUR
		DITCH/SWALE
		EASEMENT
X X	X X	FENCE
		GUARDRAIL
		PIPE, ABANDON
		PIPE, PREVIOUSLY ABANDONED
		PIPE OVER 24" (SHOWN ACTUAL SIZE)
	XXX	PIPE REMOVAL
		PROPERTY LINE
		R.O.W.
		RAILROAD
		SILT FENCE
		WATERS EDGE
WET		WETLAND

YARD PIPING ABBREVIATIONS

EXISTING	PROPOSED	
CATV		CABLE TV
E	E	ELECTRIC
DUCT	DUCT	ELECTRICAL DUCT
FO	FO	FIBER OPTIC
FM	FM	FORCEMAIN
NG	NG	GAS
OHE		OVERHEAD ELECTRIC
SAN	SAN	SANITARY SEWER
ST	ST	STORM SEWER
T		TELEPHONE
?		UNKNOWN UTILITY
W	W	WATER

ABBREVIATIONS

AGG	AGGREGATE
B/C	BACK OF CURB
BIT	BITUMINOUS/ASPHALT
CIP	CAST IRON PIPE
CO	CLEANOUT
CONC	CONCRETE
CMP	CORRUGATED METAL PIPE
CSP	CONCRETE SEWER PIPE
DIA	DIAMETER
DIP	DUCTILE IRON PIPE
DW	DEWATERING PIPE
EXTG	EXISTING
EOP	EDGE OF PAVEMENT
F&C	FRAME AND COVER
F/C	FACE OF CURB
F-F	FACE TO FACE
F/G	FINISHED GRADE
FES	FLARED END SECTION
INV	INVERT
L	LENGTH OF CURVE
LF	LINEAR FT
LT	LEFT
NG	NATURAL GAS
OH	OVERHEAD UTILITY
PC	POINT OF CURVATURE
PE	POLYETHYLENE PIPE
PI	POINT OF INTERSECTION
PL	PROPERTY LINE
PT	POINT OF TANGENCY
PVC	POLYVINYL CHLORIDE PIPE
PVI	POINT OF VERTICAL INTERSECTION
R	RADIUS
RCP	REINFORCED CONCRETE PIPE
RIM	TOP OF CASTING ELEVATION
ROW	RIGHT OF WAY
RT	RIGHT
SAN	SANITARY SEWER
STM	STORM SEWER
SD	SUMP DISCHARGE
T/C	TOP OF CURB
T/W	TOP OF WALL
UD	UNDERDRAIN
VC	VERTICAL CURVE

SYMBOLS

- EXISTING ASPHALTIC PAVEMENT
- EXISTING CONCRETE
- PROPOSED ASPHALTIC MILL PAVEMENT
- PROPOSED CONCRETE PAVEMENT
- PROPOSED LANDSCAPE STONE
- REMOVE & REPLACE ASPHALTIC PAVEMENT & BASE
- REMOVE EXISTING CONCRETE PAVEMENT
- PROPOSED ASPHALTIC SURFACE RESTORATION
- PROPOSED ASPHALT FULL DEPTH RESTORATION
- STAGING AREA

NOTE:

1. PROCESS FLOW STREAM IDENTIFIERS SAME AS SHOWN ON THE PROCESS MECHANICAL LEGEND
2. THIS IS STANDARD LEGEND. NOT ALL OF THE INFORMATION SHOWN ON THIS LEGEND IS NEEDED IN THESE CONTRACT DRAWINGS.

TRENT M. MONTEMAYOR REGISTERED No. PE11200215 STATE OF INDIANA PROFESSIONAL ENGINEER
01/06/2025

Revision Number	Revision Description	Drawn By	Checked By	Date

Designed By	KAR
Drawn By	KAR
Checked By	SPG
Approved By	TMM
Filename	001-LEGENDS.DWG
Project No.	14144
Project Date	JAN 2025

CITY OF BLOOMINGTON UTILITIES
MONROE WTP IMPROVEMENTS: CHEMICAL FEED LINE REPLACEMENT AND BACKWASH SYSTEM PUMP ADDITION AND TANK REHABILITATION - BLOOMINGTON, IN

GENERAL
CIVIL LEGEND AND GENERAL NOTES

DONOHUE

Sheet No. 4

Drawing No. 001-G-3

PLUMBING / HVAC ABBREVIATIONS AND SYMBOLS

PLUMBING LEGEND

- HW - HOT WATER PIPE (ON PLUMBING DRAWINGS)
- HWRE - HOT WATER RECIRCULATING PIPE (ON PLUMBING DRAWINGS)
- HWS - HEATING WATER SUPPLY PIPE (ON HVAC DRAWINGS)
- HWR - HEATING WATER RETURN PIPE (ON HVAC DRAWINGS)
- PIPE (REFER TO FLOW STREAM IDENTIFIERS)
- BELOW SLAB OR BURIED PIPE (REFER TO FLOW STREAM IDENTIFIERS)
- VENT
- ELBOW FITTING (TURNED DOWN)
- ELBOW FITTING (TURNED UP)
- TEE OUTLET UP
- TEE OUTLET DOWN
- PIPE ANCHOR
- PIPE HANGER
- PIPE GUIDE
- CAP
- EXPANSION JOINT
- UNION
- FLANGE
- X" VTR — VENT THRU ROOF
- FLOOR DRAIN
- X" CO — CLEANOUT
- X" CO — FLOOR CLEANOUT
- WALL CLEANOUT
- X" HD — HUB DRAIN
- X" RD — ROOF DRAIN
- X" OD — OVERFLOW DRAIN
- TRENCH DRAIN
- YARD HYDRANT
- WH — WALL HYDRANT
- HB — HOSE BIBB
- REDUCER (CONCENTRIC)
- REDUCER (ECCENTRIC)
- BALL VALVE
- BUTTERFLY VALVE
- CHECK VALVE
- GATE VALVE
- ANGLE STOP
- GLOBE VALVE
- PLUG VALVE
- PRESSURE REDUCING VALVE
- RELIEF OR SAFETY VALVE
- CONTROL VALVE (2-WAY)
- CONTROL VALVE (3-WAY)
- BALANCING VALVE
- MANUAL AIR VENT
- STRAINER
- BACKFLOW PREVENTER
- WATER HAMMER ARRESTOR

HVAC LEGEND

- AD — ACCESS DOOR
- 12x20 — DUCT (FIRST FIG. IS SIDE SHOWN)
- 20x12 — DUCT SECTION (RETURN)
- DUCT SECTION (SUPPLY)
- DUCT LINING
- RETURN, EXHAUST OR SUPPLY GRILLE W/ MVD
- ELBOW DOWN
- ELBOW W/ TURNING VANES
- MANUAL VOLUME DAMPER
- FLEXIBLE CONNECTOR
- SD — SMOKE DETECTOR
- T H P G — STAT, T=TEMP, H=HUMIDITY, P=PRESSURE, G=GAS; XX GAS MONITORED
- T H P G XX — SENSOR WITH DISPLAY AND ADJUSTMENT
- T H P G XX — SENSOR WITHOUT DISPLAY OR ADJUSTMENT
- FIRE DAMPER
- MOTOR OPERATED DAMPER
- GRAVITY BACKDRAFT DAMPER
- PRESSURE GAUGE
- THERMOMETER

FLOWSTREAM IDENTIFIERS

AI	INSTRUMENT AIR	HWR	HEATING WATER RETURN
AHP	AIR (HIGH PRESSURE)	HWRE	HOT WATER RECIRCULATION
AV	ACID VENT	HWS	HEATING WATER SUPPLY
AW	ACID WASTE	PRW	
CND	CONDENSATE	RHG	REFRIGERANT (HOT GAS)
CGR	COOLING GLYCOL RETURN	RL	REFRIGERANT (LIQUID)
CGS	COOLING GLYCOL SUPPLY	RS	REFRIGERANT (SUCTION)
CR	CONDENSATE RETURN	SAN	SANITARY SEWER
CWR	CHILLED WATER RETURN	SLP	STEAM (LOW PRESSURE)
CWS	CHILLED WATER SUPPLY	STM	STORM SEWER
F	FIRE SPRINKLER	TW	TEMPERED WATER
NG	GAS (NATURAL)	V	VENT
HGR	HEATING GLYCOL RETURN	W1	POTABLE CITY WATER
HGS	HEATING GLYCOL SUPPLY	W2	NON-POTABLE CITY WATER
HPHW	HIGH PRESSURE HOT WATER	W3	PLANT EFFLUENT WATER
HPW	HIGH PRESSURE WATER		(NOT-POTABLE)
HW	HOT WATER	"A"	WATER HAMMER SIZE, A-D

ABBREVIATIONS

AFF	ABOVE FINISHED FLOOR	MVD	MANUAL VOLUME DAMPER
BDD	BACKDRAFT DAMPER	OA	OUTSIDE AIR
BOD	BOTTOM OF DUCT	PSIG	POUND PER SQUARE INCH (GAUGE)
CL	CENTER LINE ELEVATION		
DFU	DRAINAGE FIXTURE UNIT	THRU	THROUGH
EL	ELEVATION	TOD	TOP OF DUCT
EXP	EXPLOSION PROOF	VTR	VENT THROUGH ROOF
H-O-A	HAND-OFF-AUTO SWITCH	WSFU	WATER SUPPLY FIXTURE UNIT
HP	HIGH POINT	VIF	VERIFY IN FIELD
LP	LOW POINT		

EQUIPMENT TAG IDENTIFIERS

ACU	AIR CONDITIONING UNIT	IH	INTAKE HOOD
ACCU	AIR COOLED CONDENSING UNIT	LAV	LAVATORY
AHU	AIR HANDLING UNIT	MAU	MAKE-UP AIR UNIT
B	BOILER	MCD	MOTOR CONTROL DAMPER
BS	BRANCH SELECTOR	MS	MOP SINK
CO	CLEANOUT	OAL	OUTSIDE AIR LOUVER
CP	CIRCULATING PUMP	P	PUMP
CS	COUNTERTOP SINK	RAL	RELIEF AIR LOUVER
DEH	DEHUMIDIFIER	RD	ROOF DRAIN
EAL	EXHAUST AIR LOUVER	RG	RETURN GRILLE
EEW	EMERGENCY EYEWASH STATION	RH	RELIEF HOOD
EF	EXHAUST FAN	RHP	RADIANT HEATING PANEL
EG	EXHAUST GRILLE	RPZ	REDUCED ZONE PRESSURE BACKFLOW PREVENTER
EH	ELECTRIC HEATER		
EUH	ELECTRIC UNIT HEATER	RTU	ROOFTOP UNIT
EWC	ELECTRIC WATER COOLER	SD	SUPPLY DIFFUSER
EWH	ELECTRIC WATER HEATER	SF	SUPPLY FAN
EWS	EMERGENCY WASH STATION	SG	SUPPLY GRILLE
FCU	FAN COIL UNIT	SHR	SHOWER
FD	FLOOR DRAIN	SP	SUMP PUMP
GDCP	GAS DETECTION CONTROL PANEL	SPCP	SUMP PUMP CONTROL PANEL
GUH	GAS UNIT HEATER	SS	SERVICE SINK
GWH	GAS WATER HEATER	TCP	TEMPERATURE CONTROL PANEL
HB	HOSE BIB	TG	TRANSFER GRILLE
HD	HUB DRAIN	TMV	THERMOSTATIC MIXING VALVE
HP	HEAT PUMP	UR	URINAL
HPHW	HIGH PRESSURE HOT WATER SYSTEM	VAV	VARIABLE AIR VOLUME BOX
		WCCU	WATER COOLED CONDENSING UNIT
HPW	HIGH PRESSURE WATER SYSTEM		
HUH	HOT WATER UNIT HEATER	WC	WATER CLOSET
HWC	HOT WATER CONVECTOR	WH	WALL HYDRANT
ICD	INSULATED MOTOR CONTROL DAMPER		

ELECTRICAL ABBREVIATIONS AND SYMBOLS

ABBREVIATIONS

A	AMPERE
AFF	ABOVE FINISHED FLOOR
AFG	ABOVE FINISHED GRADE
AIC	AMPERE INTERRUPTING CAPACITY
ATS	AUTOMATIC TRANSFER SWITCH
C	CONTACTOR/CONDUIT/COIL
CB	CIRCUIT BREAKER
CKT, CCT	CIRCUIT
DISC	DISCONNECT
GFCI	GROUND FAULT CIRCUIT INTERRUPTER
GFP	GROUND FAULT PROTECTION
GRD	GROUND
GRS	GALVANIZED RIGID STEEL
HF	HARMONIC FILTER
HH	HANDHOLE
HID	HIGH INTENSITY DISCHARGE
HP	HORSEPOWER
J	JUNCTION BOX
KVA	KILOVOLT AMPERE
KW	KILOWATT
LC	LIGHTING CONTACTOR
LCP	LOCAL CONTROL PANEL
LED	LIGHT EMITTING DIODE
LP	LIGHTING PANEL
LSIGA	LONG TIME, SHORT TIME, INSTANTANEOUS, GROUND, ARC FLASH
MCB	MAIN CIRCUIT BREAKER
MCC	MOTOR CONTROL CENTER
MH	MANHOLE
MV	MEDIUM VOLTAGE MANHOLE
NEC	NATIONAL ELECTRICAL CODE (ANSI/NFPA-70)
NEU, N	NEUTRAL
NC	NORMALLY CLOSED
NF	NON FUSED
NGR	NEUTRAL GROUND RESISTOR
NO	NORMALLY OPEN
OL	OVERLOAD RELAY
PC	PHOTOCELL
PMG	PADMOUNT GEAR
PMT	PADMOUNT TRANSFORMER
PP	POWER PANEL
PVC	POLY VINYL CHLORIDE
SCCR	SHORT CIRCUIT CURRENT RATING
SPD	SURGE PROTECTIVE DEVICE
SW	SWITCH
SWBD	SWITCH BOARD
SWGR	SWITCHGEAR
V	VOLTS
VFC	VENDOR FURNISHED CABLE
VFD	VARIABLE FREQUENCY DRIVE
WP	WEATHERPROOF
XFMR	TRANSFORMER
XP	EXPLOSION PROOF

ONE-LINE SYMBOLS

- 15 M (OR) CL 600 AF 500 AT — MAGENTIC STARTER AND MOLDED CASE CIRCUIT BREAKER (UPPER NUMERAL INDICATES FRAME SIZE) (LOWER NUMERAL INDICATES TRIP SETTING) (CL - INDICATES CURRENT LIMITING CIRCUIT BREAKER) (M - INDICATES MOTOR CIRCUIT PROTECTOR)
- FVNR 2a 1b 2 — (FVNR - INDICATES FULL VOLTAGE NON-REVERSING) (FVR - INDICATES FULL VOLTAGE REVERSING) (SSRV - INDICATES SOLID STATE REDUCED VOLTAGE) (TSTW - INDICATES TWO SPEED TWO WINDING) (TSSW - INDICATES TWO SPEED SINGLE WINDING) (CONT - INDICATES CONTACTOR) (AUXILIARY CONTACTS - (2a TWO N.O.)(1b ONE N.C.) (NUMERAL INDICATES NEMA SIZE)
- FVNR 2a 1b 2 — COMBINATION MAGNETIC STARTER WITH MOLDED CASE CIRCUIT BREAKER (FVNR - INDICATES FULL VOLTAGE NON-REVERSING) (FVR - INDICATES FULL VOLTAGE REVERSING) (SSRV - INDICATES SOLID STATE REDUCED VOLTAGE) (TSTW - INDICATES TWO SPEED TWO WINDING) (AUXILIARY CONTACTS - (2a TWO N.O.)(1b ONE N.C.) (NUMERAL INDICATES NEMA SIZE)
- K — KEY INTERLOCK
- DELTA
- WYE GROUND
- ATS
- GENERATOR
- 3200AF 2000AT — DRAW-OUT LV POWER CIRCUIT BREAKER
- 80A — FUSED SWITCH (NUMERAL INDICATES FUSE SIZE)
- LIGHTNING ARRESTER
- T — TRANSFORMER
- GROUND
- 75 — MOTOR (NUMERAL INDICATES HORSEPOWER)
- 52 — DRAW-OUT CIRCUIT BREAKER (NUMERAL INDICATES DEVICE NUMBER)
- MEDIUM-VOLTAGE TERMINATION
- 52 — CURRENT TRANSFORMER AND PROTECTIVE DEVICE (NUMERAL INDICATES DEVICE NUMBER)

PLAN SYMBOLS

- A — LED FIXTURE - RECESSED (LETTER DENOTES TYPE)
- A — LED FIXTURE - SURFACE/SUSPENDED (LETTER DENOTES TYPE)
- A — LED FIXTURE - WALL MOUNTED (LETTER DENOTES TYPE)
- A — LED OR HID FIXTURE - WALL MOUNTED (LETTER DENOTES TYPE)
- A — LED OR HID FIXTURE - POLE MOUNTED FIXTURE (LETTER DENOTES TYPE)
- A — LED OR HID FIXTURE - SURFACE/SUSPENDED (LETTER DENOTES TYPE)
- EMERGENCY BATTERY LIGHT
- REMOTE HEAD FOR EMERGENCY BATTERY LIGHT
- EXIT LIGHT WITH INDICATING DIRECTIONAL ARROW
- COMBO EMERGENCY LIGHT/EXIT SIGN
- 1 2 3 4 — SWITCH (SINGLE POLE, 2-POLE, 3-WAY, 4-WAY)
- MC — MOMENTARY CONTACT SWITCH - CENTER OFF
- P — SWITCH / PILOT LIGHT
- DUPLEX GROUNDED RECEPTACLE - 120V
- EXPLOSIONPROOF SIMPLEX GROUNDED RECEPTACLE - 120V
- TELEPHONE OUTLET, WALL MOUNT WITH 3/4" CONDUIT TO TELEPHONE TERMINAL CABINET
- D — DATA INFORMATION OUTLET
- RECESSED CEILING SPEAKER
- V — VOLUME CONTROL
- WALL SPEAKER
- S — SMOKE DETECTOR
- F — FIRE ALARM HORN
- F S — FIRE ALARM HORN AND STROBE
- F S — FIRE ALARM STROBE
- F — FIRE ALARM PULL STATION
- H — HEAT DETECTOR
- F FS — FLOW SWITCH
- MD — MOTION DETECTOR
- CONNECTION TO EQUIPMENT
- SPECIAL PURPOSE RECEPTACLE, NEMA TYPE AND AMPERE RATING AS INDICATED
- C — DUPLEX GROUNDED RECEPTACLE - 120V MOUNTED ABOVE COUNTERS OR WORK BENCHES
- 3 WAY OR 4 WAY nLIGHT AIR SWITCHES
- MANUAL STARTER WITH PILOT LIGHT
- THREE PHASE MAGNETIC STARTER
- I — INFORMATION OUTLET
- THREE PHASE COMBINATION MAGNETIC STARTER AND DISCONNECT SWITCH
- SINGLE PHASE MAGNETIC STARTER
- 30 — NON-FUSED DISCONNECT SWITCH (NUMERAL INDICATES SWITCH RATING)
- F — FUSED DISCONNECT SWITCH - 3 POLE UNLESS OTHERWISE INDICATED (UPPER NUMERAL INDICATES SWITCH RATING) (LOWER NUMERAL INDICATES FUSE RATING) — 60 / 40
- $ — 3-PHASE MANUAL MOTOR SWITCH
- TERMINAL CABINET (ITC - INDICATES INSTRUMENTATION) (TTC - INDICATES TELEPHONE)
- M — MOTOR
- J — JUNCTION BOX
- HH — HANDHOLE
- MH — MANHOLE
- SURVEILLANCE CAMERA
- GROUND ROD
- GROUND TEST WELL
- AIR TERMINAL
- CONDUIT STUB
- CONDUIT TURNING UP OR TO OBSERVER
- CONDUIT TURNING DOWN OR AWAY FROM OBSERVER
- FLEXIBLE CONDUIT CONNECTION
- HOMERUN CIRCUIT OR CONDUCTORS
- DIRECT BURIAL CABLE
- E — E — UNDERGROUND ELECTRICAL DUCT, CONCRETE ENCASED.
- OH — OVERHEAD ELECTRIC

PANELBOARDS

010LP1-4

- BUILDING NO.
- LIGHTING OR POWER PANEL AS INDICATED
- PANEL NO.
- CIRCUIT NO.

MOTOR CONTROL CENTER

010MCC-1

- BUILDING NO.
- MCC, SWITCHBOARD OR SWITCHGEAR AS INDICATED
- MCC NO.

DEVICE NUMBER	FUNCTION
27	UNDERVOLTAGE RELAY
32	REVERSE POWER RELAY
46	PHASE-BALANCE CURRENT RELAY
47	PHASE-SEQUENCE VOLTAGE RELAY
50	INSTANTANEOUS OVERCURRENT
51	AC TIME OVERCURRENT RELAY
51N	GROUND OVERCURRENT
52	AC CIRCUIT BREAKER
59	OVERVOLTAGE RELAY
67	AC DIRECTIONAL OVERCURRENT
81	OVER/UNDER FREQUENCY RELAY
86	LOCKOUT RELAY
87	DIFFERENTIAL
89	POTENTIAL TRANSFORMER

NOTE:

1. THIS IS A STANDARD LEGEND. NOT ALL OF THE INFORMATION SHOWN ON THIS LEGEND IS NEEDED IN THESE CONTRACT DRAWINGS.
2. WORK IN THIS CONTRACT SHOWN FULL TONE UNLESS OTHERWISE NOTED.

TRENT M. MONTEMAYOR REGISTERED No. PE11200215 STATE OF INDIANA PROFESSIONAL ENGINEER
01/06/2025

Revision Number	Revision Description	Drawn By	Checked By	Date

Designed By	KAR
Drawn By	KAR
Checked By	SPG
Approved By	TMM
Filename	001-LEGENDS.DWG
Project No.	14144
Project Date	JAN 2025

CITY OF BLOOMINGTON UTILITIES
MONROE WTP IMPROVEMENTS: CHEMICAL FEED LINE REPLACEMENT AND BACKWASH SYSTEM PUMP ADDITION AND TANK REHABILITATION - BLOOMINGTON, IN

GENERAL
PLUMBING LEGEND/HVAC LEGEND/ELECTRICAL LEGEND

DONOHUE

Sheet No. 5

Drawing No. 001-G-4

INSTRUMENT TAG IDENTIFICATION

AREA	350:	SITE IDENTIFIER
TAG TYPE	P:	FIRST LETTER, SEE TABLE BELOW
	AH:	SUCCEEDING LETTERS, SEE TABLE BELOW
TAG NUMBER	12:	P&ID NUMBER
	3:	LOOP NUMBER
	4:	COMPONENT NUMBER
	A:	DEVICE LETTER IF MULTIPLE DEVICES
TAG FUNCTION	HOA:	TAG FUNCTION ABBREVIATION, SEE LISTING AT RIGHT
(QUANTITY)	(2):	TOTAL NUMBER OF DEVICES WHERE MORE THAN ONE DEVICE IS REQUIRED. DEVICE NUMBERS ARE SEQUENTIAL BEGINNING WITH THE TAG NUMBER SHOWN. IF QUANTITY IS NOT SHOWN THEN ONE DEVICE ONLY IS REQUIRED.
COMPONENT DESIGNATOR	◆	SEE LISTING AT RIGHT

COMPONENT DESIGNATORS

- ◆ INDIVIDUAL CONTROLS COMPONENT.
- ◆◆ CONTROLS COMPONENT FURNISHED AS PART OF A MANUFACTURER'S OR VENDOR'S PACKAGED SYSTEM.
- ◆◆◆ EXISTING RELOCATED CONTROLS COMPONENT.
- ◆◆◆◆ OWNER FURNISHED CONTROLS COMPONENT.
- ✳ INDIVIDUAL MECHANICAL COMPONENT.
- ✳✳ MECHANICAL COMPONENT FURNISHED AS PART OF A MANUFACTURER'S OR VENDOR'S PACKAGED SYSTEM.
- ✳✳✳ EXISTING RELOCATED MECHANICAL COMPONENT.
- ✳✳✳✳ OWNER FURNISHED MECHANICAL COMPONENT.
- ● INDIVIDUAL ELECTRICAL COMPONENT.
- ●● ELECTRICAL COMPONENT FURNISHED AS PART OF A MANUFACTURER'S OR VENDOR'S PACKAGED SYSTEM.
- ●●● EXISTING RELOCATED ELECTRICAL COMPONENT.
- ●●●● OWNER FURNISHED ELECTRICAL COMPONENT.

COMPONENT DESIGNATORS ARE NOT INTENDED TO ENCOMPASS PIPING, CONDUIT, WIRING, OR CONCRETE STRUCTURES.

INSTRUMENT SYMBOLS

	FIELD MOUNTED	PANEL MOUNTED ACCESSIBLE TO OPERATOR	PANEL MOUNTED INACCESSIBLE TO OPERATOR	MOTOR STARTER MOUNTED ACCESSIBLE TO OPERATOR	MOTOR STARTER MOUNTED INACCESSIBLE TO OPERATOR
DISCRETE INSTRUMENTS	◯	⟷	⟷	⟷	⟷
PROGRAMMABLE CONTROLLER-BASED FUNCTIONS			◇		◇
PANEL MOUNTED OIU FUNCTIONS	⬡	⬡	⬡	⬡	⬡
PC BASED HMI WORKSTATION FUNCTIONS		▭	▭		

INSTRUMENT IDENTIFICATION LETTERS

LETTER	FIRST LETTER (S)		SUCCEEDING LETTERS		
	PROCESS OR INITIATING VARIABLE	MODIFIER	READOUT OR PASSIVE FUNCTION	OUTPUT FUNCTION	MODIFIER
A	ANALYSIS (*)		ALARM (W. LOGGING)	ANNUNCIATE	
B	BURNER, FLAME, COMBUSTION		USERS CHOICE (*)	USERS CHOICE (*)	USERS CHOICE (*)
C	USERS CHOICE (*)			CONTROL	
D	USERS CHOICE (*)	DIFFERENTIAL			
E	VOLTAGE		PRIMARY ELEMENT		
F	FLOW RATE	RATIO			FEEDBACK
G	USERS CHOICE (*)		GLASS, VIEWING DEVICE		
H	HAND (MANUAL)				HIGH
I	CURRENT		INDICATE		
J	POWER	SCAN			
K	TIME OR TIME SCHEDULE	TIME RATE OF CHANGE	KEYPAD (DATA ENTRY)	CONTROL STATION	
L	LEVEL		LIGHT (PILOT)		LOW
M	MOTOR, MOISTURE, HUMIDITY	MOMENTARY			MONITORING
N	USERS CHOICE (*)		USERS CHOICE (*)	USERS CHOICE (*)	USERS CHOICE (*)
O	USERS CHOICE (*)		ORIFICE		
P	PRESSURE OR VACUUM		POINT (TEST CONNECTION)		
Q	QUANTITY OR HEAT DUTY	INTEGRATE			
R	RADIATION		RECORD, TREND, LOG		
S	SPEED OR FREQUENCY	SAFETY		SWITCH	
T	TEMPERATURE			TRANSMIT	
U	UNIVERSAL/MULTIVARIABLE (*)		MULTIFUNCTION (*)	MULTIFUNCTION (*)	MULTIFUNCTION (*)
V	VIBRATION, MECHANICAL ANAL.			VALVE, DAMPER, LOUVER	
W	WEIGHT, FORCE, TORQUE		WELL		
X	UNCLASSIFIED (*)	X AXIS	UNCLASSIFIED (*)	UNCLASSIFIED (*)	UNCLASSIFIED (*)
Y	EVENT, STATE, OR PRESENCE	Y AXIS		RELAY,COMPUTE,CONVERT	
Z	POSITION, DIMENSION	Z AXIS		DRIVE, ACTUATE OR UNCLASSIFIED FINAL CONTROL ELEMENT	

(*) WHEN USED. AN EXPLANATION IS SHOWN ADJACENT TO SYMBOL.

COMPONENT TAG IDENTIFICATION

TAG NUMBER

V-W-XYZ ✳✳

V: SITE IDENTIFIER
W: COMPONENT TYPE
X: P&ID NUMBER
Y: LOOP NUMBER
Z: COMPONENT NUMBER
✳✳: COMPONENT DESIGNATOR

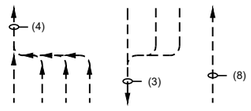
LINE IDENTIFICATION

PROCESS FLOW

- FLOW STREAM IDENTIFIERS. SEE PROCESS MECHANICAL LEGEND FOR FLOW STREAM IDENTIFIER LISTING.
- PI → NEW PROCESS FLOW STREAM (CLOSED CONDUIT)
- ALP → EXISTING PROCESS FLOW STREAM (CLOSED CONDUIT)
- PI → NEW PROCESS FLOW STREAM (OPEN CONDUIT)
- PI → EXISTING PROCESS FLOW STREAM (OPEN CONDUIT)
- PI → HEAT TRACED PROCESS FLOW STREAM (CLOSED CONDUIT)

SIGNALS

- A — MODULATED (4-20mA DC)
- HARDWIRED DISCRETE INPUTS/OUTPUTS
- X — X FAILED SYSTEM (CAPILLARY TUBING ETC.)
- PNEUMATIC
- L — L HYDRAULIC
- EM — EM ELECTROMAGNETIC OR SONIC (GUIDED)
- MECHANICAL LINK
- S SERIAL LINK (RS232/485)
- FOC FIBER OPTIC CABLE
- CE COPPER ETHERNET CABLE
- DN DEVICENET
- CN CONTROLNET



PARALLEL SIGNALS.
(PARENTHETICAL NUMBER INDICATES QUANTITY OF SIGNALS REPRESENTED)

WIRING LEGEND

( ) #14	(QUANTITY)	#14 THHN/THWN CONDUCTORS.
( ) STP	(QUANTITY)	#16 SHIELDED TWISTED PAIR.
( ) MB	(QUANTITY)	#16 SHIELDED TWISTED PAIR (MODBUS).
( ) 3C-S	(QUANTITY)	#16 SHIELDED 3-CONDUCTOR.
( ) 4C-S	(QUANTITY)	#16 SHIELDED 4-CONDUCTOR.
( ) 5C-S	(QUANTITY)	#16 SHIELDED 5-CONDUCTOR.
( ) RTD	(QUANTITY)	3-WIRE RTD CABLE.
( ) E	(QUANTITY)	TYPE E THERMOCOUPLE CABLE.
( ) K	(QUANTITY)	TYPE K THERMOCOUPLE CABLE.
( ) FOC	(QUANTITY)	FIBER OPTIC CABLE.
( ) CAT6	(QUANTITY)	CAT 6 ETHERNET CABLE, UL LISTED.
( ) VFC	(QUANTITY)	VENDOR FURNISHED CABLE.

COMPONENT TYPES

ACU	AIR CONDITIONING UNIT
ACCU	AIR COOLED CONDENSING UNIT
AHU	AIR HANDLING UNIT
ASHP	AIR SOURCE HEAT PUMP
ANT	ANTENNA
ARV	AIR RELEASE VALVE
ATS	AUTOMATIC TRANSFER SWITCH
B	BOILER
BAT	BATTERY
BFP	BELT FILTER PRESS
BLWR	BLOWER
CAM	CAMERA
CB	CIRCUIT BREAKER
CDA	CONDENSATE ACCUMULATOR
CLR	CLARIFIER
CMP	COMPRESSOR
CNT	CENTRIFUGE
CHEM	CHEMICAL FEED SYSTEM
CP	CIRCULATING PUMP
CON	CONVEYOR
CR	CARD READER
CRN	CRANE
CS	CONTROL STATION
CST	CONDENSATE SEDIMENT TRAP
DEH	DEHUMIDIFIER
DRY	DRYER
DT	DRAFT TUBE
EAL	EXHAUST AIR LOUVER
EDS	ELECTRIC DOOR STRIKE
EEW	EMERGENCY EYEWASH STATION
EF	EXHAUST FAN
EG	EXHAUST GRILLE
EH	ELECTRIC HEATER
EUH	ELECTRIC UNIT HEATER
EWC	ELECTRIC WATER COOLER
EWH	ELECTRIC WATER HEATER
EWS	EMERGENCY WASH STATION
FACP	FIRE ALARM CONTROL PANEL
FAN	FAN
FCU	FAN COIL UNIT
FCV	FLOW CONTROL VALVE
FLOC	FLOCCULATOR
FLT	FILTER
FOPP	FIBER OPTIC PATCH PANEL
FW	FIREWALL
G	GATE
GBT	GRAVITY BELT THICKENER
GCL	GRIT CLASSIFIER
GDCP	GAS DETECTION CONTROL PANEL
GEN	GENERATOR
GT	GRAVITY THICKENER
GUH	GAS UNIT HEATER
GWH	GAS WATER HEATER
GWSH	GRIT WASHER
HEX	HEAT EXCHANGER
HF	HARMONIC FILTER
HMI	HUMAN MACHINE INTERFACE
HPHW	HIGH PRESSURE HOT WATER SYSTEM
HPW	HIGH PRESSURE WATER SYSTEM
HST	HOIST
HTC	HEAT TRACE CONTROLLER
HUH	HOT WATER UNIT HEATER
HWC	HOT WATER CONVECTOR
HYD	HYDRAULIC UNIT
JBX	JUNCTION BOX
LCP	LOCAL CONTROL PANEL
LP	LIGHTING PANEL
M	MECHANICAL EQUIPMENT
MAU	MAKE-UP AIR UNIT
MCC	MOTOR CONTROL CENTER
MCP	MASTER CONTROL PANEL
MTU	MAIN TERMINAL UNIT
MS	MOTOR STARTER
MXR	MIXER
NET	NETWORK RACK
OCD	ODOR CONTROL DAMPER
OCF	ODOR CONTROL FAN
OCS	ODOR CONTROL SCRUBBER
P	PUMP
PCV	PRESSURE CONTROL VALVE
PLC	PROGRAMMABLE LOGIC CONTROLLER
PM	POWER MONITOR
PMG	PAD MOUNT GEAR
PMT	PAD MOUNT TRANSFORMER
PP	POWER PANEL
POL	POLYMER FEED SYSTEM
PRV	PRESSURE RELIEF VALVE
RAD	RADIO
RDT	ROTARY DRUM THICKENER
REG	REGULATOR
RHP	RADIANT HEATING PANEL
RIO	REMOTE I/O PANEL
RTU	REMOTE TERMINAL UNIT
SAM	SAMPLER
SBX	SPLICE BOX
SCN	SCREEN
SCC	SYSTEM CONTROL CENTER
SWC	SCREENING WASHER COMPACTOR
SF	SUPPLY FAN
SI	SOLAR INVERTER
SIL	SILO
SP	SUMP PUMP
SPCP	SUMP PUMP CONTROL PANEL
SPD	SURGE PROTECTION DEVICE
STR	STRAINER
SV	SOLENOID VALVE
SWBD	SWITCH BOARD
SWGR	SWITCHGEAR
T	TANK
TCP	TEMPERATURE CONTROL PANEL
TCV	TEMPERATURE CONTROL VALVE
TMV	THERMOSTATIC MIXING VALVE
TX	TRANSMITTER CABINET
UPS	UNINTERRUPTIBLE POWER SUPPLY
VFD	VARIABLE FREQUENCY DRIVE
VIB	VIBRATOR
WAP	WIRELESS ACCESS POINT
WGB	WASTE GAS BURNER
WS	WORKSTATION
XFMR	TRANSFORMER

TAG FUNCTION ABBREVIATIONS

ALT	ALTERNATE
AMM	AMMONIA
C	CLOSE/CLOSED
COMM	COMMUNICATIONS
CM	COMPUTER-MANUAL
DIFF	DIFFERENCE/DIFFERENTIAL
DN	DEVICENET
DO	DISSOLVED OXYGEN
DUR	DURATION
ENET	ETHERNET
ESTP	EMERGENCY STOP (ESTOP)
F	FAIL
FLT	FAULT
F(X)	CHARACTERIZED/FUNCTION
FOR	FORWARD-STOP(OFF)-REVERSE (MAINTAINED CONTACT)
FSR	FORWARD-STOP-REVERSE (MOMENTARY CONTACT)
FWD	FORWARD
F/R	FORWARD/REVERSE (MOTOR STARTER COILS)
HOA	HAND-OFF-AUTOMATIC (MAINTAINED CONTACT)
HOR	HAND-OFF-REMOTE (MAINTAINED CONTACT)
I	CURRENT TO CURRENT
INIT	INITIATE
INT	INTERVAL
IP	CURRENT TO PNEUMATIC
LL	LEAD-LAG (MAINTAINED CONTACT)
LOE	LOSS OF ECHO (ULTRASONIC SENSOR FAILURE)
LOR	LOCAL-OFF-REMOTE (MAINTAINED CONTACT
LOS	LOCKOUT STOP (LOCKABLE IN STOP POSITION)
L/R	LOCAL-REMOTE (MAINTAINED CONTACT)
MA	MANUAL-AUTOMATIC (MAINTAINED CONTACT)
MOA	MANUAL-OFF-AUTOMATIC (MAINTAINED CONTACT)
O	OPEN/OPENED
OA	OFF-AUTOMATIC
OCA	OPEN-CLOSE-AUTOMATIC (MAINTAINED CONTACT)
OC	OPEN-CLOSE
OSC	OPEN-STOP-CLOSE (SPRING RETURN TO CENTER)
OO	ON-OFF (MAINTAINED CONTACT)
OOA	ON-OFF-AUTO (MAINTAINED CONTACT)
OOR	ON-OFF-REMOTE (MAINTAINED CONTACT)
ORP	OXIDATION-REDUCTION POTENTIAL
ORTHO	ORTHOPHOSPHATE
POT	POTENTIOMETER
QTY	QUANTITY
R	RUN
REV	REVERSE
RST	RESET
SBL	SLUDGE BLANKET INTERFACE LEVEL
SQRT	SQUARE ROOT
SS	START-STOP (MOMENTARY CONTACT)
SSA	START-STOP-AUTOMATIC (MOMENTARY CONTACT)
SSL	START-STOP-LOCK (LOCKABLE IN STOP POSITION)
SUM	SUMMATION
VIB	VIBRATION
X	MULTIPLE/MULTIPLY

MISCELLANEOUS ABBREVIATIONS

ACC	ACCUMULATE/ACCUMULATION
AMB	AMBER
BLK	BLACK
BLU	BLUE
BRW	BROWN
CMD	COMMAND
CN	CONTROLNET
CPU	CENTRAL PROCESSING UNIT
CTL	CONTROL
DISCH	DISCHARGE
DN	DEVICENET
DO	DATA OUTLET
DSC	DISCONNECT
ETM	ELAPSED TIME METER
GRN	GREEN
GRY	GRAY
IP	INTERNET PROTOCOL
MOR	MOTOR OVERLOAD RELAY
MPR	MOTOR PROTECTION RELAY
MC	MEDIA CONVERTER
MM	MULTIMODE
MS	MOTOR STARTER
NIC	NETWORK INTERFACE CARD
OIT	OPERATOR INTERFACE TERMINAL
OIU	OPERATOR INTERFACE UNIT
ORG	ORANGE
PCN	PROCESS CONTROL NETWORK
PRESS	PRESSURE
PROT	PROTECTOR/PROTECTION
PWR	POWER
RED	RED
REF	REFERENCE
SEQ	SEQUENCE
SM	SINGLE MODE
TEMP	TEMPERATURE
WHT	WHITE

Revision Number	Revision Description	Drawn By	Checked By	Date

Designed By	KAR
Drawn By	KAR
Checked By	SPG
Approved By	TMM
Filename	001-LEGENDS.DWG
Project No.	14144
Project Date	JAN 2025

CITY OF BLOOMINGTON UTILITIES
MONROE WTP IMPROVEMENTS: CHEMICAL FEED LINE REPLACEMENT AND BACKWASH SYSTEM PUMP ADDITION AND TANK REHABILITATION - BLOOMINGTON, IN

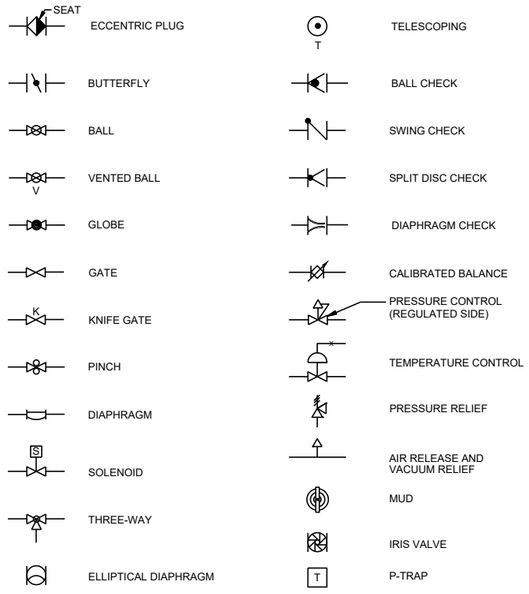
GENERAL
INSTRUMENTATION AND CONTROL STANDARD LEGEND

DONOHUE

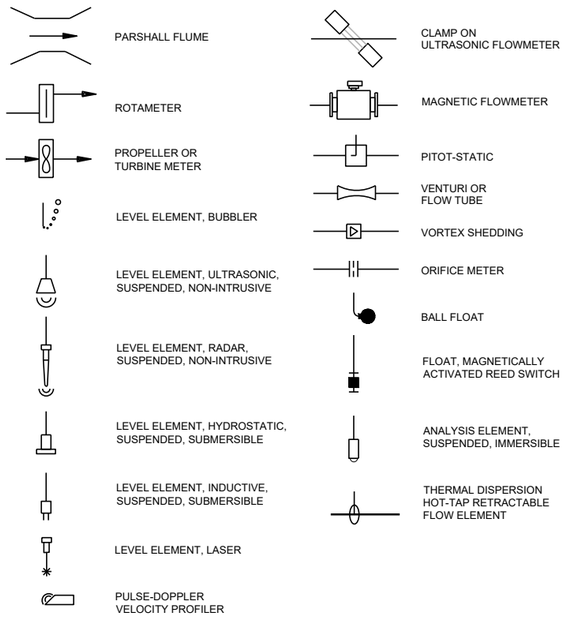
Sheet No. 6

Drawing No. 001-G-5

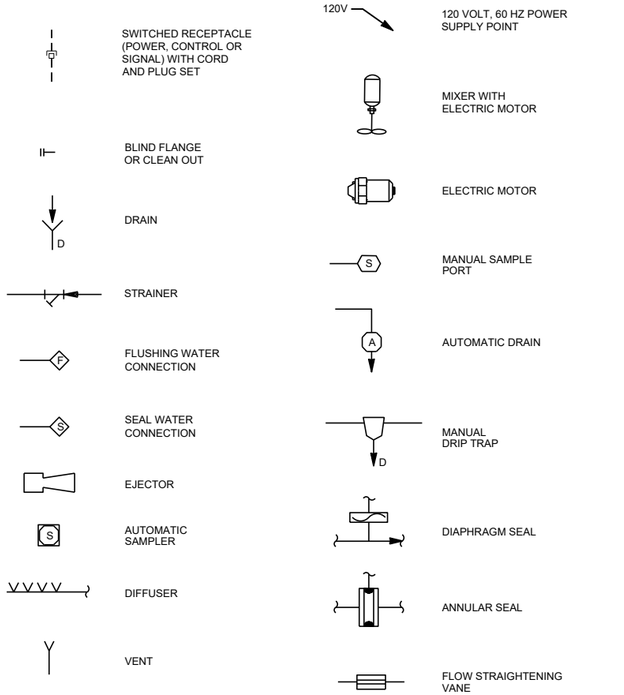
VALVE SYMBOLS



INSTRUMENT SYMBOLS



MISCELLANEOUS SYMBOLS



INPUTS & OUTPUTS (I/O) TO PLC OR DISTRIBUTED CONTROL SYSTEM

UNIVERSAL INPUT/OUPUT
(I/O = I/O POINT TYPE)

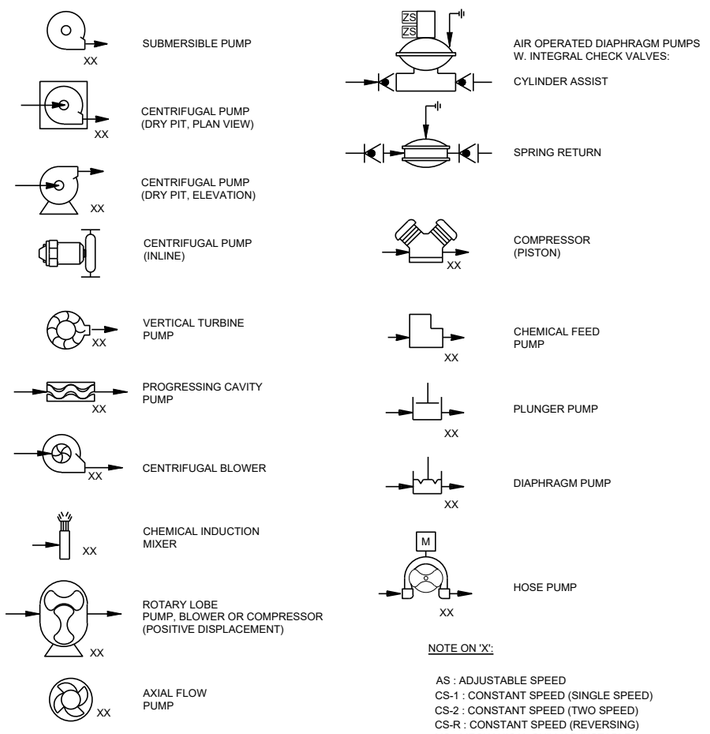
I/O POINT TYPES:

AI (ANALOG INPUT)
AO (ANALOG OUTPUT)
DI (DIGITAL INPUT)
DO (DIGITAL OUTPUT)
RO (RELAY OUTPUT)
RTD (RESISTANCE TEMPERATURE DETECTOR)

NOTE ON 'X':

X = TOTAL NUMBER OF I/O WHERE MORE THAN ONE I/O IS REQUIRED. IF QUANTITY IS NOT SHOWN THEN ONE I/O IS REQUIRED.

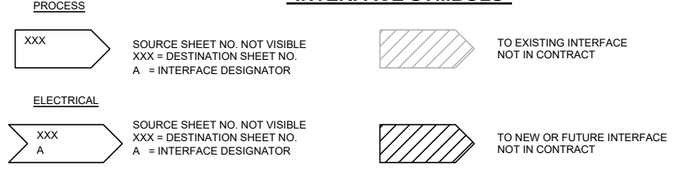
PUMP & COMPRESSOR SYMBOLS



NOTE ON 'X':

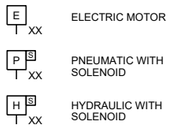
AS : ADJUSTABLE SPEED
CS-1 : CONSTANT SPEED (SINGLE SPEED)
CS-2 : CONSTANT SPEED (TWO SPEED)
CS-R : CONSTANT SPEED (REVERSING)
MS : MECHANICAL SHIV (ADJUSTABLE)

INTERFACE SYMBOLS



GATE SYMBOLS

VALVE AND GATE POWER ACTUATOR SYMBOLS



NOTE ON 'XX':

ON LOSS OF PRIMARY POWER
(PNEUMATIC OR ELECTRICAL)

XX:

FC = FAIL CLOSED POSITION
FIP = FAIL INTERMEDIATE POSITION
FLP = FAIL LAST POSITION
FO = FAIL OPEN POSITION

Revision Number	Revision Description	Drawn By	Checked By	Date

Designed By	KAR
Drawn By	KAR
Checked By	SPG
Approved By	TMM
Filename	001-LEGENDS.DWG
Project No.	14144
Project Date	JAN 2025

CITY OF BLOOMINGTON UTILITIES
MONROE WTP IMPROVEMENTS: CHEMICAL FEED LINE
REPLACEMENT AND BACKWASH SYSTEM PUMP ADDITION
AND TANK REHABILITATION - BLOOMINGTON, IN

GENERAL
INSTRUMENTATION AND CONTROL STANDARD SYMBOLOGY

DONOHUE

Sheet No. 7

Drawing No. 001-G-6

SPACE ENVIRONMENT AND HAZARDOUS RATINGS SCHEDULE

SEE MATERIALS SCHEDULE FOR REQUIRED CONSTRUCTION MATERIALS FOR VARIOUS EXPOSURES

BUILDING	SPACE NO.	SPACE NAME	EXPOSURE	HAZARDOUS RATING	HAZARD NOTES
150 - RAPID MIX BASIN	150	RAPID MIX BASIN	WET 4	UNCLASSIFIED	
210 - SETTLING BASIN 1	210	SETTLING BASIN 1	WET 4	UNCLASSIFIED	
220 - SETTLING BASIN 2	010	SLOW MIX CHAMBER	WET 4	UNCLASSIFIED	
	220	SETTLING BASIN 2	WET 4	UNCLASSIFIED	
230 - SETTLING BASIN 3	230	SETTLING BASIN 3	WET 4	UNCLASSIFIED	
300 - FILTER BUILDING	010	SOUTH FILTER BASEMENT	WET 2	UNCLASSIFIED	
	020	VALVE VAULT	WET 2	UNCLASSIFIED	
	030	NORTH FILTER BASEMENT	WET 2	UNCLASSIFIED	
	040	JUNCTION BOX	WET 2	UNCLASSIFIED	
	100	PUMP GALLERY	WET 2	UNCLASSIFIED	
800 - CHEMICAL BUILDING	110	NAOH ROOM	CHEMICAL 1	UNCLASSIFIED	
	120	ELECTRICAL ROOM	DRY 2	UNCLASSIFIED	
	130	HFSA ROOM	CHEMICAL 1	UNCLASSIFIED	
	140	NAOC ROOM	CHEMICAL 1	UNCLASSIFIED	
	150	NHOH ROOM	CHEMICAL 1	UNCLASSIFIED	
	160	HALLWAY	DRY 1	UNCLASSIFIED	
	170	MECHANICAL ROOM	DRY 2	UNCLASSIFIED	
900 - BACKWASH TANK	900	BACKWASH TANK	WET 4	UNCLASSIFIED	

MATERIALS SCHEDULE

SEE SPACE ENVIRONMENT AND HAZARDOUS RATINGS SCHEDULE FOR AREAS ASSOCIATED WITH EXPOSURES LISTED

REQUIREMENTS GIVEN IN DETAILED SPECIFICATIONS SUPERCEDE MATERIALS GIVEN IN THIS SCHEDULE

EXPOSURE	ANCHOR BOLTS/FASTENERS	PIPING NUTS AND BOLTS (7)	HANGERS AND SUPPORTS	CONDUIT	ENCLOSURES (3)(8)	DUCTWORK	PLUMBING PIPING
CHEMICAL 1	316SST	316SST	316SST	SCH 80 PVC	NEMA 4X - FRP	316SST	PVC, CPVC, OR SST
CHEMICAL 2	316SST	316SST	FRP	SCH 80 PVC	NEMA 4X - FRP	PVC OR FRP	PVC OR CPVC
CHEMICAL 3	NON-METALLIC	316SST	FRP	SCH 80 PVC	N/A	PVC OR FRP	PVC OR CPVC
CHEMICAL 4							
DRY 1	ELECTROPLATED STEEL	CARBON STEEL (10)	GALVANIZED STEEL	EMT	NEMA 1 (9) - CAST OR STEEL	GALVANIZED STEEL	COPPER, PVC, OR CPVC
DRY 2	ELECTROPLATED STEEL	CARBON STEEL (10)	GALVANIZED STEEL	GRS OR ALUMINUM	NEMA 1 (9) - CAST OR STEEL	GALVANIZED STEEL	COPPER, PVC, OR CPVC
DRY 3	GALVANIZED STEEL	CARBON STEEL (10)	GALVANIZED STEEL	GRS OR ALUMINUM	NEMA 9 - SST	ALUMINUM	PVC, CPVC, OR SST
DRY 4							
EXTERIOR	316SST	316SST (11)	316SST (6)	PVC COATED (6)	NEMA 4X - 316SST	ALUMINUM (5)	SST
WET 1	GALVANIZED STEEL	N/A	GALVANIZED STEEL	EMT (1)	NEMA 1 - STEEL	GALVANIZED STEEL	COPPER
WET 2	GALVANIZED STEEL	CARBON STEEL (10)	GALVANIZED STEEL	GRS (2)	NEMA 4 - STEEL	ALUMINUM	PVC, CPVC, OR SST
WET 3	316SST	316SST	316SST	ALUMINUM OR PVC COATED	NEMA 4X - 316SST	316SST	PVC, CPVC, OR SST
WET 4	316SST	316SST	316SST	N/A (4)	N/A (4)	N/A (4)	PVC
WET 5							

NOTES (X):

1. GRS FROM FLOOR TO 6'-0" ABOVE.
2. FIBERGLASS CONDUIT ALLOWABLE IN PIPING GALLERIES AND TUNNELS.
3. HAZARDOUS RATING GIVEN IN SPACE ENVIRONMENT AND HAZARDOUS RATING SCHEDULE TAKES PRECEDENCE; NEMA 7 FOR CLASS I AND NEMA 9 FOR CLASS II AREAS.
4. NOT ALLOWED ON INTERIOR WALLS OF WATER HOLDING STRUCTURES.
5. PROVIDE PREINSULATED DUCTWORK SYSTEM FOR TEMPERED AIR APPLICATIONS.
6. ALUMINUM WHERE SUPPORTED FROM ALUMINUM RAILING.
7. UNLESS OTHERWISE SPECIFIED IN THE DETAILED PIPING SYSTEMS SPECIFICATIONS.
8. NEMA 7 ENCLOSURES LOCATED IN EXTERIOR, WET 2, OR WET 3 LOCATIONS SHALL PROVIDED WITH AN O-RING OR GASKET IN COVER TO PREVENT WATER ENTRY.
9. ENCLOSURES FOR PLCS, EQUIPMENT CONTROL PANELS, AND OTHER CONTROL ENCLOSURES SHALL BE NEMA 12.
10. COATED ALONG WITH PIPING SYSTEM.
11. FOR PIPING SYSTEMS BEING COATED PROVIDE CARBON STEEL NUTS AND BOLTS.

HAZARD NOTES

1. ENTIRE ENCLOSED AREA.
2. AREAS WITHIN 3'-0" RADIUS OF VENTS ARE CI, D1, AREA BETWEEN 3'-0" AND 5'-0" RADIUS OF VENTS ARE CI, D2.
3. AREAS WITHIN 3'-0" RADIUS OF VENTS ARE CI, D2.
4. AREAS WITHIN 3'-0" OF REMOVABLE/OPENABLE ACCESS HATCHES ARE CI, D2 TO A HEIGHT 1'-6" ABOVE DECK.
5. AREAS WITHIN 3'-0" OF DOORS OR OTHER EXTERIOR WALL OPENINGS ARE CI, D2.
6. AREAS WITHIN 10'-0" OF EQUIPMENT OR OPEN CHANNELS ARE CI, D2.
7. ENVELOPE INCLUDES ALL LOCATIONS WITHIN 10'-0" LATERALLY, UP TO 1'-6" ABOVE AND ALONG EXTERIOR FACE OF ENCLOSING WALLS AND 1'-6" ABOVE ADJACENT GRADE OR FLOOR SURFACES.
8. AREAS WITHIN 5-FEET HORIZONTALLY AND 10'-0" ABOVE ARE CI, D1. AREA BETWEEN 5'-0" AND 10'-0" HORIZONTALLY AND BETWEEN 10'-0" AND 25'-0" ABOVE ARE CI, D2.
9. AREAS WITHIN 5'-0" RADIUS OF VENTS ARE CI, D1. AREA BETWEEN 5'-0" AND 10'-0" RADIUS OF VENTS ARE CI, D2.
10. AREAS WITHIN 5'-0" RADIUS OF VENTS ARE CI, D2.
11. AREAS WITHIN 5'-0" OF DOORS, VENTS, AND EXTERIOR WALL OPENINGS ARE CI, D1. AREA BETWEEN 5'-10" AND 10'-0" OF OPENINGS ARE CI, D2.
12. AREAS WITHIN 5'-0" OF DOORS AND EXTERIOR WALL OPENINGS ARE CI, D2.
13. AREAS WITHIN 3'-0" RADIUS OF HAZARDOUS MATERIAL EQUIPMENT ARE CI, D2.
14. AREAS WITHIN 5'-0" RADIUS OF HAZARDOUS MATERIAL EQUIPMENT ARE CI, D1.
15. AREAS WITHIN 10'-0" RADIUS OF DIGESTER GAS VALVES OR PIPING APPURTENANCES ARE CI, D1.
16. AREAS WITHIN 10'-0" RADIUS OF DIGESTER GAS VALVES OR PIPING APPURTENANCES ARE CI, D2.
17. AREAS WITHIN 3'-0" RADIUS OF ODOR CONTROL EQUIPMENT AND POINTS OF LEAKAGE SUCH AS DAMPERS AND FLANGES ARE CI, D2.
18. AREAS WITHIN A 10'-0" ENVELOPE OF ALL FIXTURES, APPURTENANCES, AND HOUSING ARE CI, D1. THE AREAS WITHIN A 15'-0" ENVELOPE ABOVE AND 5-FOOT ENVELOPE ON ALL SIDES OF THE OF THE D1 ENVELOPE ARE CI, D2.
19. AREAS WITHIN EQUIPMENT PROCESSING DRIED SLUDGE ARE CII, D1.
20. AREAS WITHIN A 10'-0" ENVELOPE OF EQUIPMENT PROCESSING DRIED SLUDGE ARE CII, D2.
21. AREAS WITHIN TANKS STORING DRIED SLUDGE ARE CII, D1.
22. AREAS WITHIN A 10'-0" ENVELOPE OF TANKS STORING DRIED SLUDGE ARE CII, D2.
23. AREAS ARE CLASSIFIED AS A CI, D2 UNTIL PROPOSED SEPARATION AND VENTILATION IS COMPLETED.
24. AREAS WITHIN 10'-0" OF NATURAL GAS OR DIGESTER GAS VALVES AND APPURTENCES ARE CLASSIFIED AS A CI, D1 AND ENCLOSED AREAS ARE CLASSIFIED AS CI, D2 UNTIL NATURAL GAS AND DIGESTER GAS PIPING HAS BEEN REMOVE AND PROPOSED SEPARATION AND VENTILATION IS COMPLETED.

Revision Number	Revision Description	Drawn By	Checked By	Date

Designed By	KAR
Drawn By	KAR
Checked By	SPG
Approved By	TMM
Filename	001ENV1.DWG
Project No.	14144
Project Date	JAN 2025

CITY OF BLOOMINGTON UTILITIES
MONROE WTP IMPROVEMENTS: CHEMICAL FEED LINE REPLACEMENT AND BACKWASH SYSTEM PUMP ADDITION AND TANK REHABILITATION - BLOOMINGTON, IN

GENERAL
SPACE ENVIRONMENT AND HAZARDOUS RATINGS SCHEDULE

DONOHUE

Sheet No.	8
Drawing No.	001-G-7

0 80'

STRUCTURE LIST

150	RAPID MIX BASIN
210	SETTLING BASIN 1
220	SETTLING BASIN 2
230	SETTLING BASIN 3
300	FILTER BUILDING
800	CHEMICAL BUILDING
810	MAINTENANCE BUILDING
900	BACKWASH TANK

Revision Number	Revision Description	Drawn By	Checked By	Date

Designed By	REK
Drawn By	REK
Checked By	MAS
Approved By	MAS
Filename	002CK1.DWG
Project No.	14144
Project Date	JAN 2025

CITY OF BLOOMINGTON UTILITIES
MONROE WTP IMPROVEMENTS: CHEMICAL FEED LINE REPLACEMENT AND BACKWASH SYSTEM PUMP ADDITION AND TANK REHABILITATION - BLOOMINGTON, IN

SITE DEVELOPMENT
OVERALL KEY PLAN

MICHAEL ARENO STYF
REGISTERED
PE11200351
STATE OF INDIANA
PROFESSIONAL ENGINEER
1/6/25

DONOHUE

Sheet No. 9

Drawing No. 002-CK-1

SUGGESTED CONSTRUCTION SEQUENCING

1. INSTALL EROSION CONTROL DEVICES.
2. COMPLETE REMOVALS.
3. INSTALL NEW CHEMICAL PIPING AND PIPE CHASE.
4. TESTING AND SITE RESTORATION.
5. REMOVE EROSION CONTROL DEVICES AFTER FINAL STABILIZATION.

EROSION CONTROL NOTES

1. KEEP A COPY OF THE CURRENT EROSION CONTROL PLAN ON SITE THROUGHOUT THE DURATION OF THE PROJECT.
2. INSTALL EROSION CONTROL DEVICES IN ACCORDANCE WITH DRAWING 002-CSE-2.
3. STOCKPILES SHALL BE STABILIZED BY TEMPORARY SEEDING AND MULCHING IF THEY ARE TO REMAIN FOR MORE THAN 7 DAYS.
4. ALL ACTIVITIES SHALL BE CONDUCTED IN A LOGICAL SEQUENCE TO MINIMIZE THE AREA OF BARE SOIL EXPOSED AT ANY ONE TIME.
5. DISTURBED SOIL OUTSIDE OF THE DAY-TO-DAY CONSTRUCTION AREAS SHALL BE STABILIZED BY MULCHING, TEMPORARY SEEDING, AND COVERING WITH TARPS OR EQUIVALENT CONTROL MEASURES.
6. EROSION CONTROL PRACTICES SHOWN ARE MINIMUM REQUIREMENTS. CONTRACTOR MAY NEED TO SUPPLEMENT PRACTICES AS REQUIRED BY CONTRACTOR'S OPERATIONS, CONSTRUCTION SEQUENCE, OR WEATHER.
7. INSPECT THE EROSION CONTROL MEASURES WITHIN 24 HOURS AFTER EACH RAINFALL EVENT OF 0.5 INCHES OR MORE AND AT LEAST ONCE EACH WEEK. MAKE NEEDED REPAIRS.
8. INSPECT AND MAINTAIN ALL INSTALLED EROSION CONTROL PRACTICES UNTIL THE CONTRIBUTING DRAINAGE AREA HAS BEEN STABILIZED.
9. WHENEVER POSSIBLE, PRESERVE EXISTING VEGETATION (ESPECIALLY ADJACENT TO SURFACE WATERS), MINIMIZE LAND-DISTURBING CONSTRUCTION ACTIVITY ON SLOPES OF 20% OR MORE, MINIMIZE SOIL COMPACTION, AND PRESERVE TOPSOIL.
10. INSTALL ALL BMPS IN ACCORDANCE WITH INDIANA STORM WATER QUALITY MANUAL, CHAPTER 7: STORM WATER QUALITY MEASURES - CONSTRUCTION & LAND DISTURBING ACTIVITIES.
11. INSTALL PERIMETER EROSION CONTROLS PRIOR TO ANY LAND-DISTURBING ACTIVITIES, INCLUDING CLEARING AND GRUBBING.
12. STAGE CONSTRUCTION GRADING ACTIVITIES TO MINIMIZE THE CUMULATIVE EXPOSED AREA.
13. SWEEP/CLEAN UP ALL SEDIMENT/TRASH THAT MOVES OFF-SITE DUE TO CONSTRUCTION ACTIVITY OR STORM EVENTS BEFORE THE END OF THE SAME WORKDAY OR AS DIRECTED BY OWNER OR OWNER'S REPRESENTATIVE. SEPARATE SWEPT MATERIALS (SOILS AND TRASH) AND DISPOSE OF APPROPRIATELY.
14. BUILT UP SEDIMENT SHALL BE REMOVED FROM THE SILT FENCE WHEN IT HAS REACHED ONE-THIRD THE HEIGHT OF THE FENCE.
15. IF DEWATERING IS NEEDED, CONTRACTOR SHALL PROVIDE FOR SEDIMENT REMOVAL ACCORDING TO INDOT. WATER PUMPED FROM THE SITE SHALL BE TREATED BY TEMPORARY SEDIMENTATION BASINS, GRIT CHAMBERS, SAND FILTERS, UPSLOPE CHAMBERS, HYDRO-CYCLONES, SWIRL CONCENTRATORS, OR OTHER APPROPRIATE CONTROLS DESIGNED AND USED TO REMOVE PARTICLES OF 100 MICRONS OR GREATER FOR THE HIGHEST DEWATERING PUMPING RATE. IF THE WATER IS DEMONSTRATED TO HAVE NO PARTICLES GREATER THAN 100 MICRONS DURING DEWATERING OPERATIONS, THEN NO CONTROL IS NEEDED BEFORE DISCHARGE. WATER MAY NOT BE DISCHARGED IN A MANNER THAT CAUSES EROSION OF THE SITE OR RECEIVING CHANNELS.
16. IMMEDIATELY STABILIZE ALL DISTURBED AREAS THAT WILL REMAIN INACTIVE FOR 14 DAYS OR LONGER.
17. EROSION CONTROL DETAILS SHOWN ON 999-C DRAWINGS.

GENERAL CONSTRUCTION WASTES (DUST, SOLID WASTES, HAZARDOUS WASTES, ETC.)

IN ADDITION TO EROSION CONTROL THE CONTRACTOR SHALL TAKE MEASURES TO PROPERLY MANAGE SOLID WASTES, HAZARDOUS WASTES, DUST GENERATION, AND ALL OTHER ACTIVITIES THAT SHALL GENERATE WASTES DURING THE CONSTRUCTION PHASE.

DUST - THE CONTRACTOR IS RESPONSIBLE FOR CONTROLLING DUST PER INDIANA STORM WATER QUALITY MANUAL, CHAPTER 7: STORM WATER QUALITY MEASURES - CONSTRUCTION & LAND DISTURBING ACTIVITIES.

SOLID WASTE MATERIALS - ALL WASTE MATERIAL SHALL BE COLLECTED ON-SITE IN ACCORDANCE WITH LOCAL AND STATE SOLID WASTE MANAGEMENT REGULATIONS. THE WASTE SHALL BE EMPTIED AND HAULED OFF SITE AT REGULARLY SCHEDULED INTERVALS OR AS NECESSARY. NO CONSTRUCTION WASTE MATERIALS SHALL BE BURIED ONSITE. ALL PERSONNEL SHALL BE INSTRUCTED REGARDING THE CORRECT PROCEDURES FOR WASTE DISPOSAL. WASHING OF TRUCKS AND OTHER CONSTRUCTION VEHICLES SHALL NOT BE ALLOWED ONSITE.

SANITARY WASTE - ALL SANITARY WASTE SHALL BE COLLECTED BY TEMPORARY SANITARY FACILITIES PROVIDED AT THE SITE THROUGH THE CONSTRUCTION PHASE. THEY MUST BE UTILIZED BY ALL CONSTRUCTION PERSONNEL AND SHALL BE SERVICED BY A COMMERCIAL OPERATOR.

PROPERLY DISPOSE OF ALL WASTE AND UNUSED CONSTRUCTION MATERIALS (INCLUDING GARBAGE, DEBRIS, AND CLEANING WASTES).

SPILL PREVENTION AND CONTROL PRACTICES

IN ORDER TO REDUCE THE RISK OF SPILLS OF HAZARDOUS MATERIALS, THE FOLLOWING PRACTICES SHALL BE FOLLOWED:

1. AN EFFORT SHALL BE MADE TO STORE ONLY ENOUGH PRODUCT REQUIRED TO DO THE WORK.
2. ALL MATERIALS STORED ONSITE SHALL BE STORED IN A NEAT, ORDERLY MANNER IN THEIR ORIGINAL CONTAINERS WITH THE ORIGINAL MANUFACTURER'S LABEL. IF THE MATERIAL IS HAZARDOUS AND THE CONTAINER CANNOT BE RESEALED, THE ORIGINAL LABEL AND MATERIAL SAFETY DATA SHALL BE RETAINED.
3. PRODUCTS SHALL NOT BE MIXED WITH ONE ANOTHER UNLESS RECOMMENDED BY THE MANUFACTURER.
4. WHENEVER POSSIBLE, ALL OF A PRODUCT SHALL BE USED BEFORE DISPOSING OF THE CONTAINER.
5. THE MANUFACTURER'S RECOMMENDATIONS FOR PROPER USE AND DISPOSAL SHALL BE FOLLOWED.
6. IF SURPLUS PRODUCT MUST BE DISPOSED OF, MANUFACTURER'S OR STATE AND LOCAL RECOMMENDED METHODS FOR PROPER DISPOSAL SHALL BE FOLLOWED.

THESE PRACTICES SHALL BE FOLLOWED FOR SPILL PREVENTION AND CLEANUP:

1. MANUFACTURER'S RECOMMENDED METHODS FOR SPILL CLEANUP SHALL BE CLEARLY POSTED AND SITE PERSONNEL SHALL BE MADE AWARE OF THE PROCEDURES AND THE LOCATION OF CLEANUP SUPPLIES.
2. ALL SPILLS SHALL BE CLEANED UP IMMEDIATELY AFTER DISCOVERY.
3. PERSONNEL PERFORMING THE SPILL CLEAN-UP SHALL BE PROPERLY TRAINED AND SHALL WEAR APPROPRIATE PROTECTIVE CLOTHING.
4. SPILL REPORTING - THE PERMITEE SHALL IMMEDIATELY NOTIFY IDEM IN ACCORDANCE WITH SECTION 327 INDIANA ADMINISTRATIVE CODE 2-6.1. IN THE EVENT THAT A SPILL OR ACCIDENTAL RELEASE OF ANY MATERIAL OR SUBSTANCE RESULTS IN THE DISCHARGE OF POLLUTANTS TO THE WATERS OF THE STATE. ANY SPILLS ABOVE THE REPORTABLE QUANTITIES LIMITS IN THE CODE OF FEDERAL REGULATIONS (CFR) TITLE 40, PART 302 SHALL BE REPORTED TO THE EPA NATIONAL RESPONSE CENTER (1-800-424-8802).

PETROLEUM PRODUCTS - ALL ONSITE VEHICLES SHALL BE MONITORED FOR LEAKS AND RECEIVE REGULAR PREVENTIVE MAINTENANCE TO REDUCE THE CHANCE OF LEAKAGE. PETROLEUM PRODUCTS SHALL BE STORED IN TIGHTLY SEALED CONTAINERS WHICH ARE CLEARLY LABELED.

FERTILIZERS - FERTILIZERS USED SHALL BE APPLIED ONLY IN THE AMOUNTS SPECIFIED. ONCE APPLIED, FERTILIZER SHALL BE WORKED INTO THE SOIL TO LIMIT EXPOSURE TO STORM WATER. FERTILIZER SHALL BE STORED IN A COVERED LOCATION.

MICHAEL AREND STYF
REGISTERED
PE11200351
STATE OF INDIANA
PROFESSIONAL ENGINEER
1/6/25

Revision Number	Revision Description	Drawn By	Checked By	Date

Designed By	REK
Drawn By	REK
Checked By	MAS
Approved By	MAS
Filename	002CSE1.DWG
Project No.	14144
Project Date	JAN 2025

CITY OF BLOOMINGTON UTILITIES
MONROE WTP IMPROVEMENTS: CHEMICAL FEED LINE REPLACEMENT AND BACKWASH SYSTEM PUMP ADDITION AND TANK REHABILITATION - BLOOMINGTON, IN

SITE DEVELOPMENT
EROSION CONTROL NOTES

DONOHUE

Sheet No. 10

Drawing No. 002-CSE-1

0 20'

GENERAL NOTES:

1. RESTORE ALL DISTURBED SURFACES TO MATCH EXISTING CONDITIONS UNLESS OTHERWISE NOTED.
2. BASE SETUP INFORMATION:
   - NORTHING: 1437811.92
   - EASTING: 3102973.48
   - ELEVATION: 833.46
   - GARAGE AT INDOT BLOOMINGTON SUBDISTRICT

PLAN NOTES:

1. SILT FENCE, SEE DETAIL C033
2. CONTRACTOR STAGING AND STOCKPILE AREA.
3. CONCRETE WASHOUT, SEE DETAIL C036

BENCHMARKS

NUMBER	DESCRIPTION	ELEVATION	NORTHING	EASTING
100	CUT "X" IN SW CORNER OF CONC. PAD	751.22	1393330.79	3129040.27
101	CUT "X" IN SW CORNER OF CONC. LANDING	752.71	1393496.43	3129097.14
102	NE BOLT IN FIRE HYDRANT	752.02	1393567.38	3128952.24
103	CUT "X" IN SE CORNER OF CONC. WALK	748.07	1393624.55	3129104.71

CONTROL POINTS

NUMBER	DESCRIPTION	ELEVATION	NORTHING	EASTING
1	5/8" REBAR W/ CAP	746.93	1393600.34	3129195.66
2	MAG NAIL	748.49	1393648.93	3128972.39
3	MAG NAIL	753.35	1393451.36	3129042.43
4	5/8" REBAR W/ CAP	749.77	1393340.02	3129003.79

MICHAEL AREND STYF REGISTERED PE 11200351 STATE OF INDIANA PROFESSIONAL ENGINEER
1/6/25

Revision Number	Revision Description	Drawn By	Checked By	Date

Designed By	REK
Drawn By	REK
Checked By	MAS
Approved By	MAS
Filename	002CSE1.DWG
Project No.	14144
Project Date	JAN 2025

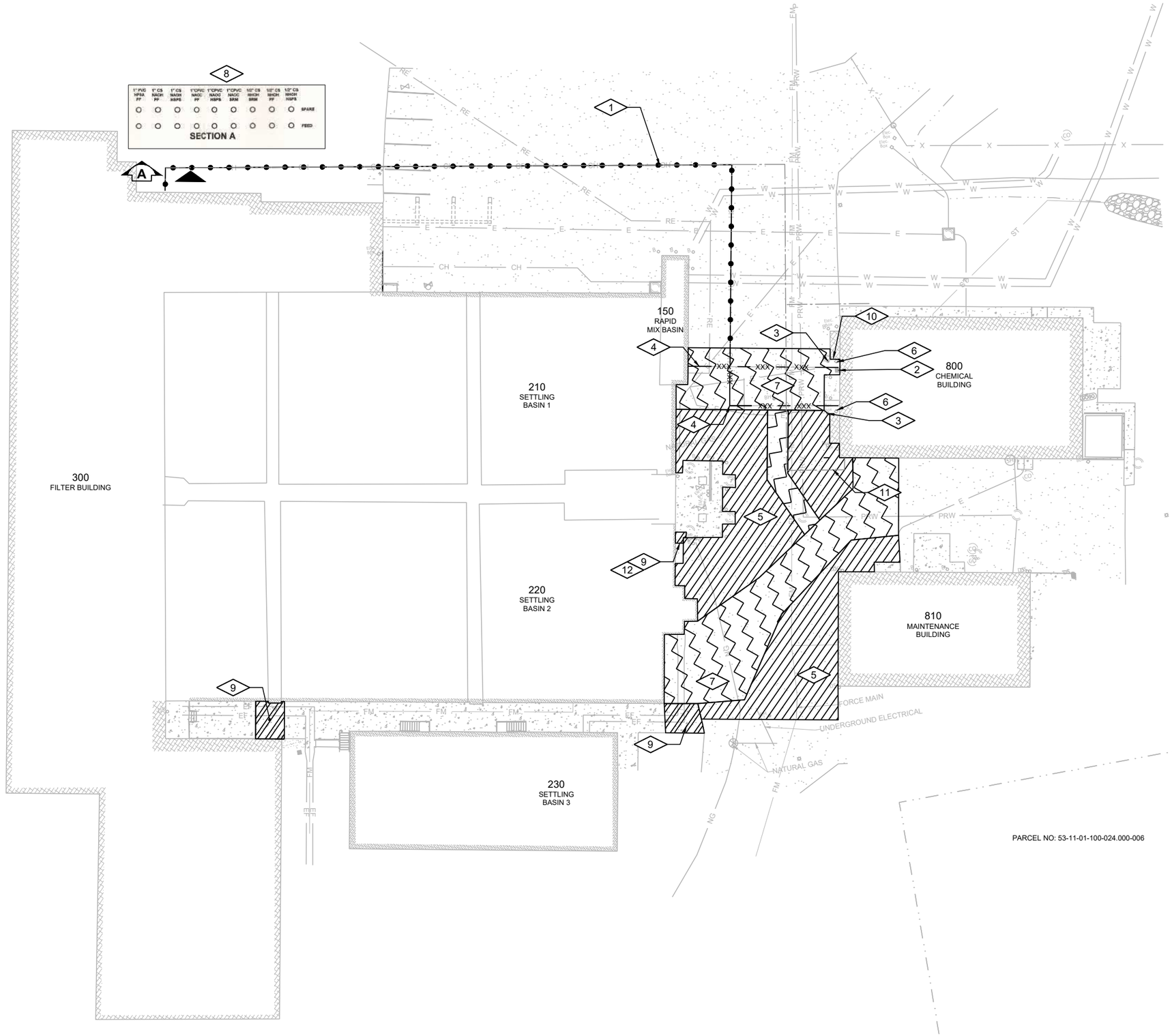
CITY OF BLOOMINGTON UTILITIES
MONROE WTP IMPROVEMENTS: CHEMICAL FEED LINE REPLACEMENT AND BACKWASH SYSTEM PUMP ADDITION AND TANK REHABILITATION - BLOOMINGTON, IN

SITE DEVELOPMENT
STAGING AND EROSION CONTROL PLAN

DONOHUE

Sheet No. 11

Drawing No. 002-CSE-2



0 20'

GENERAL NOTES:

1. DETERMINE REMOVAL OR ABANDONMENT SEQUENCING IN ACCORDANCE WITH CONTRACTOR'S CONSTRUCTION SEQUENCING AND MAINTENANCE OF PLANT OPERATIONS.
2. PROTECT EXISTING MANHOLES, PIPING, DUCTS, STRUCTURES, AND SURFACES TO REMAIN.
3. CONTRACTOR TO FIELD VERIFY EXISTING CONDITIONS, DIMENSIONS, AND ELEVATIONS PRIOR TO CONSTRUCTION AND/OR FABRICATION.
4. EXISTING UNDERGROUND UTILITIES SHOWN BASED ON RECORD DRAWINGS AND SITE SURVEY. THE CONTRACTOR SHALL INVESTIGATE ALL BURIED FACILITIES TO DETERMINE IF THEY ARE IN CONFLICT WITH THE PROPOSED IMPROVEMENTS. HYDROINVESTIGATION AND POT HOLING IS REQUIRED AS PART OF THE PROJECT. SEE SPECIFICATION SECTION 01 11 00 FOR MORE INFORMATION.
5. CONTRACTOR TO MAINTAIN 1 LANE OF TRAFFIC AT ALL TIMES THROUGH FACILITY.

PLAN NOTES:

1. ABANDON EXISTING CHEMICAL FEED LINES BY CAPPING ENDS.
2. PROTECT EXISTING EYE WASH STATION.
3. REMOVE, SALVAGE AND RELOCATE EXISTING BOLLARD.
4. REMOVE EXISTING CHEMICAL FEED LINES.
5. MILL 2-INCH SURFACE LAYER OF ASPHALT.
6. PROTECT EXISTING ELECTRICAL EQUIPMENT.
7. SAW CUT AND REMOVE ASPHALT AND BASE FOR PIPE INSTALLATION. SEE DETAIL: C180
8. EXISTING FEED LINES CONSIST OF TWELVE 1" DIAMETER CHEMICAL PIPES AND SIX 1/2" DIAMETER CHEMICAL PIPES.
9. SAW CUT AND REMOVE SIDEWALK C180
10. CONTRACTOR SHALL PROVIDE SHEETING/SHORING AS NEEDED, DO NOT UNDERMINE STRUCTURES.
11. PROTECT TEMPORARY CHEMICAL LINES DURING CONSTRUCTION.
12. SEE 002-CG-1, CONTRACTOR TO FIX LOW POINT.

MICHAEL ARENO STYF REGISTERED PE11200351 STATE OF INDIANA PROFESSIONAL ENGINEER
1/6/25

Revision Number	Revision Description	Drawn By	Checked By	Date

Designed By	REK
Drawn By	REK
Checked By	MAS
Approved By	MAS
Filename	002CR1.DWG
Project No.	14144
Project Date	JAN 2025

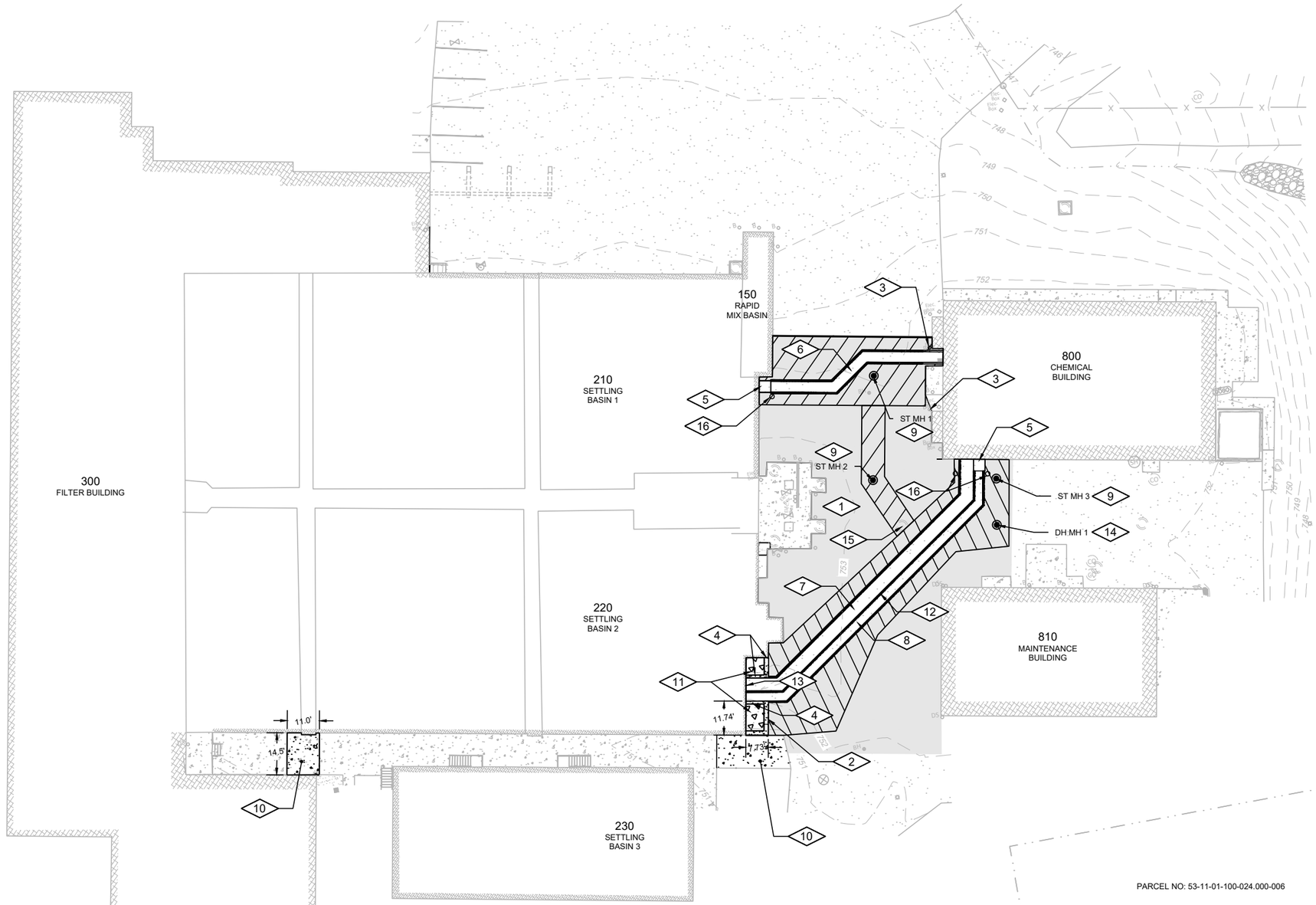
CITY OF BLOOMINGTON UTILITIES
MONROE WTP IMPROVEMENTS: CHEMICAL FEED LINE REPLACEMENT AND BACKWASH SYSTEM PUMP ADDITION AND TANK REHABILITATION - BLOOMINGTON, IN

SITE DEVELOPMENT REMOVAL PLAN

DONOHUE

Sheet No. 12

Drawing No. **002-CR-1**



0 20'

GENERAL NOTES:

1. ALL EROSION CONTROL DEVICES SHALL BE IN PLACE PRIOR TO ANY EARTH DISTURBING ACTIVITIES.
2. ANY DAMAGED FACILITIES NOT SHOWN FOR REMOVAL SHALL BE RESTORED OR REPLACED TO ORIGINAL CONDITION AT NO ADDITIONAL COST TO OWNER.
3. ALL AREAS NOT COVERED BY PAVING OR OTHERWISE NOTED SHALL BE RESTORED WITH TOPSOIL, MULCH, AND SEED. SEE DETAIL: C050

PLAN NOTES:

1. ASPHALT RESTORATION, PER DETAILS C115 C116
2. RETAINING WALL, PER DETAIL: S210
3. INSTALL SALVAGED BOLLARD.
4. CONCRETE CURB TO CONTAIN LANDSCAPE STONE, PER DETAIL: C160
5. SQUARE CHEMICAL COLLECTION VAULT. TERMINATE DOUBLE CONTAINED CHEMICAL LINES INTO VAULT WITH BOOTED CONNECTION, WITH FLOAT SWITCH ALARM TO DETECT CHEMICAL LEAK. UTILIZE JOINT FILLER BETWEEN END OF TRENWA TRENCH SYSTEM AND STRUCTURE. THE EAST TRENCH VAULT WILL BE SITTING ON TOP OF THE FOOTER, AND THE NORTH VAULT WILL MATCH THE HEIGHT WITHOUT BEING ON TOP OF THE FOOTER. SEE 800 SERIES STRUCTURAL DRAWINGS FOR DETAILS.
6. NORTH TRENCH, WITH CONCRETE COLLAR AND JOINT FILLER, PER DETAIL: C550
7. WEST TRENCH, WITH CONCRETE COLLAR AND JOINT FILLER, PER DETAIL: C550
8. EAST TRENCH, WITH CONCRETE COLLAR AND JOINT FILLER, PER DETAIL: C550
9. STORM MANHOLE, PER DETAIL: C380
10. CONCRETE SIDEWALK, PER DETAIL: C150
11. 4" DEEP LANDSCAPE STONE ABOVE EARTH FILL.
12. 6" BETWEEN TRENCHES. FILL GAP WITH FLOWABLE FILL BELOW CONCRETE COLLAR.
13. TRENCH SYSTEM TO EXTEND TO THE FACE OF STRUCTURE 220. CHEMICAL LINES WILL CORE THROUGH THE TRENCH LID AND BEGIN ABOVE GROUND ROUTE.
14. DOGHOUSE MANHOLE OVER EXISTING PRW, PER DETAIL: C205 UTILIZE INSIDE DROP BOWL FOR STORM CONNECTION, RELINER A4DB OR EQUAL. CONNECT 4" STORM, CORE AND BOOT.
15. 4" STORM INTO EXISTING MANHOLE #4, CORE AND BOOT. UTILIZE INSIDE DROP BOWL FOR STORM CONNECTION, RELINER A4DB OR EQUAL.
16. NEW BOLLARD, PER DETAIL: S101

MICHAEL AREND STYE
REGISTERED
PE11200351
STATE OF
INDIANA
PROFESSIONAL ENGINEER
1/6/25

Revision Number	Revision Description	Drawn By	Checked By	Date

Designed By	REK
Drawn By	REK
Checked By	MAS
Approved By	MAS
Filename	002CF1.DWG
Project No.	14144
Project Date	JAN 2025

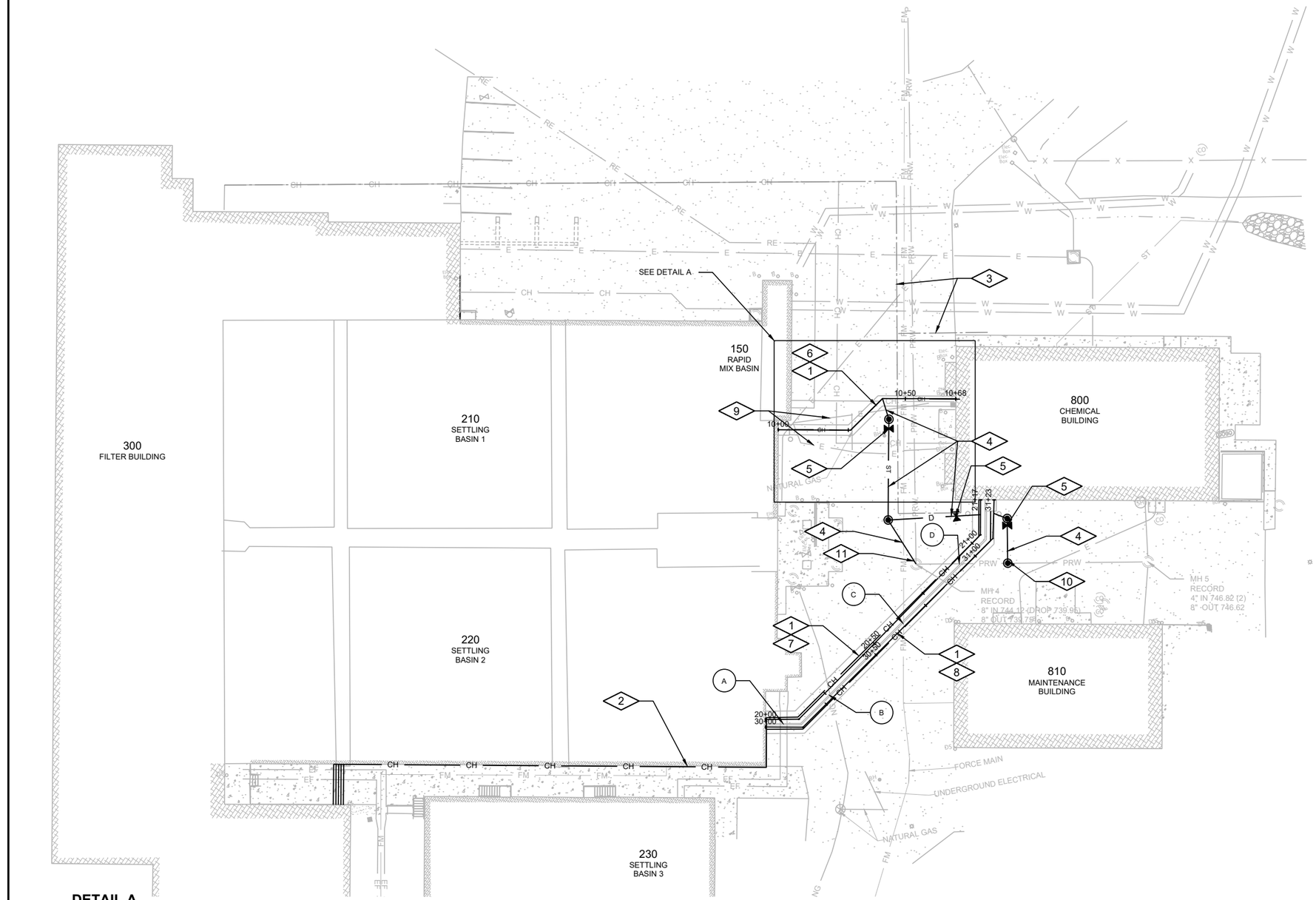
CITY OF BLOOMINGTON UTILITIES
MONROE WTP IMPROVEMENTS: CHEMICAL FEED LINE REPLACEMENT AND BACKWASH SYSTEM PUMP ADDITION AND TANK REHABILITATION - BLOOMINGTON, IN

SITE DEVELOPMENT FACILITY PLAN

DONOHUE

Sheet No. 13

Drawing No. **002-CF-1**



GENERAL NOTES:

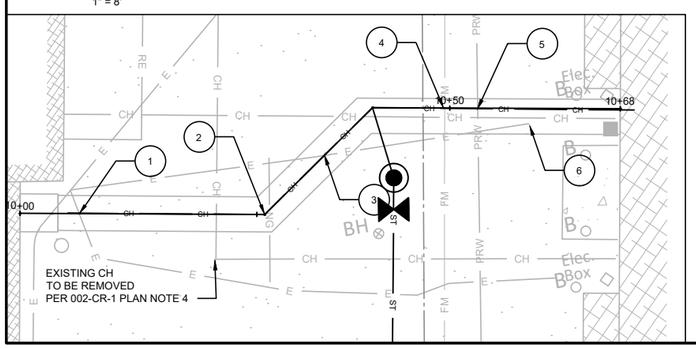
1. PROTECT ALL UTILITIES, DUCT BANKS, ETC. NOT SHOWN FOR REMOVAL WITH SHEETING, SHORING, OR OTHER MEANS NECESSARY TO PROTECT THEM FROM DAMAGE.
2. CONTRACTOR SHALL FIELD VERIFY EXISTING CONDITIONS, DIMENSIONS, AND ELEVATIONS PRIOR TO CONSTRUCTION AND/OR FABRICATION.
3. SEE SPECIFICATION SECTION 01 11 00 FOR PROJECT WORK SEQUENCES AND CONSTRAINTS.
4. CONTRACTOR IS DIRECTED TO SPECIFICATION SECTION 31 10 00. DETAILED UNDERGROUND INVESTIGATIONS ARE REQUIRED AS PART OF THIS SECTION. INVESTIGATIONS ARE REQUIRED TO DEVELOP A COMPREHENSIVE VIEW OF EXISTING CONDITIONS AND POTENTIAL INSTALLATION AND SEQUENCING CONFLICTS.
5. INSTALL PIPE WITH STANDARD TRENCHING AND BACKFILL PROCEDURE. C501

PLAN NOTES:

1. INSTALL CHEMICAL PIPING IN CONTAINMENT PIPE WITHIN TRENCH. UNISTRUTS SHALL BE EMBEDDED IN TRENCH SYSTEM TO SUPPORT PIPES. SLOPE OF PIPE TO BE INDEPENDANT OF TRENCH SLOPE.
2. RUN CHEMICAL PIPING ABOVE GRADE ALONG WALL. INSULATE AND HEAT TRACE. SEE STRUCTURE 220 DRAWINGS FOR MORE INFORMATION.
3. APPROXIMATE LOCATION OF TEMPORARY CHEMICAL LINES, CURRENTLY IN PLACE.
4. 4" STORM PIPE WITH TRACERWIRE FROM BOTTOM OF LOW POINT IN TRENCH TO PRW LINE.
5. 4" PLUG VALVE AND BOX C405
6. NORTH TRENCH (DOUBLE CONTAINED)
   1 - 4" NAOC LINE
   1 - 4" SPARE NAOH LINE.
7. WEST TRENCH (DOUBLE CONTAINED)
   2 - 4" NAOC LINES
   1 - 4" NAOH LINE
   1 - 4" HFSA LINE.
8. EAST TRENCH (DOUBLE CONTAINED)
   1 - 3" NHOH LINE
9. RELOCATE EXISTING DUCT BANK TO PROVIDE CLEARANCE FOR NEW CHEMICAL FEED TRENCH AND 4" STORM PIPE. CONTRACTOR SHALL VERIFY LOCATION, DIMENSIONS AND CONTENTS OF DUCT BANK AND COORDINATE RELOCATION WITH ENGINEER. SEE SPECIFICATION SECTION 01 21 00 FOR LUMP SUM ALLOWANCE PROVIDED FOR THIS WORK.
10. TIE DRAIN INTO DOGHOUSE MANHOLE OVER PRW GRAVITY LINE.
11. TIE DRAIN INTO EXISTING MANHOLE.

DETAIL A

1" = 8'



PIPING PROFILE VIEW DESIGNATION KEY

(1) PIPE CROSSING DESIGNATION IN SITE PIPING PLAN VIEW

(1) NUMERICAL VALUES COORDINATE TO PROFILE ON **002-CPR-1**

(A) ALPHABET VALUES COORDINATE TO PROFILES ON **002-CPR-2**

MICHAEL AREND STIFF
REGISTERED
PE11200351
STATE OF INDIANA
PROFESSIONAL ENGINEER
11/6/25

CHASE E. BENTON
REGISTERED
No. 12300012
STATE OF INDIANA
PROFESSIONAL ENGINEER
01/06/2025

Revision Number	Revision Description	Drawn By	Checked By	Date

Designed By	REK/CEB
Drawn By	REK/CEB
Checked By	MAS/JEF
Approved By	MAS/CEB
Filename	002CP1.DWG
Project No.	14144
Project Date	JAN 2025

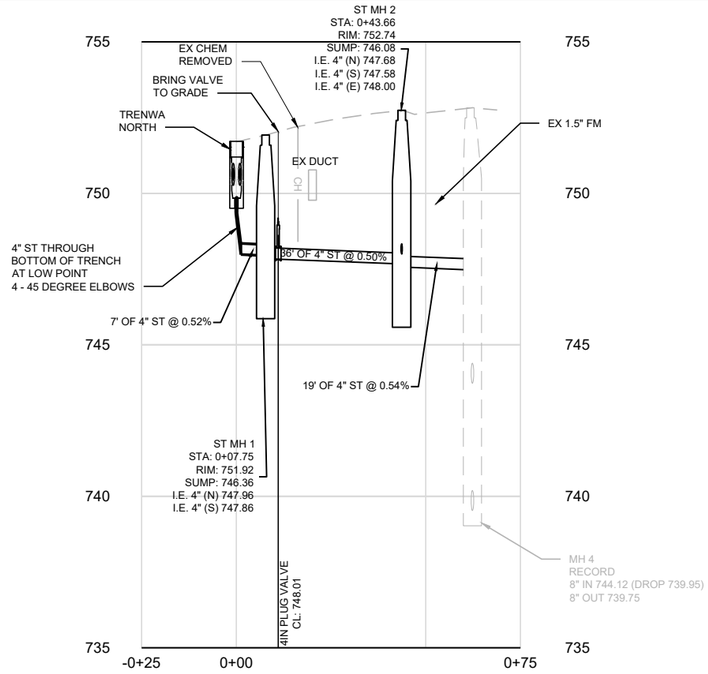
CITY OF BLOOMINGTON UTILITIES
MONROE WTP IMPROVEMENTS: CHEMICAL FEED LINE REPLACEMENT AND BACKWASH SYSTEM PUMP ADDITION AND TANK REHABILITATION - BLOOMINGTON, IN

SITE DEVELOPMENT
PIPING PLAN AND ELECTRICAL/CONTROLS PLAN

DONOHUE

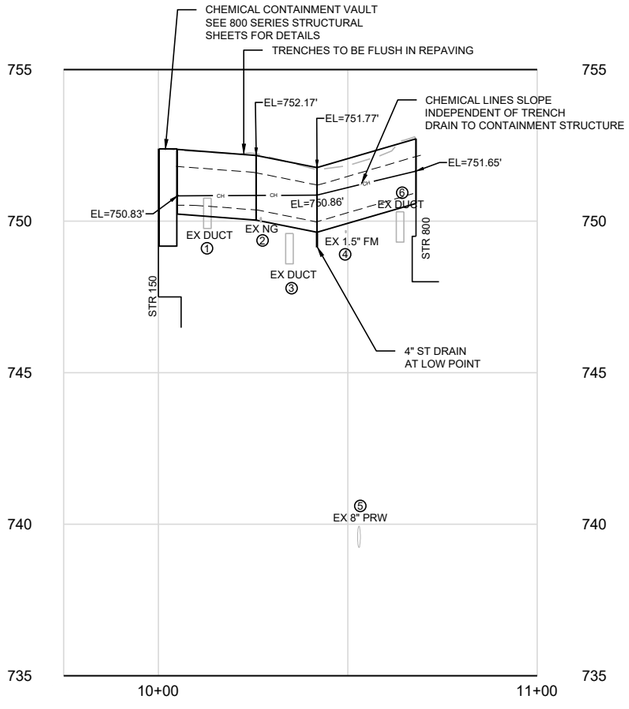
Sheet No. 14

Drawing No. **002-CPEN-1**



TRENWA (TRENCHING SYSTEM) STORM DRAIN

NTS



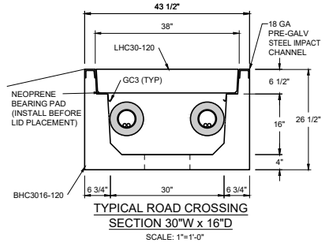
TRENWA NORTH PROFILE AND SECTION

NTS

DOUBLE CONTAINED 1 - 4" NAOC, 1 - 4" NAOH

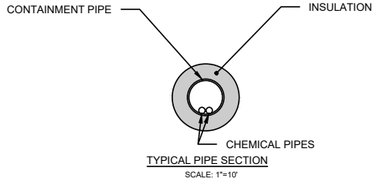
NOTE: CONTRACTOR TO ROUTE CONFLICTING UTILITIES BELOW TRENWA SYSTEM AS PART OF THE ALLOWANCE. UTILITIES SHALL HAVE 4 INCHES OF CLEARANCE BETWEEN THE TOP OF PIPE AND THE OUTSIDE OF THE TRENWA TRENCH. CONTRACTOR MUST POTHOLE AND VERIFY ALL UTILITY DEPTHS, AND ALL UTILITIES THAT REQUIRE RELOCATION, PRIOR TO CONSTRUCTION.

HS20 ROAD RATED CONCRETE TRENWA TRENCH WITH CONCRETE LID



TYPICAL ROAD CROSSING
SECTION 30"W x 16"D

SCALE: 1"=1'-0"



TYPICAL PIPE SECTION

SCALE: 1"=10'

GENERAL NOTES:

1. SEE DRAWING 002-CP-1 FOR ADDITIONAL GENERAL NOTES THAT APPLY TO THIS DRAWING.
2. PROFILE SECTIONS ARE OF A GENERAL NATURE. THE VERTICAL MITERS WILL OCCUR BEFORE AND AFTER HORIZONTAL ANGLE PIECES.
3. TRENWA TRENCHES SHALL BE FLUSH WITH FINISHED GRADE.

Revision Number	Revision Description	Drawn By	Checked By	Date

Designed By	REK
Drawn By	REK
Checked By	MAS
Approved By	MAS
Filename	002CPR1.DWG
Project No.	14144
Project Date	JAN 2025

CITY OF BLOOMINGTON UTILITIES
MONROE WTP IMPROVEMENTS: CHEMICAL FEED LINE REPLACEMENT AND BACKWASH SYSTEM PUMP ADDITION AND TANK REHABILITATION - BLOOMINGTON, IN

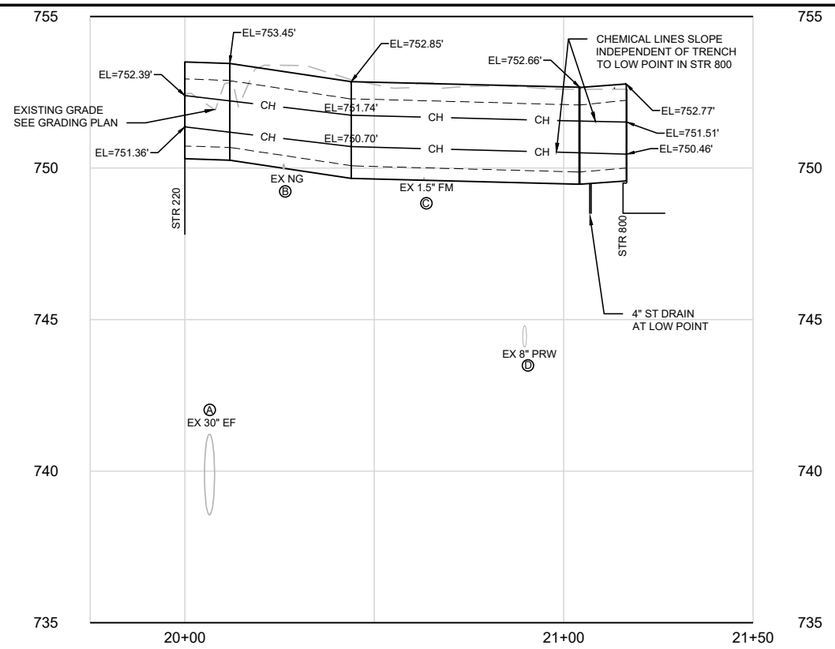
SITE DEVELOPMENT
TRENCH AND STORM PROFILES

MICHAEL AREND STYF
REGISTERED
PE11200351
STATE OF INDIANA
PROFESSIONAL ENGINEER
1/6/25

DONOHUE

Sheet No. 15

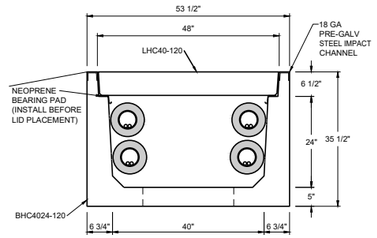
Drawing No. 002-CPR-1



TRENWA WEST PROFILE AND SECTION

NTS DOUBLE CONTAINED, 2 - 4" NAOC , 1 - 4" NAOH, AND 1 - 4" HFSA

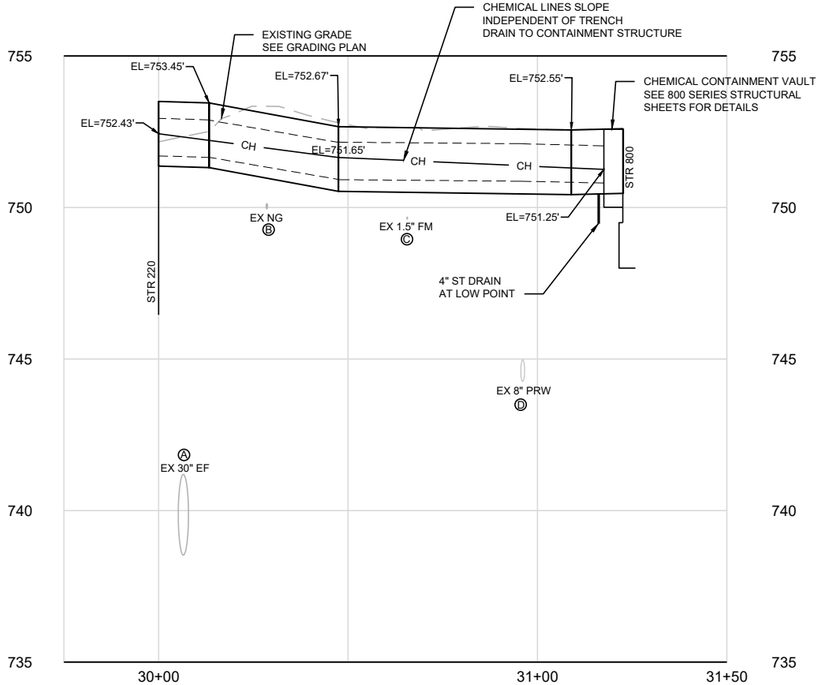
NOTE: CONTRACTOR TO ROUTE CONFLICTING UTILITIES BELOW TRENWA SYSTEM AS PART OF THE ALLOWANCE. UTILITIES SHALL HAVE 4 INCHES OF CLEARANCE BETWEEN THE TOP OF PIPE AND THE OUTSIDE OF THE TRENWA TRENCH. CONTRACTOR MUST POTHOLE AND VERIFY ALL UTILITY DEPTHS, AND ALL UTILITIES THAT REQUIRE RELOCATION, PRIOR TO CONSTRUCTION.



TYPICAL ROAD CROSSING
SECTION 40"W x 24"D
SCALE: 1"=1'-0"

GENERAL NOTES:

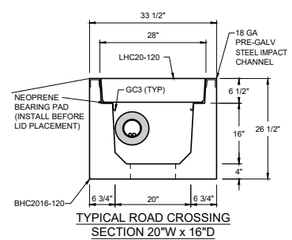
1. SEE DRAWING 002-CP-1 FOR ADDITIONAL GENERAL NOTES THAT APPLY TO THIS DRAWING.
2. PROFILE SECTIONS ARE OF A GENERAL NATURE. THE VERTICAL MITERS WILL OCCUR BEFORE AND AFTER HORIZONTAL ANGLE PIECES.
3. TRENWA TRENCHES SHALL BE FLUSH WITH FINISHED GRADE.



TRENWA EAST PROFILE AND SECTION

NTS DOUBLE CONTAINED, 1 - 3" NHOH

NOTE: CONTRACTOR TO ROUTE CONFLICTING UTILITIES BELOW TRENWA SYSTEM AS PART OF THE ALLOWANCE. UTILITIES SHALL HAVE 4 INCHES OF CLEARANCE BETWEEN THE TOP OF PIPE AND THE OUTSIDE OF THE TRENWA TRENCH. CONTRACTOR MUST POTHOLE AND VERIFY ALL UTILITY DEPTHS, AND UTILITIES THAT REQUIRE RELOCATION, PRIOR TO CONSTRUCTION.



TYPICAL ROAD CROSSING
SECTION 20"W x 16"D
SCALE: 1"=1'-0"

Revision Number	Revision Description	Drawn By	Checked By	Date

Designed By	REK
Drawn By	REK
Checked By	MAS
Approved By	MAS
Filename	002CPR1.DWG
Project No.	14144
Project Date	JAN 2025

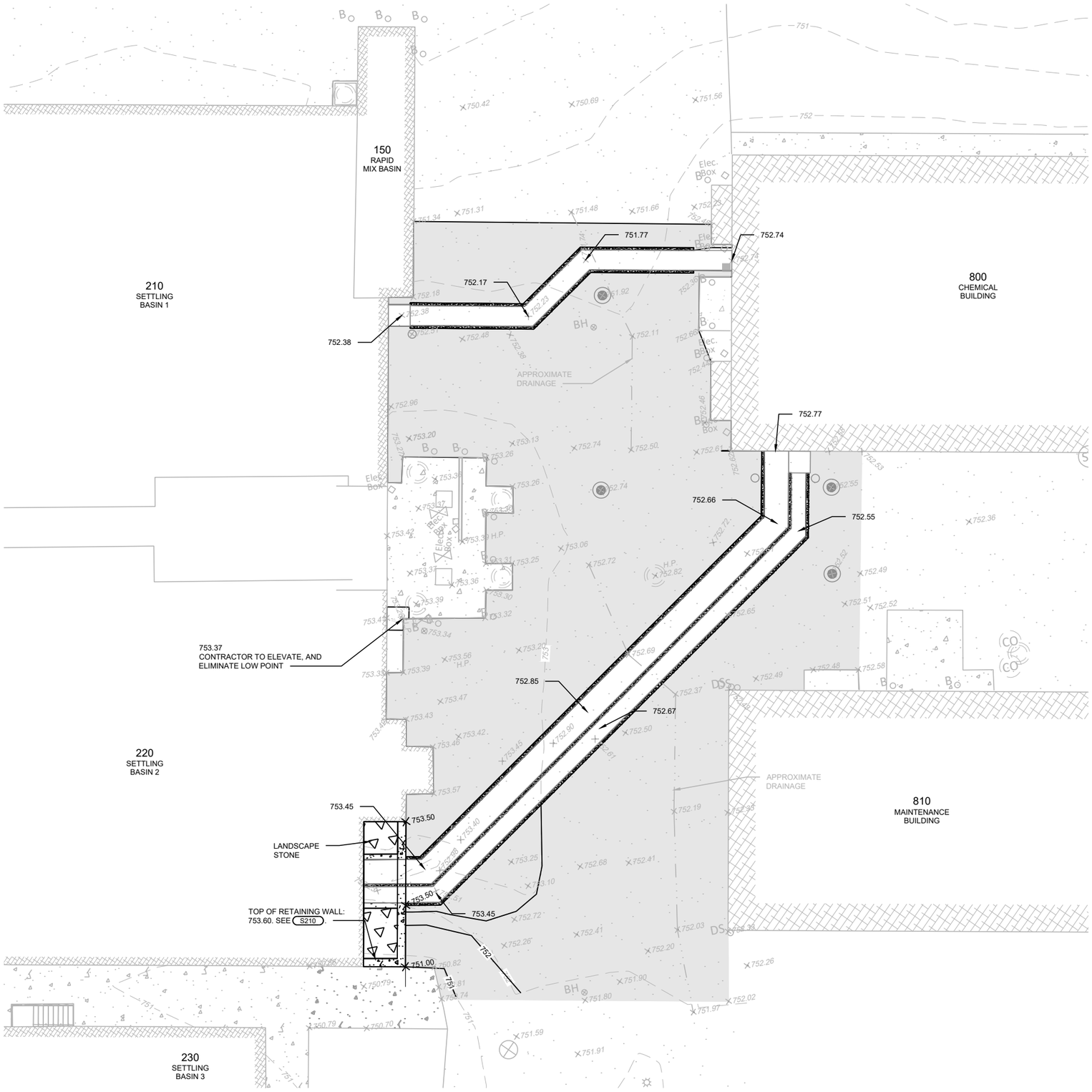
CITY OF BLOOMINGTON UTILITIES
MONROE WTP IMPROVEMENTS: CHEMICAL FEED LINE REPLACEMENT AND BACKWASH SYSTEM PUMP ADDITION AND TANK REHABILITATION - BLOOMINGTON, IN

SITE DEVELOPMENT
TRENCH PROFILES

DONOHUE

Sheet No. 16

Drawing No. **002-CPR-2**

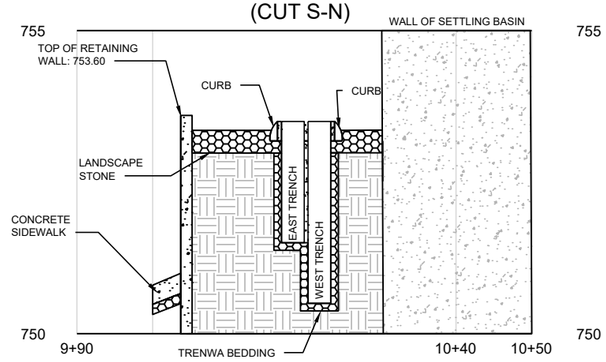


0 10'

GENERAL NOTES:

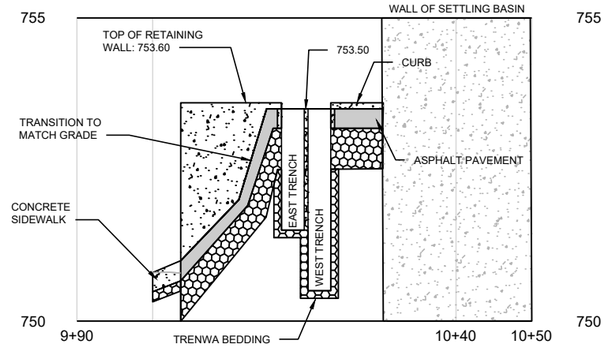
1. ALL EROSION CONTROL DEVICES SHALL BE IN PLACE PRIOR TO ANY EARTH DISTURBING ACTIVITIES.
2. ANY DAMAGED FACILITIES NOT SHOWN FOR REMOVAL SHALL BE RESTORED OR REPLACED TO ORIGINAL CONDITION AT NO ADDITIONAL COST TO OWNER.

PROFILE INSIDE RETAINING WALL (CUT S-N)



VERTICAL EXAGGERATION 1:8
V SCALE: 1" = 1.25'
H SCALE: 1" = 10'

PROFILE ALONG EAST RETAINING WALL



VERTICAL EXAGGERATION 1:8
V SCALE: 1" = 1.25'
H SCALE: 1" = 10'

MICHAEL AREND STYE
REGISTERED
PE11200351
STATE OF
INDIANA
PROFESSIONAL ENGINEER
1/6/25

Revision Number	Revision Description	Drawn By	Checked By	Date

Designed By	REK
Drawn By	REK
Checked By	MAS
Approved By	MAS
Filename	002CG1.DWG
Project No.	14144
Project Date	JAN 2025

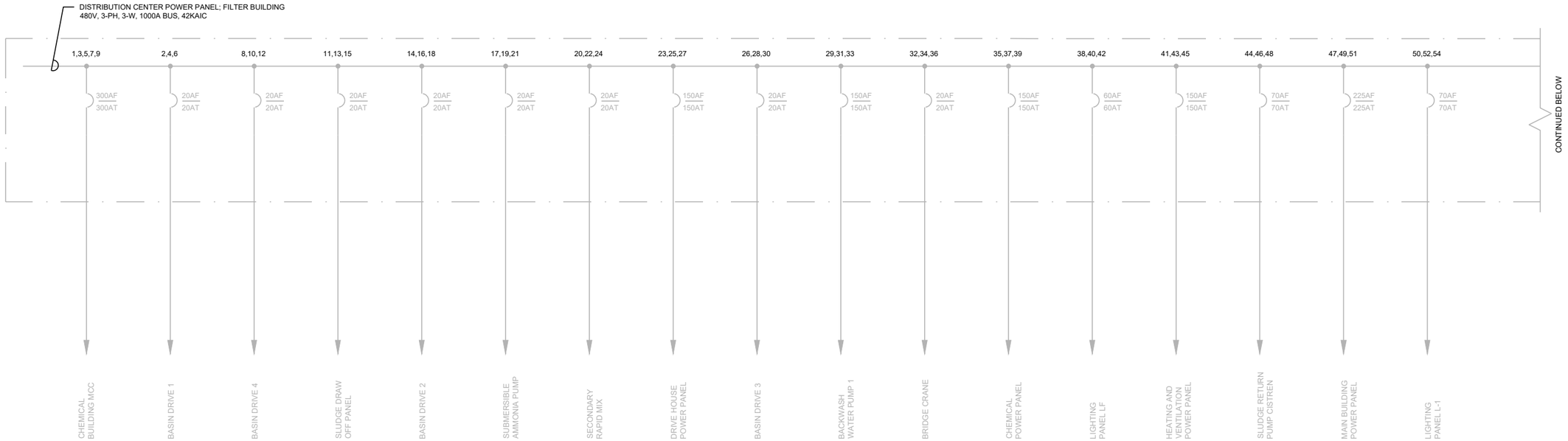
CITY OF BLOOMINGTON UTILITIES
MONROE WTP IMPROVEMENTS: CHEMICAL FEED LINE REPLACEMENT AND BACKWASH SYSTEM PUMP ADDITION AND TANK REHABILITATION - BLOOMINGTON, IN

SITE DEVELOPMENT GRADING PLAN

DONOHUE

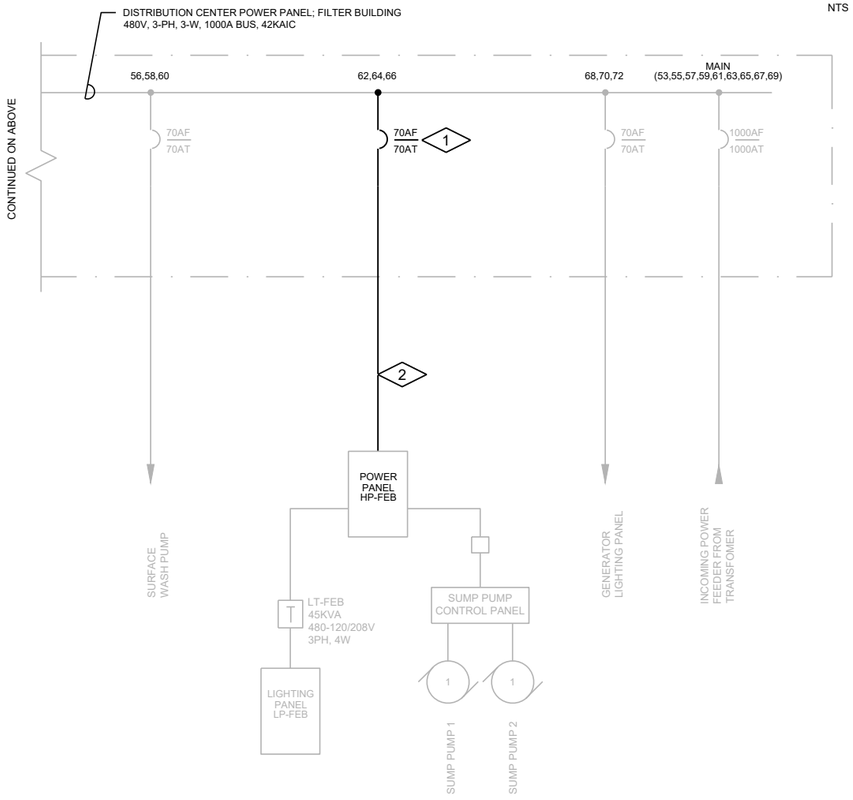
Sheet No. 17

Drawing No. **002-CG-1**



FILTER BUILDING - DISTRIBUTION CENTER POWER PANEL ONE-LINE DIAGRAM - REMOVAL

NTS



GENERAL NOTES:

1. CONTRACTOR SHALL FIELD VERIFY EXISTING CONDITIONS, DIMENSIONS, AND ELEVATIONS PRIOR TO CONSTRUCTION AND/OR FABRICATION.
2. SEE SPECIFICATION SECTION 01 11 00 FOR PROJECT SEQUENCES AND CONSTRAINTS.
3. NEW EQUIPMENT INSTALLED IN EXISTING DISTRIBUTION EQUIPMENT SHALL MATCH EXISTING MANUFACTURER, STYLE, RATING, AND COLOR.
4. PROVIDE NECESSARY APPURTENANCES FOR INSTALLATION OF NEW EQUIPMENT IN EXISTING DISTRIBUTION EQUIPMENT.

PLAN NOTES:

1. REMOVE EXISTING CIRCUIT BREAKER.
2. REMOVE EXISTING CONDUIT AND WIRE BACK TO SOURCE.

CHASE E. BENTON
REGISTERED
No. 12300012
STATE OF INDIANA
PROFESSIONAL ENGINEER
01/06/2025

Revision Number	Revision Description	Drawn By	Checked By	Date

Designed By	CEB
Drawn By	CEB
Checked By	JEF
Approved By	CEB
Filename	007E1.DWG
Project No.	14144
Project Date	JAN 2025

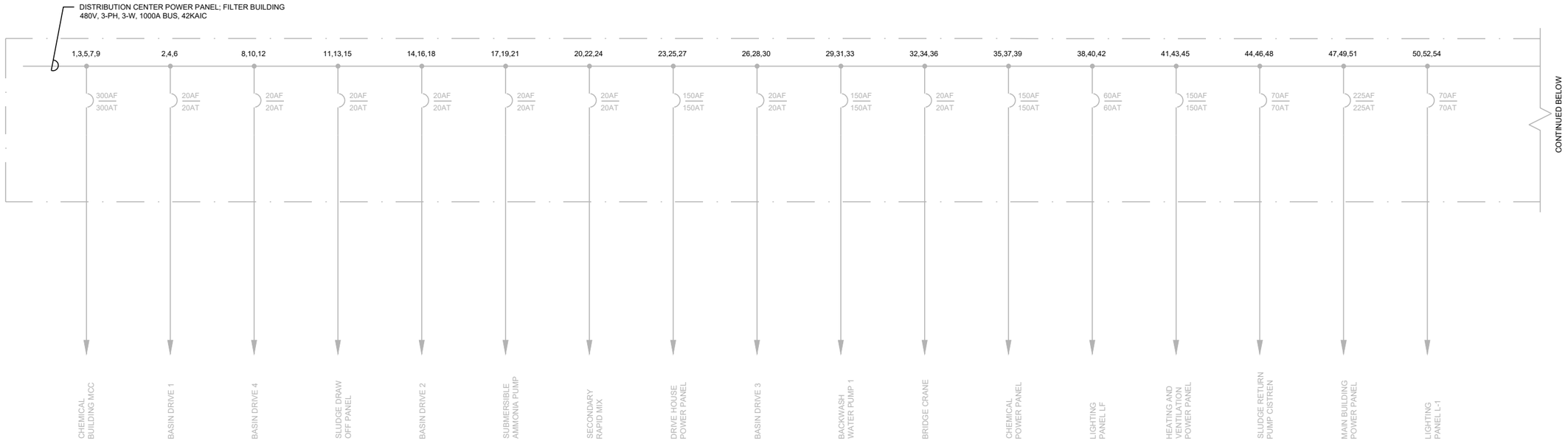
CITY OF BLOOMINGTON UTILITIES
MONROE WTP IMPROVEMENTS: CHEMICAL FEED LINE REPLACEMENT AND BACKWASH SYSTEM PUMP ADDITION AND TANK REHABILITATION - BLOOMINGTON, IN

ELECTRICAL DISTRIBUTION
FILTER BUILDING REMOVAL ONE-LINE DIAGRAM

DONOHUE

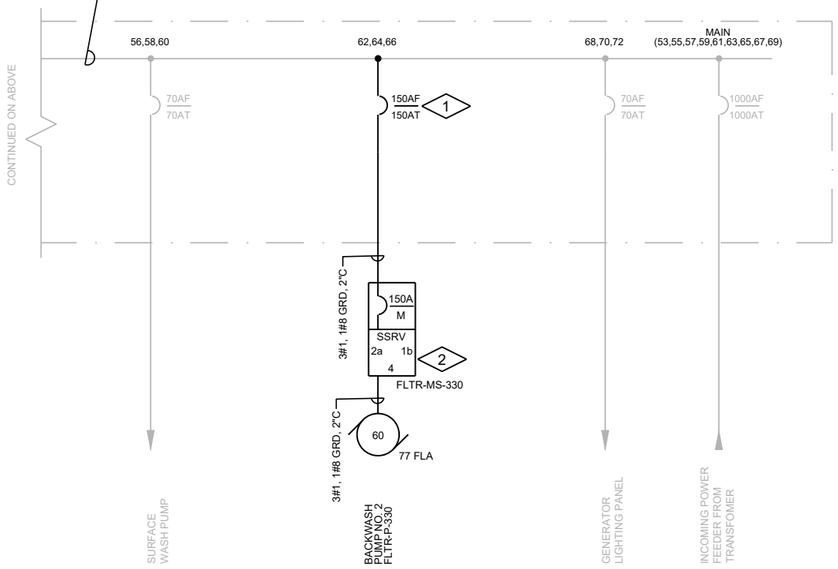
Sheet No. 18

Drawing No. **007-E-1**



FILTER BUILDING - DISTRIBUTION CENTER POWER PANEL ONE-LINE DIAGRAM

NTS



GENERAL NOTES:

1. CONTRACTOR SHALL FIELD VERIFY EXISTING CONDITIONS, DIMENSIONS, AND ELEVATIONS PRIOR TO CONSTRUCTION AND/OR FABRICATION.
2. SEE SPECIFICATION SECTION 01 11 00 FOR PROJECT SEQUENCES AND CONSTRAINTS.
3. NEW EQUIPMENT INSTALLED IN EXISTING DISTRIBUTION EQUIPMENT SHALL MATCH EXISTING MANUFACTURER, STYLE, RATING, AND COLOR.
4. PROVIDE NECESSARY APPURTENANCES FOR INSTALLATION OF NEW EQUIPMENT IN EXISTING DISTRIBUTION EQUIPMENT.

PLAN NOTES:

1. PROVIDE NEW CIRCUIT BREAKER AS INDICATED.
2. BACKWASH PUMP NO. 2 MOTOR STARTER PANEL; 75HP SOFT START WITH DISCONNECT SWITCH, NEMA 1 ENCLOSURE.

CHASE E. BENTON
REGISTERED
No. 12300012
STATE OF INDIANA
PROFESSIONAL ENGINEER
01/06/2025

Revision Number	Revision Description	Drawn By	Checked By	Date

Designed By	CEB
Drawn By	CEB
Checked By	JEF
Approved By	CEB
Filename	007E1.DWG
Project No.	14144
Project Date	JAN 2025

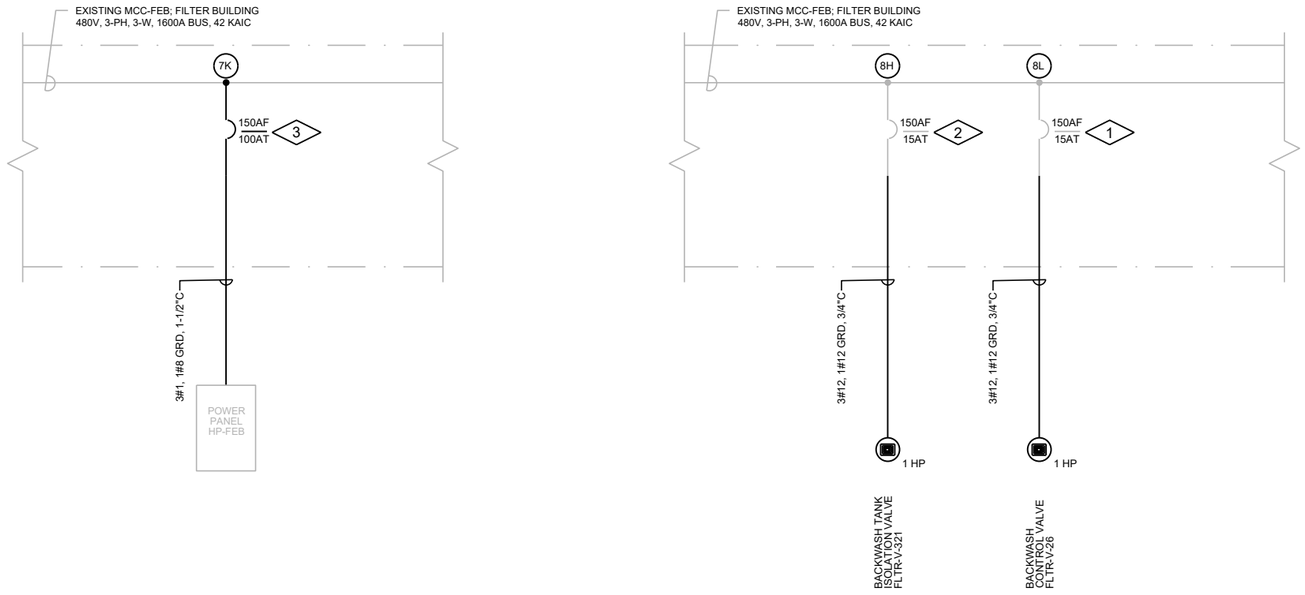
CITY OF BLOOMINGTON UTILITIES
MONROE WTP IMPROVEMENTS: CHEMICAL FEED LINE REPLACEMENT AND BACKWASH SYSTEM PUMP ADDITION AND TANK REHABILITATION - BLOOMINGTON, IN

ELECTRICAL DISTRIBUTION
FILTER BUILDING ONE-LINE DIAGRAM

DONOHUE

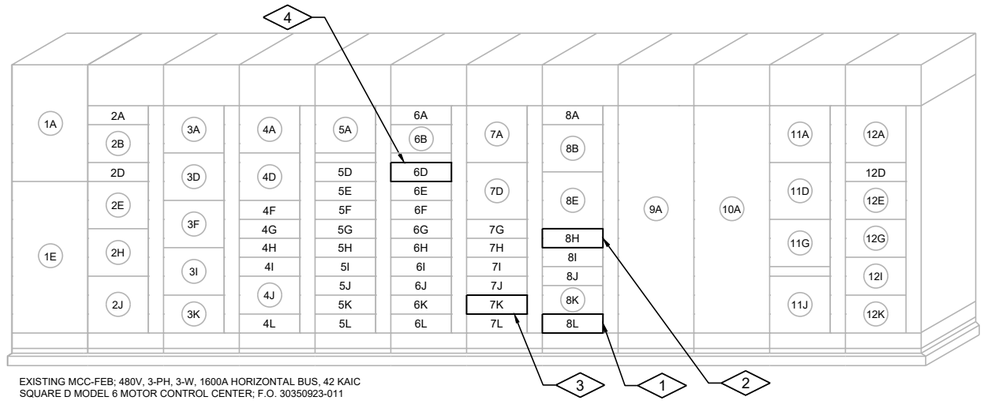
Sheet No. 19

Drawing No. 007-E-2



FILTER BUILDING - MCC-FEB
PARTIAL ONE-LINE DIAGRAM

NTS



EXISTING MCC-FEB; 480V, 3-PH, 3-W, 1600A HORIZONTAL BUS, 42 KAIC
SQUARE D MODEL 6 MOTOR CONTROL CENTER; F.O. 30350923-011

FILTER BUILDING - MCC-FEB
ELEVATION

NTS

GENERAL NOTES:

1. CONTRACTOR SHALL FIELD VERIFY EXISTING CONDITIONS, DIMENSIONS, AND ELEVATIONS PRIOR TO CONSTRUCTION AND/OR FABRICATION.
2. SEE SPECIFICATION SECTION 01 11 00 FOR PROJECT SEQUENCES AND CONSTRAINTS.
3. NEW EQUIPMENT INSTALLED IN EXISTING MOTOR CONTROL CENTER SHALL MATCH EXISTING MANUFACTURER, STYLE, RATING, AND COLOR.
4. PROVIDE NECESSARY APPURTENANCES FOR INSTALLATION OF NEW EQUIPMENT IN EXISTING MOTOR CONTROL CENTER.

PLAN NOTES:

1. PROVIDE NEW CIRCUIT BREAKER AS INDICATED IN OPEN CIRCUIT SPACE.
2. UTILIZE SPARE 3P-15A CIRCUIT BREAKER FOR NEW LOAD.
3. REPLACING EXISTING SPARE CIRCUIT BREAKER WITH NEW CIRCUIT BREAKER AS INDICATED.
4. RE-LABEL EXISTING CIRCUIT BREAKER BUCKET AS SPARE.

CHASE E. BENTON
REGISTERED
No. 12300012
STATE OF
INDIANA
PROFESSIONAL ENGINEER

01/06/2025

Revision Number	Revision Description	Drawn By	Checked By	Date

Designed By	CEB
Drawn By	CEB
Checked By	JEF
Approved By	CEB
Filename	007E1.DWG
Project No.	14144
Project Date	JAN 2025

CITY OF BLOOMINGTON UTILITIES
MONROE WTP IMPROVEMENTS: CHEMICAL FEED LINE REPLACEMENT AND BACKWASH SYSTEM PUMP ADDITION AND TANK REHABILITATION - BLOOMINGTON, IN

ELECTRICAL DISTRIBUTION
FILTER BUILDING ONE-LINE DIAGRAM AND ELEVATION

DONOHUE

Sheet No. 20

Drawing No. 007-E-3

PANEL SCHEDULE
LP-FEB
(FILTER BLDG - STR. 300)

SURFACE MOUNTED NEMA 1 | 120 / 208 V, 3 PHASE, 4 WIRE | RATING 10,000A SCCR | - MAIN BREAKER | 150A MAIN BUS | 100A GRD. BUS

	CKT. NO.	TRIP/P	DESCRIPTION	PHASE A	PHASE B	PHASE C	DESCRIPTION	TRIP/P	CKT. NO.
	1	20/1	LIGHTS & RECEPTACLES FLOC	•			NORTH STAIRS, ELECTRIC RM. LIGHTS	20/1	2
	3	20/1	LIGHTS & RECEPTACLES FLOC		•		RECEPTACLES	20/1	4
	5	20/1	LIGHTS & RECEPTACLES FLOC			•	PLC-7A	20/1	6
	7	20/1	LIGHTS BASEMENT	•			LIGHTS FILTER GALLERY	20/1	8
	9	20/1	LIGHTS BASEMENT		•		LIGHTS FILTER GALLERY	20/1	10
	11	20/1	LIGHTS BASEMENT			•	RECEPTACLES	20/1	12
	13	20/1	LIGHTS BASEMENT	•			LIGHTS BLOWER ROOM	20/1	14
1	15	20/1	FLTR-V-321		•		RECEPTACLES BLOWER ROOM	20/1	16
	17	20/1	LIGHTS BASEMENT			•	LIGHTS	20/1	18
	19	20/1	RECEPTACLES	•			LIGHTS	20/1	20
	21	20/1	RECEPTACLES		•		RECEPTACLES	20/1	22
	23	20/1	RECEPTACLES			•	RECEPTACLES	20/1	24
	25	20/1	BASEMENT GALLERY	•			SPARE TO FILTER	20/1	26
1	27	20/1	FLTR-V-26		•		OUTSIDE WALL PACK	20/1	28
	29	20/1	SLUDGE DRAWUFF PANEL			•	BLOWER CONTROL PANEL (S)	20/1	30
	31	20/1	BLOWER CONTROL PANEL (W)	•			SPARE	20/1	32
	33	20/1	SPARE		•		OUTSIDE LIGHTS	20/1	34
	35	20/1	PLC-8			•	RECEPTACLES WALKWAY	20/1	36
	37	20/1	UNKNOWN LOAD	•			SOUTH STAIRWAY	20/1	38
	39	20/1	UNKNOWN LOAD		•		UPS	60/2	40
	41	20/1	UNKNOWN LOAD			•			42
	43	20/1	UNKNOWN LOAD (SPARE?)	•			NAOC-V-11A, NAOC-V-11B	20/1	44
	45	20/1	UNKNOWN LOAD (SPARE?)		•		HTP-2	30/2	46
1	47	20/1	NAOC-V-12A, NAOC-V-12B			•			48
1	49	20/1	NAOH-V-1A, NAOH-V-1B	•			SURGE PROTECTION	60/3	50
1	51	20/1	HFSA-V-1A, HFSA-V-1B		•				52
1	53	20/1	NHOH-V-1A, NHOH-V-1B			•			54
			TOTALS:	-	-	-			

PANEL SCHEDULE
LP-CB
(CHEMICAL BLDG - STR. 800)

SURFACE MOUNTED NEMA 4X | 208 / 120 V, 3 PHASE, 4 WIRE | RATING 14,000 A.I.C. | 100A MAIN BREAKER | 100A MAIN BUS | 100A GRD. BUS

	CKT. NO.	TRIP/P	DESCRIPTION	PHASE A	PHASE B	PHASE C	DESCRIPTION	TRIP/P	CKT. NO.
	1	20/1	LIGHTS CORRIDOR	•			LIGHTS 104, 105	20/1	2
	3	20/1	LIGHTS 102		•		RECEPTACLES 101, 106, 107	20/1	4
	5	20/1	LIGHTS 105, 107			•	RECEPTACLES 102, 103	20/1	6
	7	20/1	RECEPTACLES	•			RECEPTACLES 104, EXITS	20/1	8
	9	20/1	WALL PACKS, EXITS		•		RECEPTACLES 105, 106	20/1	10
	11	20/1	HFSA P2, P3			•	RECEPTACLES 107, 108, EXITS	20/1	12
3	13	20/1	PLC-10	•			LIT 600 AMMONIA	20/1	14
	15	20/1	LIT 641, 642, 643		•		LIT 621 HFSA	20/1	16
	17	20/1	LIT 671, 672, 678			•	NHOH SUMP	20/1	18
	19	20/1	WIT/WSH 625	•			HFSA P4 SUMP	20/1	20
	21	20/1	NAOC V1, V4		•		NAOC V2, V5	20/1	22
	23	20/1	NAOC V3, V6			•	NAOC P8 SUMP	20/1	24
	25	20/1	NAOC V7, V9	•			NAOC V8, V10	20/1	26
	27	20/1	LIT 651, 652		•				28
	29	20/1	NAOH P-6 SUMP			•	DF 103	20/3	30
1	31	20/1	NAOC P-3, P-4, P-5, P-6 (NAOC-JBX-2)	•					32
	33	20/1	NHOH P-1, P-2 (NHOH-JBX-2)		•		NAOH P-3, P-4, P-5 (NAOH-JBX-2)	20/1	34
1	35	20/1	NHOH-LCP-1			•	HTP-1	40/2	36
1	37	20/1	NAOH-LCP-1	•					38
	39	20/1	AMMONIA COMPRESSOR		•		NETWORK RACK	20/1	40
	41	20/1	OPERATOR WORK STATION			•	DF 104	--	42
			TOTALS:	-	-	-			

PANEL SCHEDULE
PP-CB
(CHEMICAL BLDG - STR. 800)

SURFACE MOUNTED NEMA 4X | 208 / 120 V, 3 PHASE, 4 WIRE | RATING 14,000 A.I.C. | 100A MAIN BREAKER | 100A MAIN BUS | 100A GRD. BUS

CKT. NO.	TRIP/P	DESCRIPTION	PHASE A	PHASE B	PHASE C	DESCRIPTION	TRIP/P	CKT. NO.
1			•					2
3	20/3	EUH 101		•		EUH 102	20/3	4
5					•			6
7			•					8
9	20/3	EUH 103		•		EUH 104	20/3	10
11					•			12
13	20/1	SOL. XFER PUMPS 1 AND 2	•					14
15	20/1	UNKNOWN		•		EUH 106	20/3	16
17	20/1	UNKNOWN			•			18
19			•					20
21	20/3	EUH 107		•		EUH 108	20/3	22
23					•			24
25			•					26
27	20/3	EUH 109		•		EUH 110	20/3	28
29					•			30
31	20/2	WH-101	•			WH 102	20/2	32
33				•				34
35	20/1	TCP			•	SPARE	20/1	36
37	20/1	WATER HEATER	•			HEAT TRACE	20/1	38
1 39	20/1	NAOC-FSH-1		•		NHOH-FSH-3	20/1	40 1
41	20/1	SEC. PANEL			•	UNKNOWN	--	42
		TOTALS:	-	-	-			

GENERAL NOTES:

1. CONTRACTOR SHALL FIELD VERIFY EXISTING CONDITIONS, DIMENSIONS, AND ELEVATIONS PRIOR TO CONSTRUCTION AND/OR FABRICATION.
2. SEE SPECIFICATION SECTION 01 11 00 FOR PROJECT SEQUENCES AND CONSTRAINTS.
3. NEW EQUIPMENT INSTALLED IN EXISTING PANELBOARDS SHALL MATCH EXISTING MANUFACTURER, STYLE, RATING, AND COLOR.
4. PROVIDE NECESSARY APPURTENANCES FOR INSTALLATION OF NEW EQUIPMENT IN EXISTING PANELBOARDS.
5. PROVIDE UPDATED PANEL SCHEDULES FOR EXISTING PANELS WITH NEW LOADS.

PLAN NOTES:

1. PROVIDE CIRCUIT BREAKER WITHIN EXISTING BLANK SPACE AS INDICATED.
2. EXISTING LIGHTING PANEL CONTAINS 54 BRANCH CIRCUIT SPACES. RE-LABEL CIRCUIT SPACES TO REFLECT A 54 BRANCH CIRCUITS, CURRENT LABELED AS 42 CIRCUIT PANEL.
3. UTILIZE EXISTING CIRCUIT BREAKER FOR NEW LOAD.
4. INCLUDE NEUTRAL CONDUCTOR FOR CIRCUIT.

Revision Number	Revision Description	Drawn By	Checked By	Date

Designed By	CEB
Drawn By	CEB
Checked By	JEF
Approved By	CEB
Filename	007E1.DWG
Project No.	14144
Project Date	JAN 2025

CITY OF BLOOMINGTON UTILITIES
MONROE WTP IMPROVEMENTS: CHEMICAL FEED LINE REPLACEMENT AND BACKWASH SYSTEM PUMP ADDITION AND TANK REHABILITATION - BLOOMINGTON, IN

ELECTRICAL DISTRIBUTION
FILTER AND CHEMICAL BUILDING PANEL SCHEDULES

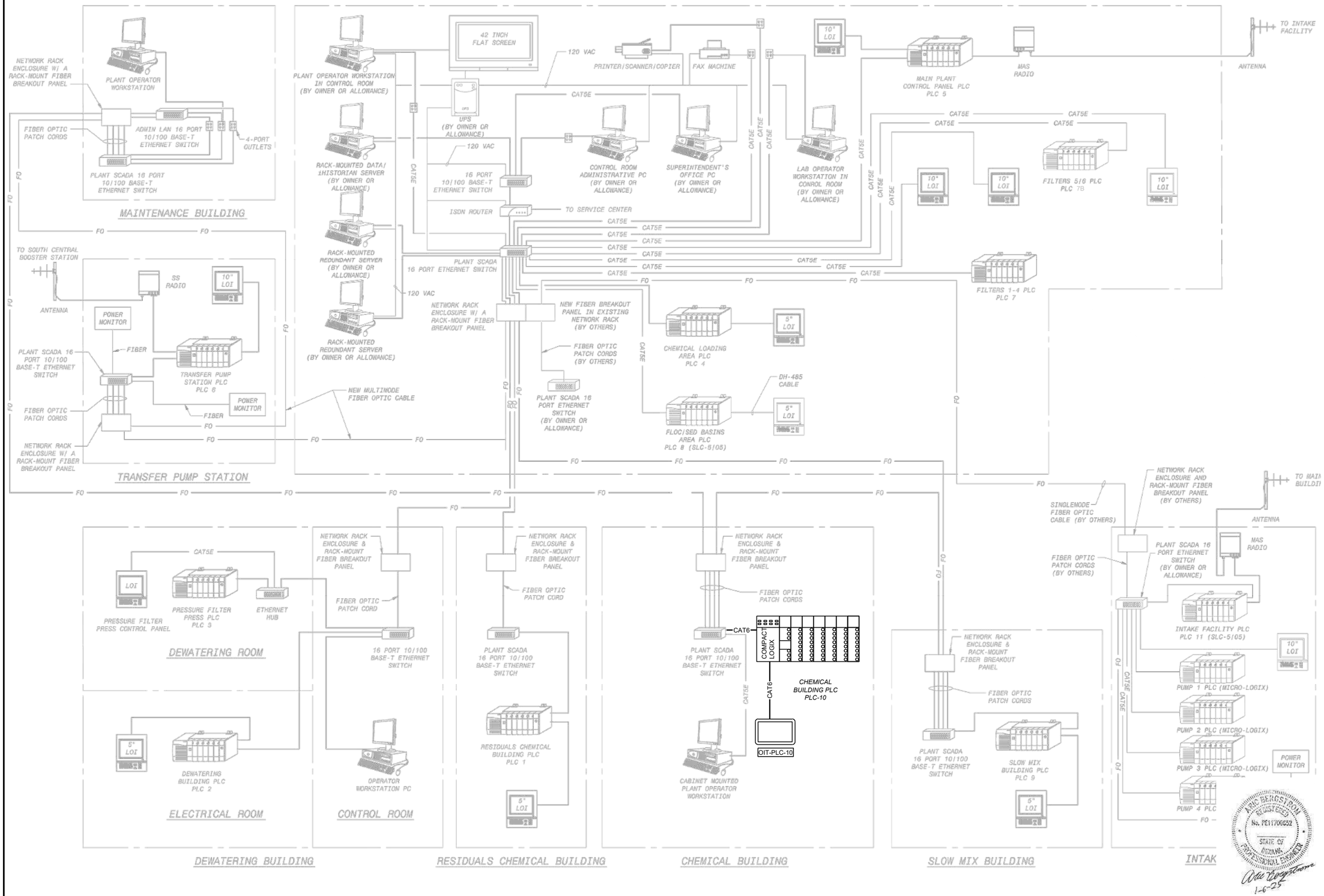
DONOHUE

Sheet No. 21

Drawing No. 007-E-4

CHASE E. BENTON REGISTERED No. 12300012 STATE OF INDIANA PROFESSIONAL ENGINEER

01/06/2025



Revision Number	Revision Description	Drawn By	Checked By	Date

Designed By	JCE
Drawn By	JCE
Checked By	AHB
Approved By	AHB
Filename	008I1.DWG
Project No.	14144
Project Date	JAN 2025

CITY OF BLOOMINGTON UTILITIES
MONROE WTP IMPROVEMENTS: CHEMICAL FEED LINE REPLACEMENT AND BACKWASH SYSTEM PUMP ADDITION AND TANK REHABILITATION - BLOOMINGTON, IN

PROCESS AND CONTROL SYSTEM NETWORK DIAGRAM

DONOHUE

Sheet No. 22

Drawing No. **008-I-1**

PROCESS CONTROL SYSTEM HMI
PCS-HMI
(PARTIAL)

PLC COMM FAIL YA
ON UPS YA
LINE FILTER FAIL YA
HI LEVEL ALARM YA (2)
COMBINED FILTER EFFLUENT FI GPM
UPS FAIL YA
LOW BATTERY YA

VALVE (x14)
YL LR
ZSO OPEN
ZSC CLOSED
YA FAIL
HC O/C FAIL TIMER
HS MA
HS OPEN
HS CLOSE
YA FAULT

HEAT TRACE CONTROLLER FAIL YA

CHEMICAL BUILDING CONTROL PANEL
PLC-10
(PARTIAL)

PWR YL WHT
PLC XX
ETHR SW XX
OIT
1
2
LINE FILTER JX
UPS
DO
ETHR XX

120V
LINE FILTER FAILURE
UPS
ON UPS PWR
UPS LOW BATTERY
UPS FAILURE
NAOC STO. TANK LEVEL (3)
NAOC XFER PUMP 1 IN REMOTE (2)
NAOC XFER PUMP 1 RUNNING (2)
NAOC XFER PUMP 1 FAIL (2)
NAOC XFER PUMP 1 START (2)
NAOC XFER PUMP 1 STOP (2)
NAOC XFER PUMP 1 ESTOP (2)
NAOC STORE EWS ALARM
NAOC SUMP HIGH LEVEL
NAOC FEED EWS ALARM
NAOC DAY TANK HI. LEVEL (2)
NAOC DAY TNK. LEVEL (2)
NAOC VALVE 1 OPEN IND. (12)
NAOC VALVE 1 CLOSED IND. (12)
NAOC VALVE 1 OPEN CMD (12)
NAOC VALVE 1 CLOSE CMD (12)
NAOC MTR PUMP IN REMOTE (4)
NAOC MTR PUMP RUNNING (4)
NAOC MTR PUMP FAIL (4)
NAOC MTR PUMP REQUIRED (4)
NAOC MTR PUMP SPEED (4)
NAOC MTR PUMP SPEED CONTROL (4)
HEAT TRACE CONTROLLER 1 FAIL (6)

(3) LOOP POWER
JBX-10 (PARTIAL)
(2) LOOP POWERED
JBX-10 (PARTIAL)
TO MOTOR STARTERS
STORAGE NAOC EWS FSH 2

FILTER 1-4 PLC PANEL
PLC-7B
(PARTIAL)
NAOC VALVE 12A OPEN IND. (4)
NAOC VALVE 12A CLOSED IND. (4)
NAOC VALVE 12A OPEN CMD (4)
NAOC VALVE 12A CLOSE CMD (4)

VALVE ACTUATOR DETAIL 1
NTS
ZI ZSO ZSC E FLP V
NAOC-V-1 ✱
NAOC-V-2 ✱
NAOC-V-3 ✱
NAOC-V-4 ✱
NAOC-V-5 ✱
NAOC-V-6 ✱
NAOC-V-7 ✱
NAOC-V-8 ✱
NAOC-V-9 ✱
NAOC-V-10 ✱

VALVE ACTUATOR DETAIL 2
NTS
ZI ZSO ZSC E FLP V
NAOC-V-11A ✱
NAOC-V-11B ✱
NAOC-V-12A ✱
NAOC-V-12B ✱

GENERAL NOTES:
1. NOT ALL DETAILS OF EXISTING EQUIPMENT IS SHOWN FOR CLARITY.
2. EXISTING CHEMICAL BUILDING CONTROL PANEL SHALL REMAIN AND BE CONVERTED INTO JBX-10 TO ALLOW FOR REUSE OF EXISTING INSTRUMENTATION AND CONTROL WIRES.
3. REUSE EXISTING WIRING AND CONDUIT RUNS WHENEVER POSSIBLE, PROVIDE NEW CONDUIT AND WIRING AS NEEDED. NO SPLICES PERMITTED.

PLAN NOTES:
1. PLC-10 IS A REPLACEMENT TO EXISTING CONTROL PANEL THAT SHALL BE REPURPOSED AS A TERMINAL JUNCTION BOX JBX-10. ALL EXISTING SIGNALS SHALL BE EXTENDED TO NEW PLC-10 PANEL.
2. REFER TO SPECIFICATION SECTION 40 61 93 - PROCESS CONTROL SYSTEM I/O LIST FOR ALL REQUIRED I/O'S.

FILTER WITH INSECT SCREEN
TRUCK UNLOADING CONNECTION (TYP.)
SODIUM HYPOCHLORITE STORAGE TANK T-1 NAOC-T-1
SODIUM HYPOCHLORITE STORAGE TANK T-2 NAOC-T-2
SODIUM HYPOCHLORITE STORAGE TANK T-3 NAOC-T-3
HTP-1 (HTC-7)
NAOC LIT 1 (3)
NAOC LE 1
NAOC LI 1
NAOC-V-1 ✱
NAOC PI 1
SODIUM HYPOCHLORITE TRANSFER PUMP P-1 NAOC-P-1
CS-1
NAOC LIT 2 (3)
NAOC LE 2
NAOC LI 2
NAOC-V-2 ✱
NAOC PI 2
SODIUM HYPOCHLORITE TRANSFER PUMP P-2 NAOC-P-2
NAOC LE 3
NAOC LI 3
NAOC-V-3 ✱
NAOC-V-4 ✱
NAOC-V-5 ✱
NAOC-V-6 ✱
EMERGENCY WASH STATION ✱✱✱
TWP
FROM POTABLE WATER
NAOC FSH 1
NAOC HS 1
NAOC LIT 4 (2)
NAOC LSH 4
NAOC LE 4
SODIUM HYPOCHLORITE DAY TANK T-4 NAOC-T-4 ✱
NAOC LSH 5
NAOC LE 5
SODIUM HYPOCHLORITE DAY TANK T-5 NAOC-T-5 ✱
NAOC-V-7 ✱
NAOC-V-8 ✱
NAOC-V-9 ✱
NAOC-V-10 ✱
SODIUM HYP. SUMP PUMP NAOC-P-7
NAOC LSH 7
STORAGE SUMP
CS-1
TRUCK FILL CONTAINMENT
STORAGE CONTAINMENT
STORAGE CONTAINMENT
STORAGE CONTAINMENT

(4x6)
208V
BLDG 800 HEAT TRACE PANEL 1
HTP-1 ✱
(PARTIAL)
HTC 1 (7)
HTP-1 (HTC-1)
HTP-1 (HTC-2)
HTP-1 (HTC-3)
NAOC-V-12A ✱
NAOC-V-12B ✱
NAOC-V-11A ✱
NAOC-V-11B ✱
TO TRANSFER PUMP STATION
CFE
FROM FILTERS
PRIMARY RAPID MIX CHAMBER
SLOW MIX CHAMBER
SODIUM HYPOCHLORITE METERING SKID 1 NAOC-M-1 ✱✱
NAOC-JBX-1
NAOC-JBX-2
SODIUM HYPOCHLORITE METERING PUMP P-3 NAOC-P-3 ✱✱
SODIUM HYPOCHLORITE METERING PUMP P-4 NAOC-P-4 ✱✱
SODIUM HYPOCHLORITE METERING PUMP P-5 NAOC-P-5 ✱✱
SODIUM HYPOCHLORITE METERING PUMP P-6 NAOC-P-6 ✱✱
NAOC PI 3
NAOC PI 4
NAOC PI 5
NAOC PI 6

ARIC BERGSTROM REGISTERED No. PE11706652 STATE OF MONTANA PROFESSIONAL ENGINEER
1-6-25

Revision Number	Revision Description	Drawn By	Checked By	Date

Designed By	JCE
Drawn By	JCE
Checked By	AHB
Approved By	AHB
Filename	009N1.DWG
Project No.	14144
Project Date	JAN 2025

CITY OF BLOOMINGTON UTILITIES
MONROE WTP IMPROVEMENTS: CHEMICAL FEED LINE REPLACEMENT AND BACKWASH SYSTEM PUMP ADDITION AND TANK REHABILITATION - BLOOMINGTON, IN

PROCESS & INSTRUMENTATION DIAGRAM
SODIUM HYPOCHLORITE SYSTEM

DONOHUE

Sheet No. 23

Drawing No. 009-N-1

PROCESS CONTROL SYSTEM HMI
PCS-HMI
(PARTIAL)

VALVE (x2)
YL LR | ZSO OPEN | ZSC CLOSED | YA FAIL | HC O/C FAIL TIMER
HS MA | HS OPEN | HS CLOSE | YA FAULT

CHEMICAL BUILDING CONTROL PANEL
PLC-10
(PARTIAL)
1

FILTER 1-4 PLC PANEL
PLC-7B
(PARTIAL)

NHOH STORAGE EWS ALARM
NHOH FEED EWS ALARM
AQUA AMMONIA STORAGE TANK T-1 LEVEL
AQUA AMMONIA STORAGE TANK T-1 HIGH PRESSURE ALARM
CHEM. BLDG. EYEWASH ALARM
SPRINKLER TAMPER SW1 ALARM
SPRINKLER TAMPER SW2 ALARM
SPRINKLER TAMPER SW3 ALARM
AIR COMPRESSORS COMM. ALARM
TEMP. CONTROL PANEL COMM. ALARM
ALARM HORN ACTIVATE
NHOH METERING PUMP P-1 IN AUTO MODE
NHOH METERING PUMP P-1 RUNNING
NHOH METERING PUMP P-1 FAIL
NHOH METERING PUMP P-1 RUN COMMAND
NHOH METERING PUMP P-1 SPEED FEEDBACK
NHOH METERING PUMP P-1 SPEED CONTROL
AQUA AMMONIA FLOW DETECTED
AQUA AMMONIA FLOW HIGH
AQUA AMMONIA SUMP HIGH LEVEL ALARM
NHOH VALVE 1A OPEN IND.
NHOH VALVE 1A CLOSED IND.
NHOH VALVE 1A OPEN CMD
NHOH VALVE 1A CLOSE CMD

JBX-10 (PARTIAL)
NHOH FSH 2 — AQUA AMMONIA STORAGE EWS
NHOH FSH 1 — AQUA AMMONIA FEED EWS
LOOP POWER
TO/FROM FIELD DEVICES

120V
AQUA AMMONIA METERING PUMPS LOCAL CONTROL PANEL
NHOH-LCP-1
HS HOA (2) | YL RUNNING RED (2) | POT (2) | YL FAIL AMB (2)
IN REMOTE, RUNNING, FAIL, START, SPEED REF, SPEED CMD, SPEED POT, 3C-S
(14)

ZI, ZSO, ZSC
120V — E — FLP — V
(2x4)

VALVE ACTUATOR DETAIL 1
NTS 009-N-2

NHOH-V-1A ✱
NHOH-V-1B ✱
TO TRANSFER PUMP STATION
FROM FILTERS
CFE
NHOH
1 E 009-N-2

NHOH LIT 1
NHOH-JBX-T-1
VFC
NHOH LE 1
NHOH PSH 1
AQUA AMMONIA STORAGE TANK T-1
NHOH-T-1
VAPOR RECOVERY CONNECTION
TRUCK UNLOADING CONNECTION
STORAGE CONTAINMENT

TO OUTSIDE
NHOH-JBX-1
120V
NHOH-JBX-2
NHOH PI 1
AQUA AMMONIA METERING SKID 1
NHOH-M-1 **
AQUA AMMONIA METERING PUMP P-1
NHOH-P-1 **
AQUA AMMONIA METERING PUMP P-1
NHOH-P-2 **
M AS

JBX-10 (PARTIAL) (2)
120V — NHOH FSH 3
NHOH LSH 3
AQUA AMMONIA SUMP PUMP P-3
NHOH-P-3
CS-1
CONTAINMENT

PLAN NOTES:

1. REFER TO SPECIFICATION SECTION 40 61 93 - PROCESS CONTROL SYSTEM I/O LIST FOR ALL REQUIRED I/O'S.

ARC BERGSTROM REGISTERED No. PE1170GG52 STATE OF INDIANA PROFESSIONAL ENGINEER
1-6-25

Revision Number	Revision Description	Drawn By	Checked By	Date

Designed By	JCE
Drawn By	JCE
Checked By	AHB
Approved By	AHB
Filename	009N2.DWG
Project No.	14144
Project Date	JAN 2025

CITY OF BLOOMINGTON UTILITIES
MONROE WTP IMPROVEMENTS: CHEMICAL FEED LINE REPLACEMENT AND BACKWASH SYSTEM PUMP ADDITION AND TANK REHABILITATION - BLOOMINGTON, IN

PROCESS & INSTRUMENTATION DIAGRAM
AQUA AMMONIA SYSTEM

DONOHUE

Sheet No. 24
Drawing No. 009-N-2

PROCESS CONTROL SYSTEM HMI
PCS-HMI
(PARTIAL)

HI LEVEL ALARM — YA
HEAT TRACE CONTROLLER FAIL — YA

VALVE (x4)
LR — YL
OPEN — ZSO
CLOSED — ZSC
FAIL — YA
O/C FAIL TIMER — HC
MA — HS
OPEN — HS
CLOSE — HS
FAULT — YA

CHEMICAL BUILDING CONTROL PANEL
PLC-10
(PARTIAL)
3

NAOH STORE EWS ALARM — JBX-10 (PARTIAL) — NAOH FSH 2
NAOH FEED EWS ALARM — JBX-10 (PARTIAL) — NAOH FSH 1
NAOH STORAGE TANK LEVEL — (2) LOOP POWERED — JBX-10 (PARTIAL)
NAOH T-1 VALVE OPEN IND. — (4) — JBX-10 (PARTIAL)
NAOH T-1 VALVE CLOSED IND. — (2) — JBX-10 (PARTIAL)
NAOH XFER PUMP IN REMOTE
NAOH XFER PUMP RUNNING
NAOH XFER PUMP FAIL
NAOH XFER PUMP START
NAOH XFER PUMP STOP
NAOH XFER PUMP ESTOP
(2) — JBX-10 (PARTIAL) — TO CHEMICAL BUILDING MCC
NAOH DAY TANK HI. LEVEL
NAOH DAY TANK LEVEL — LOOP POWERED — JBX-10 (PARTIAL)
NAOH SUMP HIGH LEVEL ALARM

SOD. HYDRO. MTR. PUMP IN AUTO MODE
SOD. HYDRO. MTR. PUMP RUNNING
SOD. HYDRO. MTR. PUMP FAIL
SOD. HYDRO. MTR. PUMP RUN COMMAND
SOD. HYDRO. MTR. PUMP SPEED REFERENCE
SOD. HYDRO. MTR. PUMP SPEED CONTROL
(3)

SODIUM HYDROXIDE METERING PUMPS LOCAL CONTROL PANEL
NAOH-LCP-1
HOA — HS — (3)
RUNNING — YL — RED — (3)
POT — (3)
FAIL — YL — AMB — (3)

IN REMOTE
RUNNING
FAIL
START
SPEED REF
SPEED CMD
SPEED POT 3C-S
(3)
(21)
1

FILTER 1-4 PLC PANEL
PLC-7B
(PARTIAL)

HEAT TRACE CNTR. FAIL

208V — BLDG 300 HEAT TRACE PANEL — HTP-2 — HTC 7

120V — ZI, ZSO, ZSC, E — FLP — (4x5)
NAOH VALVE 1A IN REMOTE
NAOH VALVE 1A OPEN IND.
NAOH VALVE 1A CLOSED IND.
NAOH VALVE 1A OPEN CMD
NAOH VALVE 1A CLOSE CMD

VALVE ACTUATOR DETAIL 1
NTS 009-N-3

NAOH-V-1A ✱
NAOH-V-1B ✱

BLDG 800 HEAT TRACE PANEL 1
HTP-1
(PARTIAL)

PRIMARY RAPID MIX CHAMBER

HTP-1 (HTC-4)
HTP-1 (HTC-5)
HTP-2 (HTC-7)
NAOH-V-1A ✱ — E — 1 — 009-N-3
NAOH-V-1B ✱ — E — 1 — 009-N-3
TO TRANSFER PUMP STATION
CFE
FROM FILTERS

FILTER WITH INSECT SCREEN
NAOH LIT 1 (2)
NAOH LE 1
NAOH LI 1
HTP-1 (HTC-7)
SODIUM HYDROXIDE STORAGE TANK T-1 — NAOH-T-1
NAOH ZS 1 ✱ (2) — NAOH-V-1 ✱
NAOH PI 1
SODIUM HYDROXIDE TRANSFER PUMP P-1 — NAOH-P-1
NAOH LE 2
NAOH LI 2
SODIUM HYDROXIDE STORAGE TANK T-2 — NAOH-T-2
NAOH ZS 2 ✱ (2) — NAOH-V-2 ✱
NAOH PI 2
SODIUM HYDROXIDE TRANSFER PUMP P-2 — NAOH-P-2
NAOH LIT 3
NAOH LSH 3
NAOH LE 3
SODIUM HYDROXIDE DAY TANK T-3 — NAOH-T-3
NAOH LSH 7
SODIUM HYDROXIDE SUMP PUMP — NAOH-P-7 — CS-1

SODIUM HYDROXIDE METERING SKID 1 — NAOH-M-1 ✱✱
NAOH-JBX-1
120V — NAOH-JBX-2
NAOH PI 1
NAOH PI 2
NAOH PI 3
SODIUM HYDROXIDE METERING PUMP P-1 — NAOH-P-1 ✱✱
SODIUM HYDROXIDE METERING PUMP P-2 — NAOH-P-2 ✱✱
SODIUM HYDROXIDE METERING PUMP P-3 — NAOH-P-3 ✱✱

TRUCK FILL CONTAINMENT
STORAGE CONTAINMENT
STORAGE CONTAINMENT

GENERAL NOTES:

1. FOR SIMPLICITY, NOT ALL DETAILS OF EXISTING EQUIPMENT IS SHOWN.

PLAN NOTES:

1. CONTRACTOR TO MODIFY EXISTING STEEL DAY TANK TO PROVIDE 3" FLANGE FOR LEVEL SWITCH INSTALLATION.
2. VALVE LOCATED IN BUILDING 300.
3. REFER TO SPECIFICATION SECTION 40 61 93 - PROCESS CONTROL SYSTEM I/O LIST FOR ALL REQUIRED I/O'S.

ARC REGISTERED — REGISTERED — No. PE1170GC52 — STATE OF KANSAS — PROFESSIONAL ENGINEER
1-6-25

Revision Number	Revision Description	Drawn By	Checked By	Date

Designed By	JCE
Drawn By	JCE
Checked By	AHB
Approved By	AHB
Filename	009N3.DWG
Project No.	14144
Project Date	JAN 2025

CITY OF BLOOMINGTON UTILITIES
MONROE WTP IMPROVEMENTS: CHEMICAL FEED LINE REPLACEMENT AND BACKWASH SYSTEM PUMP ADDITION AND TANK REHABILITATION - BLOOMINGTON, IN

PROCESS & INSTRUMENTATION DIAGRAM
SODIUM HYDROXIDE SYSTEM

DONOHUE

Sheet No. 25

Drawing No. 009-N-3

PROCESS CONTROL SYSTEM HMI
PCS-HMI ◆
(PARTIAL)

HEAT TRACE CONTROLLER FAIL — YA

VALVE (x2)
YL LR | ZSO OPEN | ZSC CLOSED | YA FAIL | HC O/C FAIL TIMER
HS MA | HS OPEN | HS CLOSE | YA FAULT

CHEMICAL BUILDING CONTROL PANEL
PLC-10 ◆ 3
(PARTIAL)

HFSA STORAGE EWS ALARM — JBX-10 ● (PARTIAL) — HFSA FSH 2
HFSA FEED EWS ALARM — JBX-10 ● (PARTIAL) — HFSA FSH 1
HFSA STORAGE TANK LEVEL (LOOP POWERED) — JBX-10 ● (PARTIAL)
HFSA TRANSFER PUMP IN REMOTE
HFSA TRANSFER PUMP RUNNING
HFSA TRANSFER PUMP FAIL
HFSA TRANSFER PUMP START
HFSA TRANSFER PUMP STOP
HFSA TRANSFER PUMP ENABLE
HFSA TRANSFER PUMP ESTOP
— JBX-10 ● (PARTIAL) — TO/FROM MOTOR STARTERS
HFSA DAYTANK LEVEL — JBX-10 ● (PARTIAL)
HFSA SUMP HIGH LEVEL ALARM — JBX-10 ● (PARTIAL)
HFSA METERING PUMP RATE CONTROL (2)
HFSA METERING PUMP RUN COMMAND (2)
— JBX-10 ● (PARTIAL) — TO/FROM MOTOR STARTERS

BLDG 800 HEAT TRACE PANEL 1
HTP-1 ✱
(PARTIAL)

FILTER 1-4 PLC PANEL
PLC-7B ◆
(PARTIAL)

HFSA VALVE 1A IN REMOTE (2)
HFSA VALVE 1A OPEN IND. (2)
HFSA VALVE 1A CLOSED IND. (2)
HFSA VALVE 1A OPEN CMD (2)
HFSA VALVE 1A CLOSE CMD (2)

ZI, ZSO, ZSC — 120V — FLP — E — (2x5)

VALVE ACTUATOR DETAIL 1
NTS 009-N-4
HFSA-V-1A ✱
HFSA-V-1B ✱

1

HYDROFLUOROSILICIC ACID FEED SKID

FILTER WITH INSECT SCREEN
HTP-1 (HTC-7) — V — HFSA — OF — T — D
HFSA LIT 1 — VFC — HFSA LE 1
HYDROFLUOROSILICIC ACID STORAGE TANK T-1 HFSA-T-1
HFSA — F — D
HFSA PI 1
CS-1
HYDROFLUOROSILICIC ACID TRANSFER PUMP P-1 HFSA-P-1
HFSA WE 1 — HFSA WE 1
HFSA LI 1 — OF — T
HYDROFLUOROSILICIC ACID DAY TANK T-2 HFSA-T-2
SCALE
HFSA LSH 4
D — D — 2 — D
HFSA SUMP PUMP P-4 HFSA-P-4

HTP-1 (HTC-1) — HFSA — HFSA
1 009-N-4 4 E — HFSA-V-1A ✱
1 009-N-4 4 E — HFSA-V-1B ✱
TO TRANSFER PUMP STATION
CFE
FROM FILTERS

CONTAINMENT

GENERAL NOTES:

1. FOR SIMPLICITY, NOT ALL DETAILS OF EXISTING EQUIPMENT IS SHOWN.
2. IF OWNER ACCEPTS ALTERNATE 1, PERFORM ALL WORK ASSOCIATED WITH HYDROFLUOROSILICIC ACID.

PLAN NOTES:

1. PROVIDE ALL FULL TONE INSTRUMENTATION, HEAT TRACE, DEVICES, PIPING, AND VALVES LOCATED IN FULL TONE BOARDER IF OWNER ACCEPTS ALTERNATE 1.
2. CONNECT TO EXISTING FLOOR DRAIN WHICH DRAINS TO BACKWASH BASIN.
3. REFER TO SPECIFICATION SECTION 40 61 93 - PROCESS CONTROL SYSTEM I/O LIST FOR ALL REQUIRED I/O'S.
4. VALVE LOCATED IN BUILDING 300.

ARC EROSION REGISTERED No. PE11706G52 STATE OF INDIANA PROFESSIONAL ENGINEER
1-6-25

Revision Number	Revision Description	Drawn By	Checked By	Date

Designed By	JCE
Drawn By	JCE
Checked By	AHB
Approved By	AHB
Filename	009N4.DWG
Project No.	14144
Project Date	JAN 2025

CITY OF BLOOMINGTON UTILITIES
MONROE WTP IMPROVEMENTS: CHEMICAL FEED LINE REPLACEMENT AND BACKWASH SYSTEM PUMP ADDITION AND TANK REHABILITATION - BLOOMINGTON, IN

PROCESS & INSTRUMENTATION DIAGRAM
HYDROFLUOROSILICIC ACID SYSTEM

DONOHUE

Sheet No. 26
Drawing No. 009-N-4

PROCESS CONTROL SYSTEM HMI

PCS-HMI ◆

(PARTIAL)

BACKWASH HOLDING BASIN ISOLATION VALVE

YL LR | ZSO OPEN | ZSC CLOSED | YA FAIL | HC O/C FAIL TIMER

HS MA | HS OPEN | HS CLOSE | YA FAULT

BACKWASH PUMP 2

YL OOR | YL RUN | ETM | YA MOTOR OT

HS MA | HS START | HS STOP | YA OL

FILTER 1-4 PLC PANEL

PLC-7B ◆

(PARTIAL)

BW HOLDING BASIN ISO. VALVE IN REMOTE (D)

BW HOLDING BASIN ISO. VALVE COMFIRMED OPEN (D)

BW HOLDING BASIN ISO. VALVE CONFIRMED CLOSED (D)

BW HOLDING BASIN ISO. VALVE FAULT (D)

BW HOLDING BASIN ISO. VALVE OPEN CMD (X)

BW HOLDING BASIN ISO. VALVE CLOSE CMD (X)

ZI / ZSO / ZSC

FLP E (6)

VALVE ACTUATOR DETAIL 1

NTS 009-N-5

FLTR-V-321 ✳

BACKWASH PUMP NO. 2 MOTOR OVERTEMP (D)

BACKWASH CONTROL VALVE POSITION (A)

BACKWASH CONTROL VALVE CLOSED (D)

BACKWASH CONTROL VALVE IN REMOTE (D)

BACKWASH HOLDING BASIN HIGH HIGH LEVEL (D)

BACKWASH HOLDING BASIN LEVEL (A)

FLTR LIT 321

FLTR LSHH 321

FLTR LE 321

BACKWASH TANK

BACKWASH TO FILTERS

BW

E

BACKWASH CONTROL VALVE

FLTR-V-26 ✳

1 009-N-5

BACKWASH TANK ISOLATION VALVE

FLTR-V-321 ✳

FLTR PI 320

FLTR PI 321

BACKWASH PUMP NO. 1

FLTR-P-320

CS-1

FLTR TSH 330 ✳✳

FLTR PI 330

BACKWASH PUMP NO. 2

FLTR-P-330 ✳✳

CS-1

FROM FILTERS 1-4

FLT

FROM FILTERS 5 AND 6

1

BACKWASH PUMP NO. 2 IN ON (D)

BACKWASH PUMP NO. 2 IN REMOTE (D)

BACKWASH PUMP NO. 2 RUNNING (D)

BACKWASH PUMP NO. 2 OVERLOAD (D)

BACKWASH PUMP NO. 2 REQUIRED (X)

BACKWASH PUMP NO. 2 STARTER

FLTR-MS-330 ●

(PARTIAL)

SSRV | MOL | HS DISC. | YL RUN RED | HS OL RESET | YA OL AMB | HS OOR

BACKWASH PUMP NO. 1 FAILED (D)

BACKWASH PUMP NO. 1 IN REMOTE (D)

BACKWASH PUMP NO. 1 RUNNING (D)

BACKWASH PUMP NO. 1 SUCTION PRESSURE LOW (D)

BACKWASH PUMP NO. 1 RUN COMMAND (X)

BACKWASH PUMP NO. 1 STARTER

FLTR-MS-320

HS DISC. | MS | MOL | YA LOW WATER | YA HIGH WATER | AMB | YL RUN RED | YL OFF GRN | YA OL AMB | HS OOR

PLAN NOTES: ◇

1. PROVIDE PROGRAMING FOR BACKWASH PUMP ALTERNATION WITH PLC INTERLOCK THAT WILL ONLY ALLOW ONE BACKWASH PUMP TO RUN AT ANY GIVEN TIME.

Revision Number	Revision Description	Drawn By	Checked By	Date

Designed By	JCE
Drawn By	JCE
Checked By	AHB
Approved By	AHB
Filename	009N5.DWG
Project No.	14144
Project Date	JAN 2025

CITY OF BLOOMINGTON UTILITIES
MONROE WTP IMPROVEMENTS: CHEMICAL FEED LINE REPLACEMENT AND BACKWASH SYSTEM PUMP ADDITION AND TANK REHABILITATION - BLOOMINGTON, IN

PROCESS & INSTRUMENTATION DIAGRAM
BACKWASH PUMPING

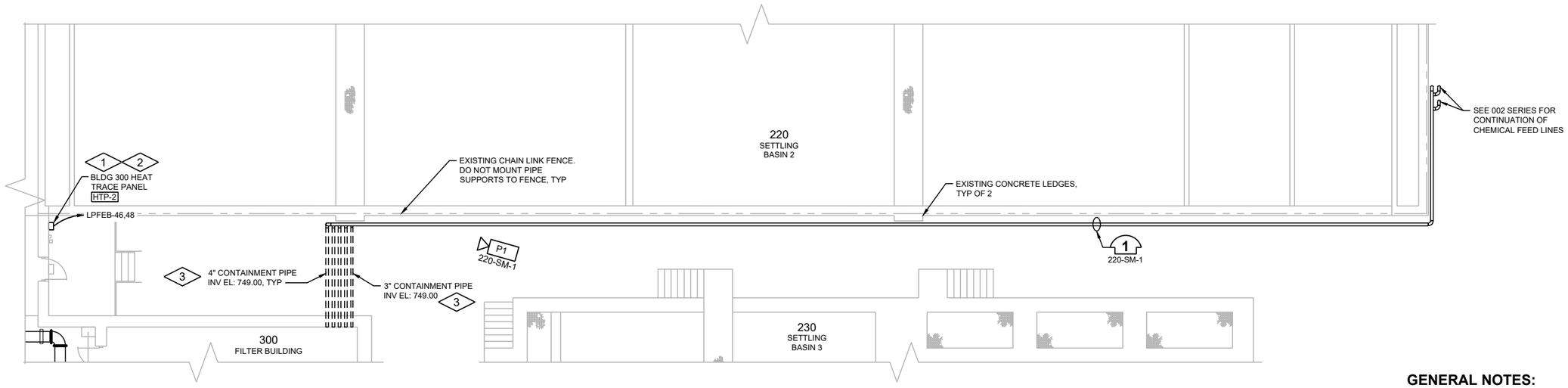
ERIC BERGSTROM REGISTERED No. PE11700052 STATE OF INDIANA PROFESSIONAL ENGINEER 1-6-25

DONOHUE

Sheet No. 27

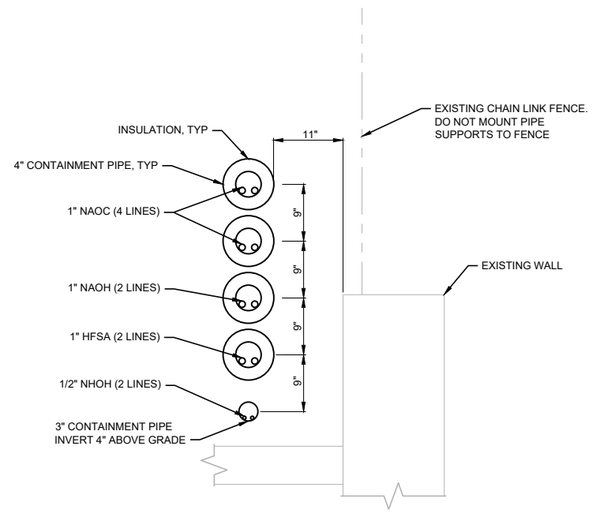
Drawing No. 009-N-5

TAG NAME	DESCRIPTION	DETAIL	WIRING	DESTINATION
NAOH-HTP-2	BLDG 300 HEAT TRACE PANEL	N170	(2) #14	PLC-7
SEE DRAWING 999-N-1 FOR CONTROL WIRING GENERAL NOTES.				



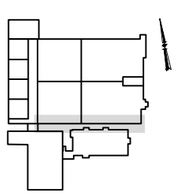
GRADE PLAN

0 1' 4'



DETAIL 1

NTS 220-SM-1



KEY PLAN

PHOTO 1

NTS 220-SM-1

GENERAL NOTES:

1. CONTRACTOR SHALL FIELD VERIFY EXISTING CONDITIONS, DIMENSIONS, AND ELEVATIONS PRIOR TO CONSTRUCTION AND/OR FABRICATION.
2. SEE SPECIFICATION SECTION 01 11 00 FOR PROJECT WORK SEQUENCES AND CONSTRAINTS.
3. ALL LINES EXCEPT NHOH SHALL BE HEAT TRACED AND INSULATED.

PLAN NOTES:

1. MOUNT PANEL ON STAINLESS STEEL UNISTRUT RACK, ANCHOR TO EXTERIOR WALL.
2. APPLY HEAT TRACE TO ALL EXTERIOR ABOVE GROUND (EXPOSED) CARRIER PIPING CONTAINING SODIUM HYDROXIDE CHEMICAL LINES.
3. INSTALL PIPES TO PROVIDE A MINIMUM 3' OF COVER.

TIMOTHY J BATES REGISTERED No. 11400728 STATE OF INDIANA PROFESSIONAL ENGINEER
01/06/2025

TRENT M. MONTEMAYOR REGISTERED No. PE11200215 STATE OF INDIANA PROFESSIONAL ENGINEER
01/06/2025

Revision Number	Revision Description	Drawn By	Checked By	Date

Designed By	CDP/KAR
Drawn By	CDP/KAR
Checked By	TJB/SPG
Approved By	TJB/TMM
Filename	220SMP1.DWG
Project No.	14144
Project Date	JAN 2025

CITY OF BLOOMINGTON UTILITIES
MONROE WTP IMPROVEMENTS: CHEMICAL FEED LINE REPLACEMENT AND BACKWASH SYSTEM PUMP ADDITION AND TANK REHABILITATION - BLOOMINGTON, IN

SETTLING BASIN 2
PLAN, DETAIL AND PHOTO

DONOHUE

Sheet No. 28

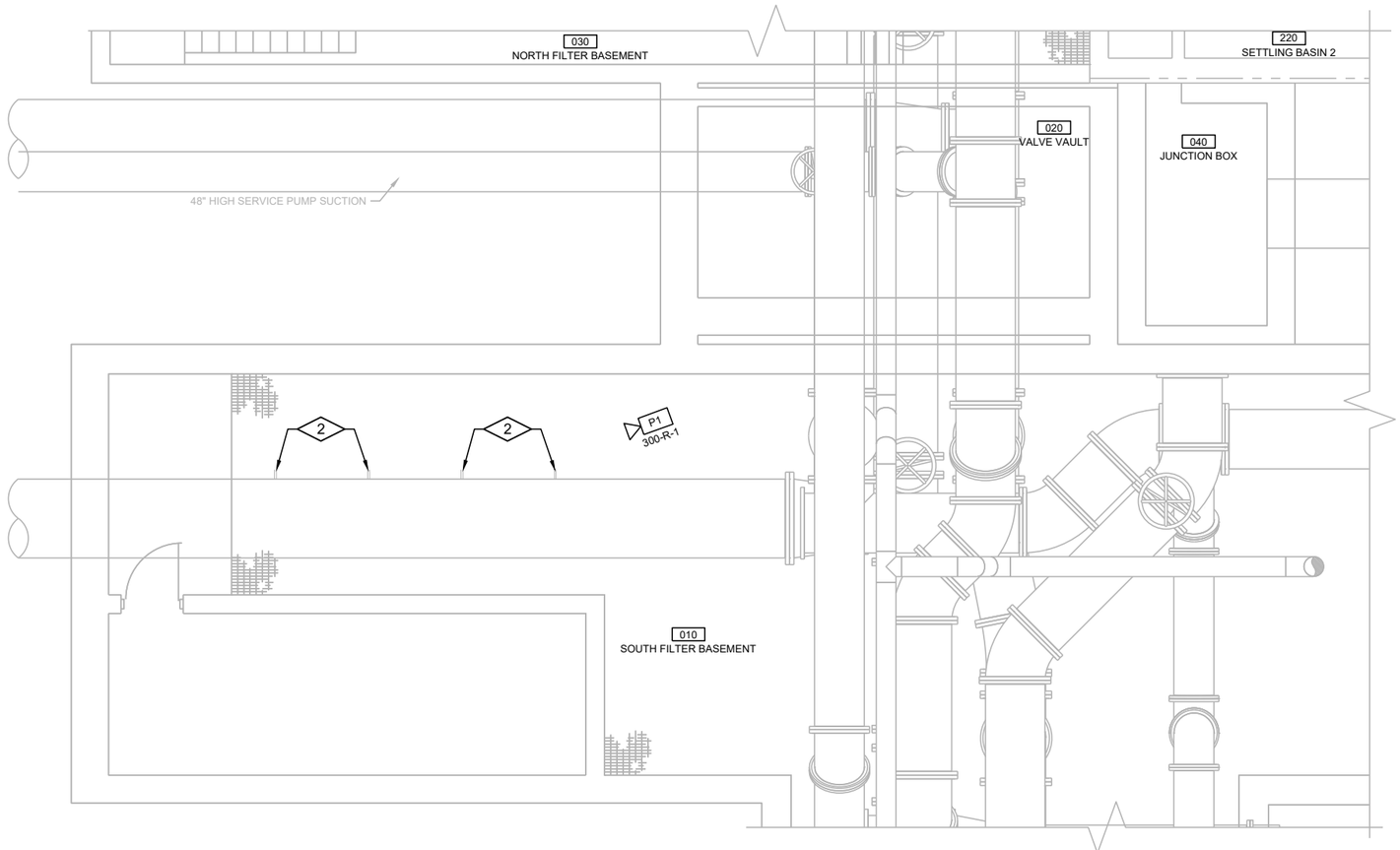
Drawing No. 220-SMEN-1

GENERAL NOTES:

1. CONTRACTOR TO FIELD VERIFY EXISTING CONDITIONS, DIMENSIONS, AND ELEVATIONS PRIOR TO CONSTRUCTION AND/OR FABRICATION.
2. FULL TONE COMPONENTS TO BE REMOVED.
3. SAWCUT AND REMOVE CONCRETE TO THE LIMITS NOTED. IN EXPOSED AREAS NOT COVERED BY NEW CONSTRUCTION, REMOVE REINFORCEMENT AND EMBEDMENTS 1" BEYOND FINISHED SURFACE AND PATCH SURFACE WITH PATCHING MORTAR TO MATCH ADJACENT FINISHED SURFACE.
4. REMOVE CONCRETE ANCHORS, ANCHOR BOLTS, AND OTHER EMBEDMENTS FOR MATERIALS AND EQUIPMENT BEING REMOVED. IN EXPOSED AREAS NOT COVERED BY NEW CONSTRUCTION, REMOVE CONCRETE ANCHORS, ANCHOR BOLTS, AND OTHER EMBEDMENTS 1" BEYOND FINISHED SURFACE AND PATCH SURFACE WITH PATCHING MORTAR. FINISH SURFACE TO MATCH ADJACENT FINISHED SURFACE.
5. WHERE EQUIPMENT IS INDICATED TO BE REMOVED, REMOVE ALL ASSOCIATED POWER AND CONTROL WIRING AND CONDUIT BACK TO SOURCE. REMOVE JUNCTION BOXES AND PULL BOXES ASSOCIATED WITH THE REMOVED CONDUITS. WHERE CONDUIT SYSTEM CONTAINS CIRCUITS TO OTHER EQUIPMENT THAT REMAINS, RETAIN THESE CIRCUITS AND RELOCATE EXISTING CONDUIT AND EXTEND EXISTING CIRCUITS AS REQUIRED FOR THE INSTALLATION OF NEW EQUIPMENT.
6. REMOVE ALL SUPPORTS ASSOCIATED WITH REMOVED PIPING, DUCTWORK, CONDUIT, AND EQUIPMENT. REMOVE RODS AND FASTENERS FROM CEILINGS, FLOORS, AND WALLS WITH CARE. WHERE SURFACE HAS BEEN MARRED, CHIPPED, SPAWLED, ETC. AS A RESULT OF REMOVAL, PATCH SURFACE WITH PATCHING MORTAR AND FINISH TO MATCH ADJACENT FINISHED SURFACE.
7. REMOVE EXISTING CONCRETE PADS OF ANY EQUIPMENT BEING REMOVED. REMOVE CONCRETE REINFORCEMENT A MINIMUM OF 1" BEYOND FINISHED SURFACE AT ANY LOCATION WHERE NEW CONCRETE PAD WILL NOT COVER ROUGH SURFACE OF REMOVED PAD. PATCH SURFACE WITH PATCHING MORTAR AND FINISH TO MATCH ADJACENT FINISHED SURFACE.
8. WHERE OPENINGS ARE LEFT IN WALLS, SLABS, OR CEILINGS DUE TO REMOVED PIPING, DUCTWORK, EQUIPMENT, OR OTHER WORK, PATCH OPENING TO MATCH ADJACENT SURFACES UNLESS NOTED OTHERWISE. THE PERIMETER OF OPENINGS IN CONCRETE WALLS AND SLABS EXPOSED TO EARTH, WEATHER, OR WATER SHALL BE LINED WITH A GASKET TYPE WATERSTOP PRIOR TO PATCHING OF THE WALL. OPENINGS IN PRECAST CONCRETE ROOF MEMBERS ARE TO BE PATCHED WITH CONCRETE AND DOWELED TO THE EXISTING ROOF MEMBERS UNLESS NOTED OTHERWISE. ROOFING SYSTEM SHALL BE PATCHED TO PREVENT ANY LEAKING AT THE OPENING.
9. ALL PIPING AND EQUIPMENT WITHIN ROOMS AND SPACES IS NOT SHOWN FOR CLARITY OF DEPICTING NEW WORK.

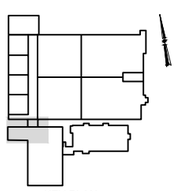
PLAN NOTES:

1. REMOVE ALL CHEMICAL FEED LINES AND ASSOCIATED VALVES IN THE FILTER BUILDING.
2. CHEMICAL INJECTION APPARATUS TO REMAIN EXISTING, TYP FOR ALL INJECTION POINTS.



PARTIAL LOWER PLAN

0 1' 4'



KEY PLAN

PHOTO 1

NTS 300-R-1

TRENT M. MONTEMAYOR REGISTERED No. PE11200215 STATE OF INDIANA PROFESSIONAL ENGINEER

01/06/2025

Revision Number	Revision Description	Drawn By	Checked By	Date

Designed By	KAR
Drawn By	KAR
Checked By	SPG
Approved By	TMM
Filename	300RP1.DWG
Project No.	14144
Project Date	JAN 2025

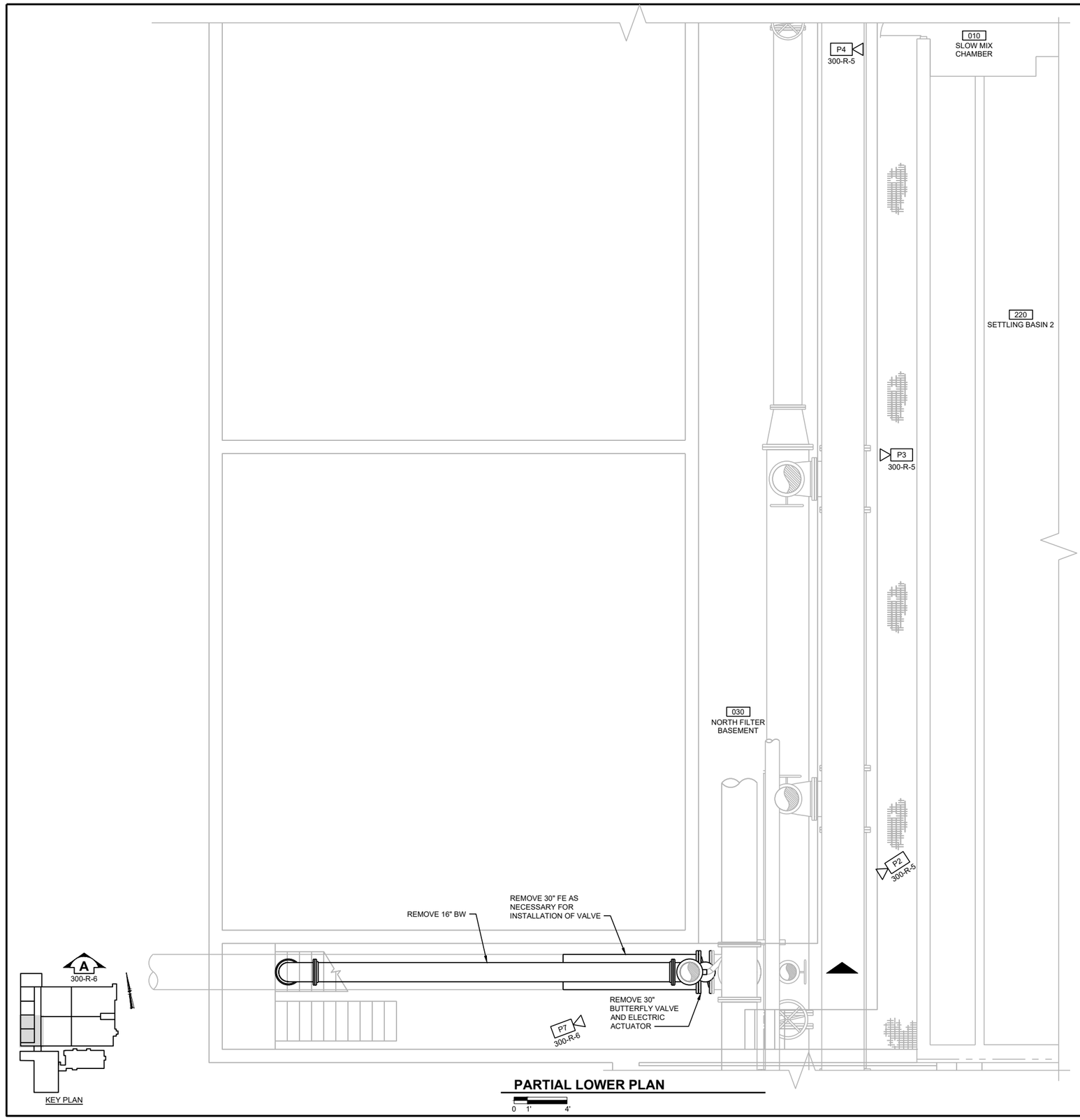
CITY OF BLOOMINGTON UTILITIES
MONROE WTP IMPROVEMENTS: CHEMICAL FEED LINE REPLACEMENT AND BACKWASH SYSTEM PUMP ADDITION AND TANK REHABILITATION - BLOOMINGTON, IN

FILTER BUILDING
LOWER REMOVAL PLAN AND PHOTO

DONOHUE

Sheet No. 29

Drawing No. 300-R-1



GENERAL NOTES:

1. CONTRACTOR TO FIELD VERIFY EXISTING CONDITIONS, DIMENSIONS, AND ELEVATIONS PRIOR TO CONSTRUCTION AND/OR FABRICATION.
2. FULL TONE COMPONENTS TO BE REMOVED.
3. SAWCUT AND REMOVE CONCRETE TO THE LIMITS NOTED. IN EXPOSED AREAS NOT COVERED BY NEW CONSTRUCTION, REMOVE REINFORCEMENT AND EMBEDMENTS 1" BEYOND FINISHED SURFACE AND PATCH SURFACE WITH PATCHING MORTAR TO MATCH ADJACENT FINISHED SURFACE.
4. REMOVE CONCRETE ANCHORS, ANCHOR BOLTS, AND OTHER EMBEDMENTS FOR MATERIALS AND EQUIPMENT BEING REMOVED. IN EXPOSED AREAS NOT COVERED BY NEW CONSTRUCTION, REMOVE CONCRETE ANCHORS, ANCHOR BOLTS, AND OTHER EMBEDMENTS 1" BEYOND FINISHED SURFACE AND PATCH SURFACE WITH PATCHING MORTAR. FINISH SURFACE TO MATCH ADJACENT FINISHED SURFACE.
5. WHERE EQUIPMENT IS INDICATED TO BE REMOVED, REMOVE ALL ASSOCIATED POWER AND CONTROL WIRING AND CONDUIT BACK TO SOURCE. REMOVE JUNCTION BOXES AND PULL BOXES ASSOCIATED WITH THE REMOVED CONDUITS. WHERE CONDUIT SYSTEM CONTAINS CIRCUITS TO OTHER EQUIPMENT THAT REMAINS, RETAIN THESE CIRCUITS AND RELOCATE EXISTING CONDUIT AND EXTEND EXISTING CIRCUITS AS REQUIRED FOR THE INSTALLATION OF NEW EQUIPMENT.
6. REMOVE ALL SUPPORTS ASSOCIATED WITH REMOVED PIPING, DUCTWORK, CONDUIT, AND EQUIPMENT. REMOVE RODS AND FASTENERS FROM CEILINGS, FLOORS, AND WALLS WITH CARE. WHERE SURFACE HAS BEEN MARRED, CHIPPED, SPAWLED, ETC. AS A RESULT OF REMOVAL, PATCH SURFACE WITH PATCHING MORTAR AND FINISH TO MATCH ADJACENT FINISHED SURFACE.
7. REMOVE EXISTING CONCRETE PADS OF ANY EQUIPMENT BEING REMOVED. REMOVE CONCRETE REINFORCEMENT A MINIMUM OF 1" BEYOND FINISHED SURFACE AT ANY LOCATION WHERE NEW CONCRETE PAD WILL NOT COVER ROUGH SURFACE OF REMOVED PAD. PATCH SURFACE WITH PATCHING MORTAR AND FINISH TO MATCH ADJACENT FINISHED SURFACE.
8. WHERE OPENINGS ARE LEFT IN WALLS, SLABS, OR CEILINGS DUE TO REMOVED PIPING, DUCTWORK, EQUIPMENT, OR OTHER WORK, PATCH OPENING TO MATCH ADJACENT SURFACES UNLESS NOTED OTHERWISE. THE PERIMETER OF OPENINGS IN CONCRETE WALLS AND SLABS EXPOSED TO EARTH, WEATHER, OR WATER SHALL BE LINED WITH A GASKET TYPE WATERSTOP PRIOR TO PATCHING OF THE WALL. OPENINGS IN PRECAST CONCRETE ROOF MEMBERS ARE TO BE PATCHED WITH CONCRETE AND DOWELED TO THE EXISTING ROOF MEMBERS UNLESS NOTED OTHERWISE. ROOFING SYSTEM SHALL BE PATCHED TO PREVENT ANY LEAKING AT THE OPENING.
9. ALL PIPING AND EQUIPMENT WITHIN ROOMS AND SPACES IS NOT SHOWN FOR CLARITY OF DEPICTING NEW WORK.

Revision Number	Revision Description	Drawn By	Checked By	Date

Designed By	KAR
Drawn By	KAR
Checked By	SPG
Approved By	TMM
Filename	300RP1.DWG
Project No.	14144
Project Date	JAN 2025

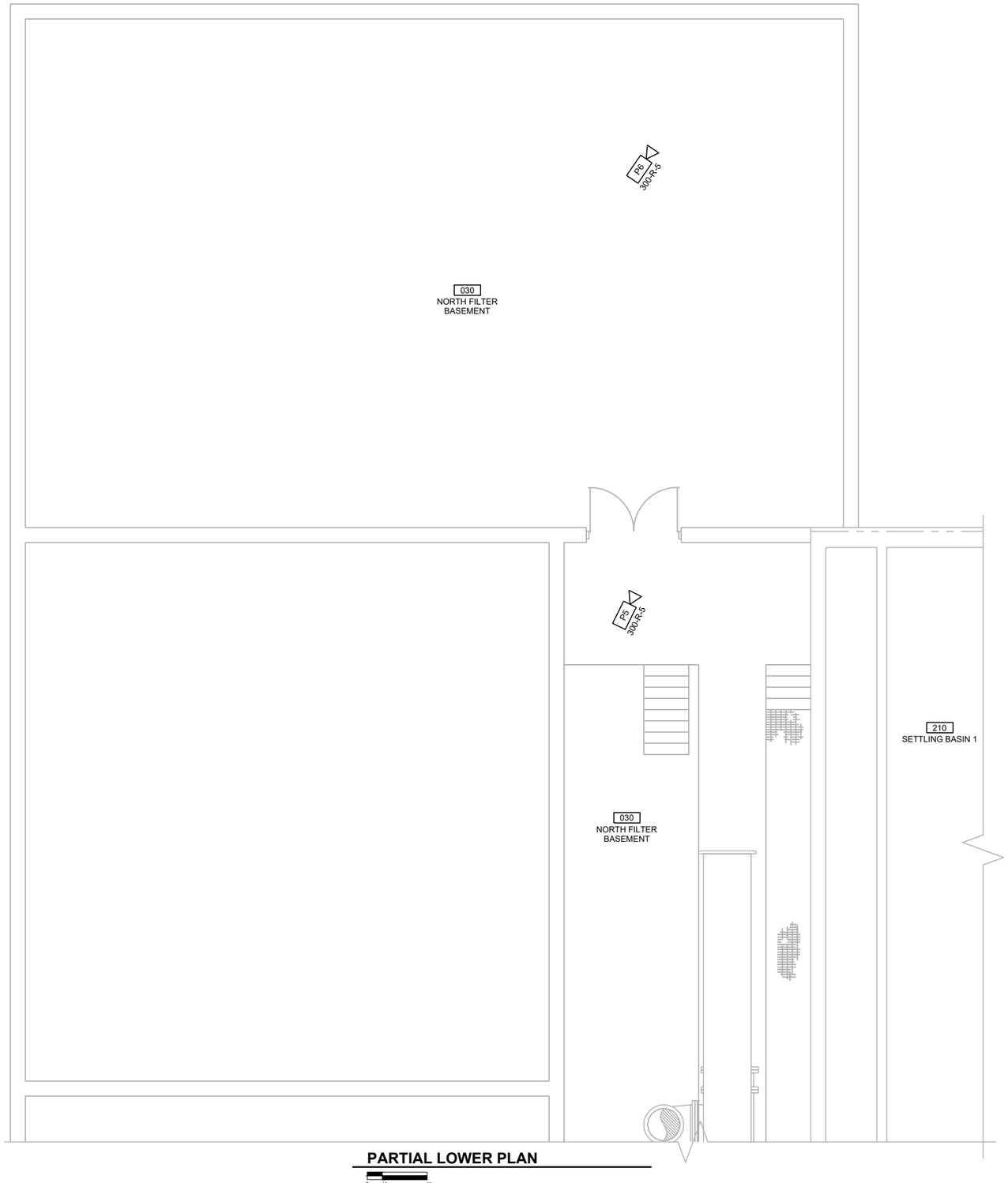
CITY OF BLOOMINGTON UTILITIES
MONROE WTP IMPROVEMENTS: CHEMICAL FEED LINE
REPLACEMENT AND BACKWASH SYSTEM PUMP ADDITION
AND TANK REHABILITATION - BLOOMINGTON, IN

FILTER BUILDING
LOWER REMOVAL PLAN

DONOHUE

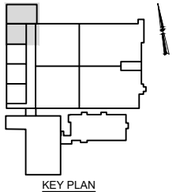
Sheet No. 30

Drawing No. 300-R-2



PARTIAL LOWER PLAN

0 1' 4'



KEY PLAN

GENERAL NOTES:

1. CONTRACTOR TO FIELD VERIFY EXISTING CONDITIONS, DIMENSIONS, AND ELEVATIONS PRIOR TO CONSTRUCTION AND/OR FABRICATION.
2. FULL TONE COMPONENTS TO BE REMOVED.
3. SAWCUT AND REMOVE CONCRETE TO THE LIMITS NOTED. IN EXPOSED AREAS NOT COVERED BY NEW CONSTRUCTION, REMOVE REINFORCEMENT AND EMBEDMENTS 1" BEYOND FINISHED SURFACE AND PATCH SURFACE WITH PATCHING MORTAR TO MATCH ADJACENT FINISHED SURFACE.
4. REMOVE CONCRETE ANCHORS, ANCHOR BOLTS, AND OTHER EMBEDMENTS FOR MATERIALS AND EQUIPMENT BEING REMOVED. IN EXPOSED AREAS NOT COVERED BY NEW CONSTRUCTION, REMOVE CONCRETE ANCHORS, ANCHOR BOLTS, AND OTHER EMBEDMENTS 1" BEYOND FINISHED SURFACE AND PATCH SURFACE WITH PATCHING MORTAR. FINISH SURFACE TO MATCH ADJACENT FINISHED SURFACE.
5. WHERE EQUIPMENT IS INDICATED TO BE REMOVED, REMOVE ALL ASSOCIATED POWER AND CONTROL WIRING AND CONDUIT BACK TO SOURCE. REMOVE JUNCTION BOXES AND PULL BOXES ASSOCIATED WITH THE REMOVED CONDUITS. WHERE CONDUIT SYSTEM CONTAINS CIRCUITS TO OTHER EQUIPMENT THAT REMAINS, RETAIN THESE CIRCUITS AND RELOCATE EXISTING CONDUIT AND EXTEND EXISTING CIRCUITS AS REQUIRED FOR THE INSTALLATION OF NEW EQUIPMENT.
6. REMOVE ALL SUPPORTS ASSOCIATED WITH REMOVED PIPING, DUCTWORK, CONDUIT, AND EQUIPMENT. REMOVE RODS AND FASTENERS FROM CEILINGS, FLOORS, AND WALLS WITH CARE. WHERE SURFACE HAS BEEN MARRED, CHIPPED, SPAWLED, ETC. AS A RESULT OF REMOVAL, PATCH SURFACE WITH PATCHING MORTAR AND FINISH TO MATCH ADJACENT FINISHED SURFACE.
7. REMOVE EXISTING CONCRETE PADS OF ANY EQUIPMENT BEING REMOVED. REMOVE CONCRETE REINFORCEMENT A MINIMUM OF 1" BEYOND FINISHED SURFACE AT ANY LOCATION WHERE NEW CONCRETE PAD WILL NOT COVER ROUGH SURFACE OF REMOVED PAD. PATCH SURFACE WITH PATCHING MORTAR AND FINISH TO MATCH ADJACENT FINISHED SURFACE.
8. WHERE OPENINGS ARE LEFT IN WALLS, SLABS, OR CEILINGS DUE TO REMOVED PIPING, DUCTWORK, EQUIPMENT, OR OTHER WORK, PATCH OPENING TO MATCH ADJACENT SURFACES UNLESS NOTED OTHERWISE. THE PERIMETER OF OPENINGS IN CONCRETE WALLS AND SLABS EXPOSED TO EARTH, WEATHER, OR WATER SHALL BE LINED WITH A GASKET TYPE WATERSTOP PRIOR TO PATCHING OF THE WALL. OPENINGS IN PRECAST CONCRETE ROOF MEMBERS ARE TO BE PATCHED WITH CONCRETE AND DOWELED TO THE EXISTING ROOF MEMBERS UNLESS NOTED OTHERWISE. ROOFING SYSTEM SHALL BE PATCHED TO PREVENT ANY LEAKING AT THE OPENING.
9. ALL PIPING AND EQUIPMENT WITHIN ROOMS AND SPACES IS NOT SHOWN FOR CLARITY OF DEPICTING NEW WORK.

Revision Number	Revision Description	Drawn By	Checked By	Date

Designed By	KAR
Drawn By	KAR
Checked By	SPG
Approved By	TMM
Filename	300RP1.DWG
Project No.	14144
Project Date	JAN 2025

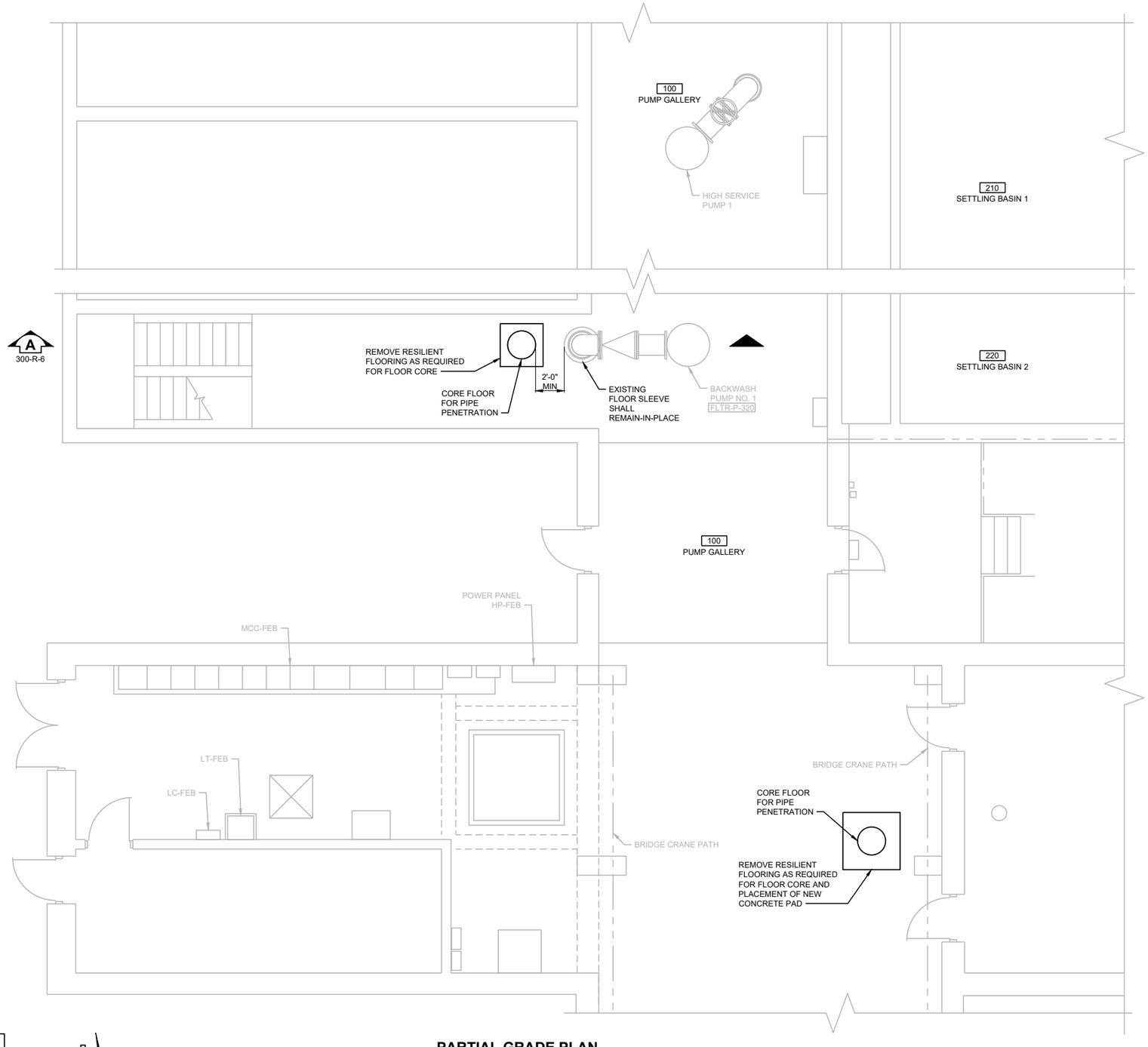
CITY OF BLOOMINGTON UTILITIES
MONROE WTP IMPROVEMENTS: CHEMICAL FEED LINE REPLACEMENT AND BACKWASH SYSTEM PUMP ADDITION AND TANK REHABILITATION - BLOOMINGTON, IN

FILTER BUILDING
LOWER REMOVAL PLAN

DONOHUE

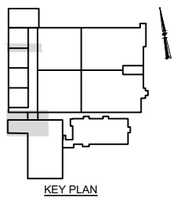
Sheet No. 31

Drawing No. 300-R-3



PARTIAL GRADE PLAN

0 1' 4'



KEY PLAN

GENERAL NOTES:

1. CONTRACTOR TO FIELD VERIFY EXISTING CONDITIONS, DIMENSIONS, AND ELEVATIONS PRIOR TO CONSTRUCTION AND/OR FABRICATION.
2. FULL TONE COMPONENTS TO BE REMOVED.
3. SAWCUT AND REMOVE CONCRETE TO THE LIMITS NOTED. IN EXPOSED AREAS NOT COVERED BY NEW CONSTRUCTION, REMOVE REINFORCEMENT AND EMBEDMENTS 1" BEYOND FINISHED SURFACE AND PATCH SURFACE WITH PATCHING MORTAR TO MATCH ADJACENT FINISHED SURFACE.
4. REMOVE CONCRETE ANCHORS, ANCHOR BOLTS, AND OTHER EMBEDMENTS FOR MATERIALS AND EQUIPMENT BEING REMOVED. IN EXPOSED AREAS NOT COVERED BY NEW CONSTRUCTION, REMOVE CONCRETE ANCHORS, ANCHOR BOLTS, AND OTHER EMBEDMENTS 1" BEYOND FINISHED SURFACE AND PATCH SURFACE WITH PATCHING MORTAR. FINISH SURFACE TO MATCH ADJACENT FINISHED SURFACE.
5. WHERE EQUIPMENT IS INDICATED TO BE REMOVED, REMOVE ALL ASSOCIATED POWER AND CONTROL WIRING AND CONDUIT BACK TO SOURCE. REMOVE JUNCTION BOXES AND PULL BOXES ASSOCIATED WITH THE REMOVED CONDUITS. WHERE CONDUIT SYSTEM CONTAINS CIRCUITS TO OTHER EQUIPMENT THAT REMAINS, RETAIN THESE CIRCUITS AND RELOCATE EXISTING CONDUIT AND EXTEND EXISTING CIRCUITS AS REQUIRED FOR THE INSTALLATION OF NEW EQUIPMENT.
6. REMOVE ALL SUPPORTS ASSOCIATED WITH REMOVED PIPING, DUCTWORK, CONDUIT, AND EQUIPMENT. REMOVE RODS AND FASTENERS FROM CEILINGS, FLOORS, AND WALLS WITH CARE. WHERE SURFACE HAS BEEN MARRED, CHIPPED, SPAWLED, ETC. AS A RESULT OF REMOVAL, PATCH SURFACE WITH PATCHING MORTAR AND FINISH TO MATCH ADJACENT FINISHED SURFACE.
7. REMOVE EXISTING CONCRETE PADS OF ANY EQUIPMENT BEING REMOVED. REMOVE CONCRETE REINFORCEMENT A MINIMUM OF 1" BEYOND FINISHED SURFACE AT ANY LOCATION WHERE NEW CONCRETE PAD WILL NOT COVER ROUGH SURFACE OF REMOVED PAD. PATCH SURFACE WITH PATCHING MORTAR AND FINISH TO MATCH ADJACENT FINISHED SURFACE.
8. WHERE OPENINGS ARE LEFT IN WALLS, SLABS, OR CEILINGS DUE TO REMOVED PIPING, DUCTWORK, EQUIPMENT, OR OTHER WORK, PATCH OPENING TO MATCH ADJACENT SURFACES UNLESS NOTED OTHERWISE. THE PERIMETER OF OPENINGS IN CONCRETE WALLS AND SLABS EXPOSED TO EARTH, WEATHER, OR WATER SHALL BE LINED WITH A GASKET TYPE WATERSTOP PRIOR TO PATCHING OF THE WALL. OPENINGS IN PRECAST CONCRETE ROOF MEMBERS ARE TO BE PATCHED WITH CONCRETE AND DOWELED TO THE EXISTING ROOF MEMBERS UNLESS NOTED OTHERWISE. ROOFING SYSTEM SHALL BE PATCHED TO PREVENT ANY LEAKING AT THE OPENING.
9. ALL PIPING AND EQUIPMENT WITHIN ROOMS AND SPACES IS NOT SHOWN FOR CLARITY OF DEPICTING NEW WORK.

Revision Number	Revision Description	Drawn By	Checked By	Date

Designed By	KAR
Drawn By	KAR
Checked By	SPG
Approved By	TMM
Filename	300RP1.DWG
Project No.	14144
Project Date	JAN 2025

CITY OF BLOOMINGTON UTILITIES
MONROE WTP IMPROVEMENTS: CHEMICAL FEED LINE
REPLACEMENT AND BACKWASH SYSTEM PUMP ADDITION
AND TANK REHABILITATION - BLOOMINGTON, IN

FILTER BUILDING
GRADE REMOVAL PLAN

TRENT M. MONTEMAYOR
REGISTERED
No. PE11200215
STATE OF INDIANA
PROFESSIONAL ENGINEER
01/06/2025

DONOHUE

Sheet No. 32

Drawing No. 300-R-4

PHOTO **2**
NTS 300-R-2

PHOTO **3**
NTS 300-R-2

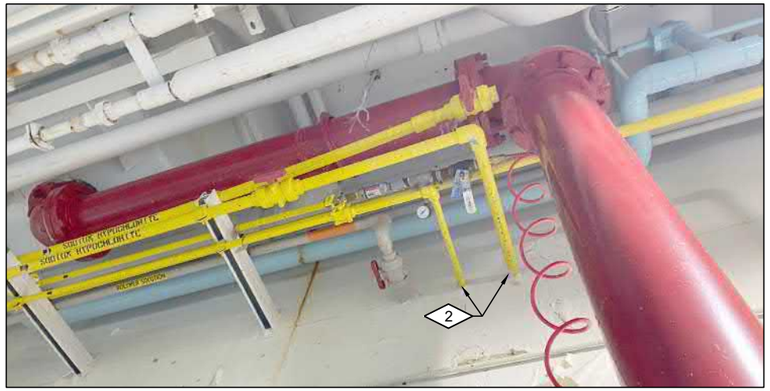


PHOTO **4**
NTS 300-R-2

PHOTO **5**
NTS 300-R-3

PHOTO **6**
NTS 300-R-3

GENERAL NOTES:

1. CONTRACTOR TO FIELD VERIFY EXISTING CONDITIONS, DIMENSIONS, AND ELEVATIONS PRIOR TO CONSTRUCTION AND/OR FABRICATION.
2. FULL TONE COMPONENTS TO BE REMOVED.
3. SAWCUT AND REMOVE CONCRETE TO THE LIMITS NOTED. IN EXPOSED AREAS NOT COVERED BY NEW CONSTRUCTION, REMOVE REINFORCEMENT AND EMBEDMENTS 1" BEYOND FINISHED SURFACE AND PATCH SURFACE WITH PATCHING MORTAR TO MATCH ADJACENT FINISHED SURFACE.
4. REMOVE CONCRETE ANCHORS, ANCHOR BOLTS, AND OTHER EMBEDMENTS FOR MATERIALS AND EQUIPMENT BEING REMOVED. IN EXPOSED AREAS NOT COVERED BY NEW CONSTRUCTION, REMOVE CONCRETE ANCHORS, ANCHOR BOLTS, AND OTHER EMBEDMENTS 1" BEYOND FINISHED SURFACE AND PATCH SURFACE WITH PATCHING MORTAR. FINISH SURFACE TO MATCH ADJACENT FINISHED SURFACE.
5. WHERE EQUIPMENT IS INDICATED TO BE REMOVED, REMOVE ALL ASSOCIATED POWER AND CONTROL WIRING AND CONDUIT BACK TO SOURCE. REMOVE JUNCTION BOXES AND PULL BOXES ASSOCIATED WITH THE REMOVED CONDUITS. WHERE CONDUIT SYSTEM CONTAINS CIRCUITS TO OTHER EQUIPMENT THAT REMAINS, RETAIN THESE CIRCUITS AND RELOCATE EXISTING CONDUIT AND EXTEND EXISTING CIRCUITS AS REQUIRED FOR THE INSTALLATION OF NEW EQUIPMENT.
6. REMOVE ALL SUPPORTS ASSOCIATED WITH REMOVED PIPING, DUCTWORK, CONDUIT, AND EQUIPMENT. REMOVE RODS AND FASTENERS FROM CEILINGS, FLOORS, AND WALLS WITH CARE. WHERE SURFACE HAS BEEN MARRED, CHIPPED, SPAWLED, ETC. AS A RESULT OF REMOVAL, PATCH SURFACE WITH PATCHING MORTAR AND FINISH TO MATCH ADJACENT FINISHED SURFACE.
7. REMOVE EXISTING CONCRETE PADS OF ANY EQUIPMENT BEING REMOVED. REMOVE CONCRETE REINFORCEMENT A MINIMUM OF 1" BEYOND FINISHED SURFACE AT ANY LOCATION WHERE NEW CONCRETE PAD WILL NOT COVER ROUGH SURFACE OF REMOVED PAD. PATCH SURFACE WITH PATCHING MORTAR AND FINISH TO MATCH ADJACENT FINISHED SURFACE.
8. WHERE OPENINGS ARE LEFT IN WALLS, SLABS, OR CEILINGS DUE TO REMOVED PIPING, DUCTWORK, EQUIPMENT, OR OTHER WORK, PATCH OPENING TO MATCH ADJACENT SURFACES UNLESS NOTED OTHERWISE. THE PERIMETER OF OPENINGS IN CONCRETE WALLS AND SLABS EXPOSED TO EARTH, WEATHER, OR WATER SHALL BE LINED WITH A GASKET TYPE WATERSTOP PRIOR TO PATCHING OF THE WALL. OPENINGS IN PRECAST CONCRETE ROOF MEMBERS ARE TO BE PATCHED WITH CONCRETE AND DOWELED TO THE EXISTING ROOF MEMBERS UNLESS NOTED OTHERWISE. ROOFING SYSTEM SHALL BE PATCHED TO PREVENT ANY LEAKING AT THE OPENING.

PLAN NOTES:

1. REMOVE ALL CHEMICAL FEED LINES AND ASSOCIATED VALVES IN THE FILTER BUILDING.
2. REMOVE CHEMICAL FEED LINES THROUGH THE WALL PENETRATION.

TRENT M. MONTEMAYOR REGISTERED No. PE11200215 STATE OF INDIANA PROFESSIONAL ENGINEER
01/06/2025

Revision Number	Revision Description	Drawn By	Checked By	Date

Designed By	KAR
Drawn By	KAR
Checked By	SPG
Approved By	TMM
Filename	300RP1.DWG
Project No.	14144
Project Date	JAN 2025

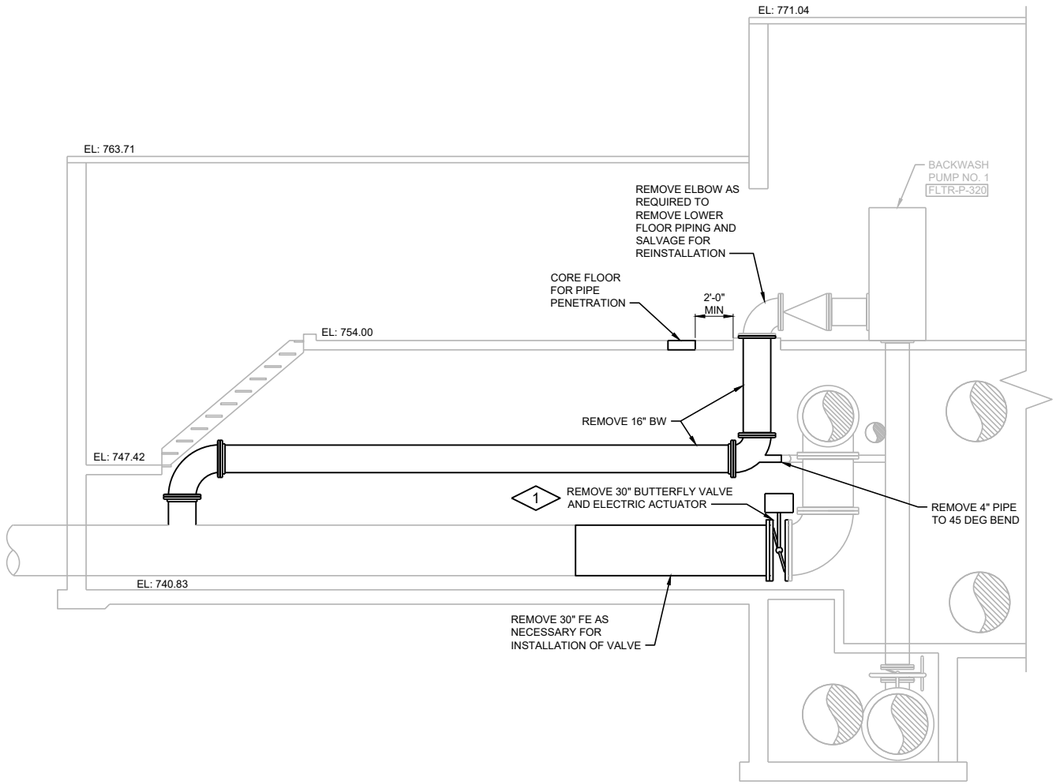
CITY OF BLOOMINGTON UTILITIES
MONROE WTP IMPROVEMENTS: CHEMICAL FEED LINE REPLACEMENT AND BACKWASH SYSTEM PUMP ADDITION AND TANK REHABILITATION - BLOOMINGTON, IN

FILTER BUILDING REMOVAL PHOTOS

DONOHUE

Sheet No. 33

Drawing No. 300-R-5



SECTION A

300-R-2
300-R-4

0 1' 4'

PHOTO 7

NTS

300-R-2

GENERAL NOTES:

1. CONTRACTOR TO FIELD VERIFY EXISTING CONDITIONS, DIMENSIONS, AND ELEVATIONS PRIOR TO CONSTRUCTION AND/OR FABRICATION.
2. FULL TONE COMPONENTS TO BE REMOVED.
3. SAWCUT AND REMOVE CONCRETE TO THE LIMITS NOTED. IN EXPOSED AREAS NOT COVERED BY NEW CONSTRUCTION, REMOVE REINFORCEMENT AND EMBEDMENTS 1" BEYOND FINISHED SURFACE AND PATCH SURFACE WITH PATCHING MORTAR TO MATCH ADJACENT FINISHED SURFACE.
4. REMOVE CONCRETE ANCHORS, ANCHOR BOLTS, AND OTHER EMBEDMENTS FOR MATERIALS AND EQUIPMENT BEING REMOVED. IN EXPOSED AREAS NOT COVERED BY NEW CONSTRUCTION, REMOVE CONCRETE ANCHORS, ANCHOR BOLTS, AND OTHER EMBEDMENTS 1" BEYOND FINISHED SURFACE AND PATCH SURFACE WITH PATCHING MORTAR. FINISH SURFACE TO MATCH ADJACENT FINISHED SURFACE.
5. WHERE EQUIPMENT IS INDICATED TO BE REMOVED, REMOVE ALL ASSOCIATED POWER AND CONTROL WIRING AND CONDUIT BACK TO SOURCE. REMOVE JUNCTION BOXES AND PULL BOXES ASSOCIATED WITH THE REMOVED CONDUITS. WHERE CONDUIT SYSTEM CONTAINS CIRCUITS TO OTHER EQUIPMENT THAT REMAINS, RETAIN THESE CIRCUITS AND RELOCATE EXISTING CONDUIT AND EXTEND EXISTING CIRCUITS AS REQUIRED FOR THE INSTALLATION OF NEW EQUIPMENT.
6. REMOVE ALL SUPPORTS ASSOCIATED WITH REMOVED PIPING, DUCTWORK, CONDUIT, AND EQUIPMENT. REMOVE RODS AND FASTENERS FROM CEILINGS, FLOORS, AND WALLS WITH CARE. WHERE SURFACE HAS BEEN MARRED, CHIPPED, SPAWLED, ETC. AS A RESULT OF REMOVAL, PATCH SURFACE WITH PATCHING MORTAR AND FINISH TO MATCH ADJACENT FINISHED SURFACE.
7. REMOVE EXISTING CONCRETE PADS OF ANY EQUIPMENT BEING REMOVED. REMOVE CONCRETE REINFORCEMENT A MINIMUM OF 1" BEYOND FINISHED SURFACE AT ANY LOCATION WHERE NEW CONCRETE PAD WILL NOT COVER ROUGH SURFACE OF REMOVED PAD. PATCH SURFACE WITH PATCHING MORTAR AND FINISH TO MATCH ADJACENT FINISHED SURFACE.
8. WHERE OPENINGS ARE LEFT IN WALLS, SLABS, OR CEILINGS DUE TO REMOVED PIPING, DUCTWORK, EQUIPMENT, OR OTHER WORK, PATCH OPENING TO MATCH ADJACENT SURFACES UNLESS NOTED OTHERWISE. THE PERIMETER OF OPENINGS IN CONCRETE WALLS AND SLABS EXPOSED TO EARTH, WEATHER, OR WATER SHALL BE LINED WITH A GASKET TYPE WATERSTOP PRIOR TO PATCHING OF THE WALL. OPENINGS IN PRECAST CONCRETE ROOF MEMBERS ARE TO BE PATCHED WITH CONCRETE AND DOWELED TO THE EXISTING ROOF MEMBERS UNLESS NOTED OTHERWISE. ROOFING SYSTEM SHALL BE PATCHED TO PREVENT ANY LEAKING AT THE OPENING.
9. ALL PIPING AND EQUIPMENT WITHIN ROOMS AND SPACES IS NOT SHOWN FOR CLARITY OF DEPICTING NEW WORK.

PLAN NOTES:

1. EXISTING VALVE DOES NOT ENTIRELY SEAL.

TRENT M. MONTEMAYOR REGISTERED No. PE11200215 STATE OF INDIANA PROFESSIONAL ENGINEER
01/06/2025

Revision Number	Revision Description	Drawn By	Checked By	Date

Designed By	KAR
Drawn By	KAR
Checked By	SPG
Approved By	TMM
Filename	300RP1.DWG
Project No.	14144
Project Date	JAN 2025

CITY OF BLOOMINGTON UTILITIES
MONROE WTP IMPROVEMENTS: CHEMICAL FEED LINE REPLACEMENT AND BACKWASH SYSTEM PUMP ADDITION AND TANK REHABILITATION - BLOOMINGTON, IN

FILTER BUILDING REMOVAL SECTION

DONOHUE

Sheet No. 34

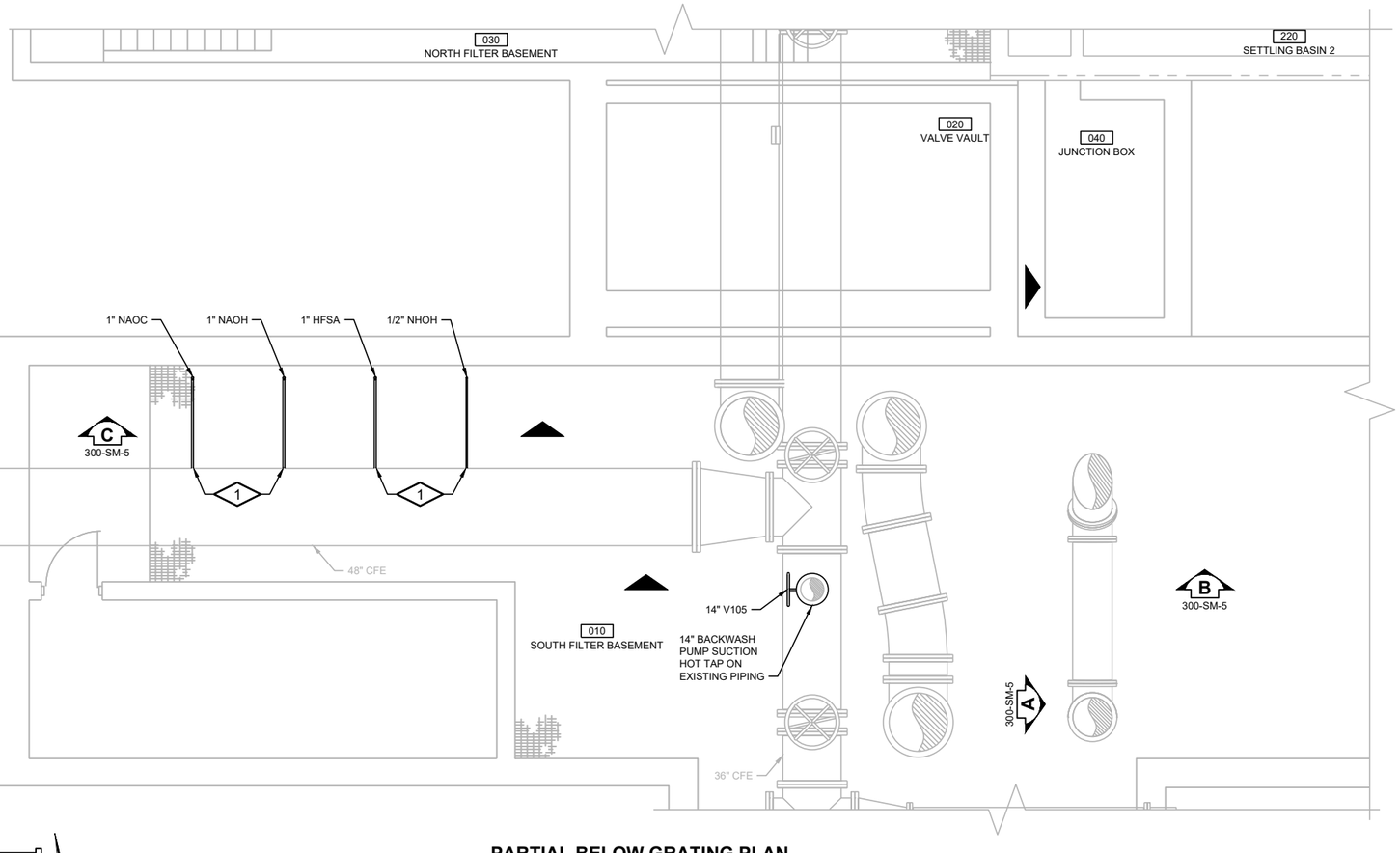
Drawing No. 300-R-6

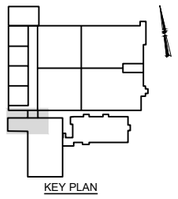
GENERAL NOTES:

1. CONTRACTOR SHALL FIELD VERIFY EXISTING CONDITIONS, DIMENSIONS, AND ELEVATIONS PRIOR TO CONSTRUCTION AND/OR FABRICATION.
2. SEE SPECIFICATION SECTION 01 11 00 FOR PROJECT WORK SEQUENCES AND CONSTRAINTS.
3. ALL NHOH AND NAOC BALL VALVES SHALL BE VENTED.
4. ALL PIPING AND EQUIPMENT WITHIN ROOMS AND SPACES IS NOT SHOWN FOR CLARITY OF DEPICTING NEW WORK.

PLAN NOTES:

1. CONNECT TO EXISTING CHEMICAL INJECTION APPARATUS.





PARTIAL BELOW GRATING PLAN

0 1' 4'

TIMOTHY J BATES REGISTERED No. 11400728 STATE OF INDIANA PROFESSIONAL ENGINEER
01/06/2025

TRENT M. MONTEMAYOR REGISTERED No. PE11200215 STATE OF INDIANA PROFESSIONAL ENGINEER
01/06/2025

Revision Number	Revision Description	Drawn By	Checked By	Date

Designed By	CDP/KAR
Drawn By	CDP/KAR
Checked By	TJB/SPG
Approved By	TJB/TMM
Filename	300SMP1.DWG
Project No.	14144
Project Date	JAN 2025

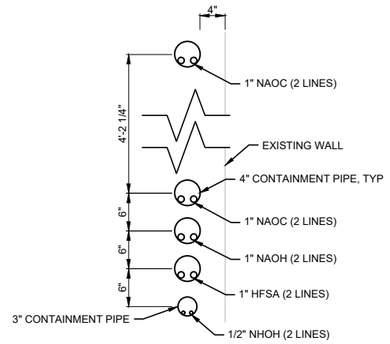
CITY OF BLOOMINGTON UTILITIES
MONROE WTP IMPROVEMENTS: CHEMICAL FEED LINE REPLACEMENT AND BACKWASH SYSTEM PUMP ADDITION AND TANK REHABILITATION - BLOOMINGTON, IN

FILTER BUILDING
PARTIAL BELOW GRATING PLAN

DONOHUE

Sheet No. 35

Drawing No. 300-SM-1



DETAIL 1

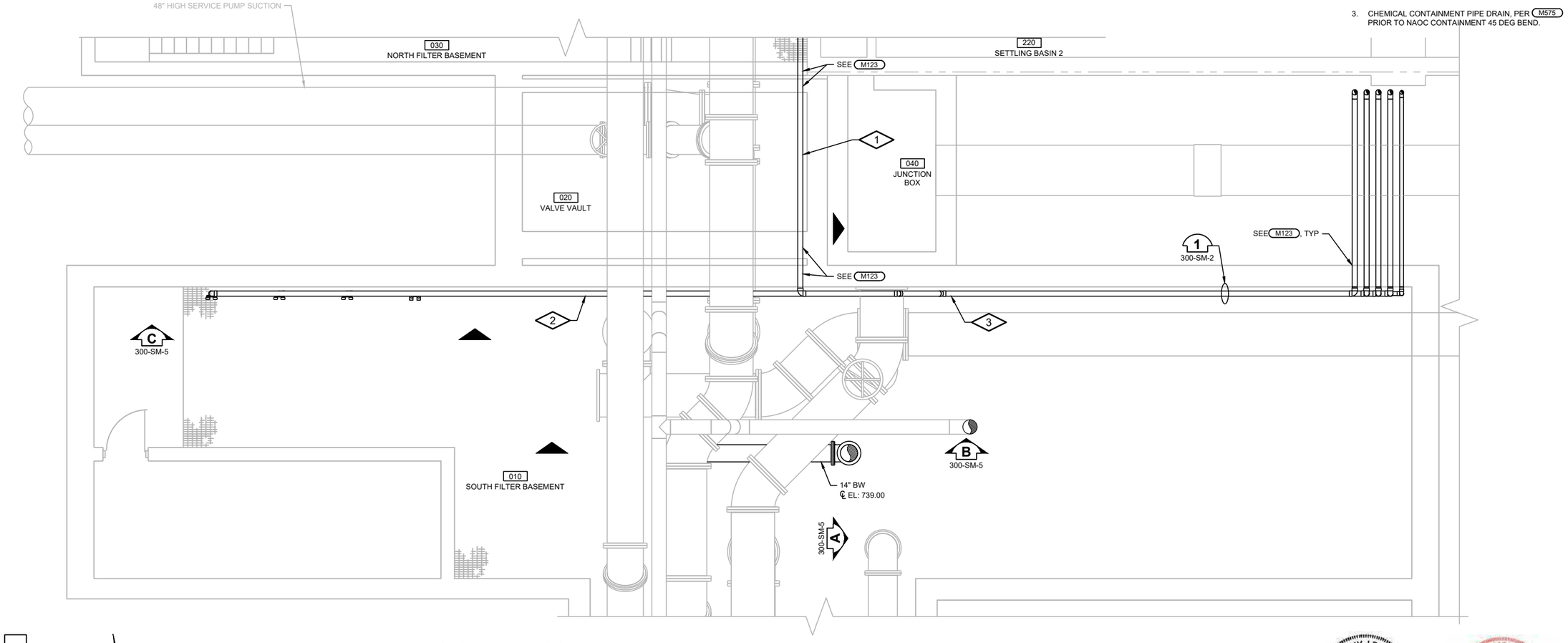
NTS 300-M-2

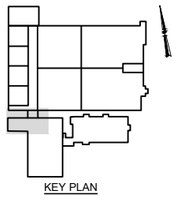
GENERAL NOTES:

1. CONTRACTOR SHALL FIELD VERIFY EXISTING CONDITIONS, DIMENSIONS, AND ELEVATIONS PRIOR TO CONSTRUCTION AND/OR FABRICATION.
2. SEE SPECIFICATION SECTION 01 11 00 FOR PROJECT WORK SEQUENCES AND CONSTRAINTS.
3. ALL NHOH AND NAOC BALL VALVES SHALL BE VENTED.
4. ALL PIPING AND EQUIPMENT WITHIN ROOMS AND SPACES IS NOT SHOWN FOR CLARITY OF DEPICTING NEW WORK.

PLAN NOTES:

1. 4" CONTAINMENT PIPE WITH TWO 1" NAOC FEED LINES. ℄ EL: 752.42.
2. ROUTE PIPING ABOVE THE GRATING.
3. CHEMICAL CONTAINMENT PIPE DRAIN, PER (M575) PRIOR TO NAOC CONTAINMENT 45 DEG BEND.





PARTIAL LOWER PLAN

0 1' 4'

TIMOTHY J BATES REGISTERED No. 11400728 STATE OF INDIANA PROFESSIONAL ENGINEER
01/06/2025

TRENT M. MONTEMAYOR REGISTERED No. PE11200215 STATE OF INDIANA PROFESSIONAL ENGINEER
01/06/2025

Revision Number	Revision Description	Drawn By	Checked By	Date

Designed By	CDP/KAR
Drawn By	CDP/KAR
Checked By	TJB/SPG
Approved By	TJB/TMM
Filename	300SMP1.DWG
Project No.	14144
Project Date	JAN 2025

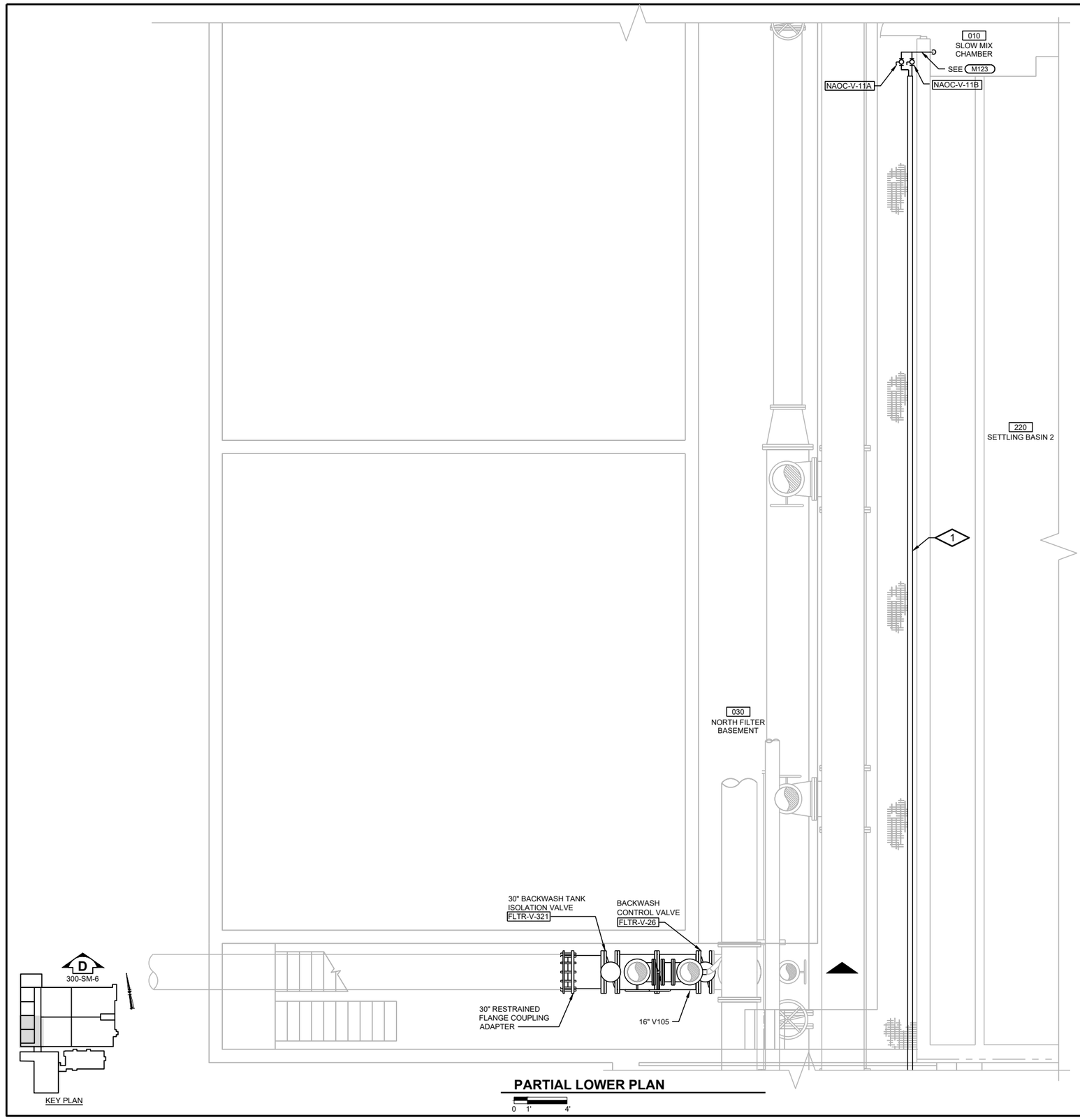
CITY OF BLOOMINGTON UTILITIES
MONROE WTP IMPROVEMENTS: CHEMICAL FEED LINE REPLACEMENT AND BACKWASH SYSTEM PUMP ADDITION AND TANK REHABILITATION - BLOOMINGTON, IN

FILTER BUILDING
PARTIAL LOWER PLAN

DONOHUE

Sheet No. 36

Drawing No. 300-SM-2



PARTIAL LOWER PLAN

0 1' 4'

GENERAL NOTES:

1. CONTRACTOR SHALL FIELD VERIFY EXISTING CONDITIONS, DIMENSIONS, AND ELEVATIONS PRIOR TO CONSTRUCTION AND/OR FABRICATION.
2. SEE SPECIFICATION SECTION 01 11 00 FOR PROJECT WORK SEQUENCES AND CONSTRAINTS.
3. ALL NHOH AND NAOC BALL VALVES SHALL BE VENTED.
4. ALL PIPING AND EQUIPMENT WITHIN ROOMS AND SPACES IS NOT SHOWN FOR CLARITY OF DEPICTING NEW WORK.

PLAN NOTES:

1. 4" CONTAINMENT PIPE WITH TWO 1" NAOC FEED LINES. ℄ EL: 752.42

TIMOTHY J BATES REGISTERED No. 11400728 STATE OF INDIANA PROFESSIONAL ENGINEER
01/06/2025

TRENT M. MONTEMAYOR REGISTERED No. PE11200215 STATE OF INDIANA PROFESSIONAL ENGINEER
01/06/2025

Revision Number	Revision Description	Drawn By	Checked By	Date

Designed By	CDP/KAR
Drawn By	CDP/KAR
Checked By	TJB/SPG
Approved By	TJB/TMM
Filename	300SMP1.DWG
Project No.	14144
Project Date	JAN 2025

CITY OF BLOOMINGTON UTILITIES
MONROE WTP IMPROVEMENTS: CHEMICAL FEED LINE REPLACEMENT AND BACKWASH SYSTEM PUMP ADDITION AND TANK REHABILITATION - BLOOMINGTON, IN

FILTER BUILDING
PARTIAL LOWER PLAN

DONOHUE

Sheet No. 37

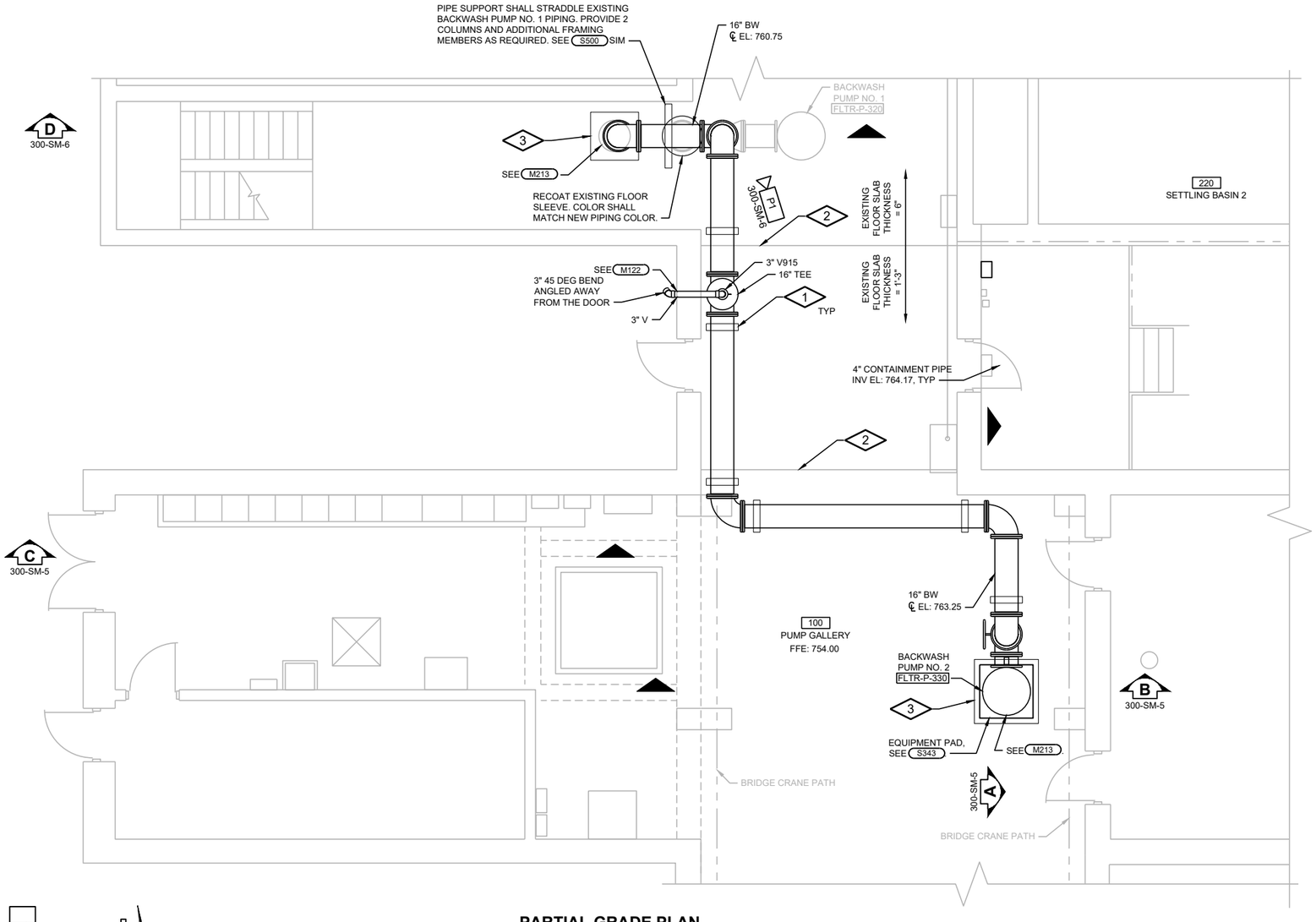
Drawing No. 300-SM-3

GENERAL NOTES:

1. CONTRACTOR SHALL FIELD VERIFY EXISTING CONDITIONS, DIMENSIONS, AND ELEVATIONS PRIOR TO CONSTRUCTION AND/OR FABRICATION.
2. SEE SPECIFICATION SECTION 01 11 00 FOR PROJECT WORK SEQUENCES AND CONSTRAINTS.
3. ALL PIPING AND EQUIPMENT WITHIN ROOMS AND SPACES IS NOT SHOWN FOR CLARITY OF DEPICTING NEW WORK.

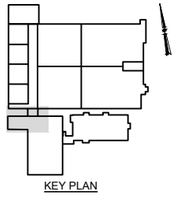
PLAN NOTES:

1. PIPE SUPPORT, SEE S500. APPROXIMATE PIPE SUPPORT LOCATIONS AS SHOWN. CONTRACTOR IS RESPONSIBLE IN DETERMINING FINAL SUPPORT LOCATIONS AND NUMBER OF SUPPORTS REQUIRED. SUPPORTS SHALL ALL BE FLOOR MOUNTED. SUPPORTS SHALL NOT IMPEDE FOOT TRAFFIC THROUGH DOORWAYS AND CENTER PASSAGE WAY THROUGH PUMP GALLERY. SEE SECTION 40 05 07 FOR MAXIMUM SPACING OF PIPE SUPPORTS PER SIZE AND MATERIAL OF PIPE. REMOVE RESILIENT FLOORING AS REQUIRED BELOW BASE PLATES FOR PIPE SUPPORTS. PROVIDE SEALANT AROUND PERIMETER OF FLOORING AND NONSHRINK GROUT.
2. EXISTING EXPANSION JOINT IN CONCRETE FLOOR SLAB. CONCRETE ANCHORS FOR PIPE SUPPORTS SHALL BE INSTALLED AT A MINIMUM OF 6 INCHES AWAY FROM EDGE OF THE EXPANSION JOINT.
3. PATCH RESILIENT FLOORING AS REQUIRED AFTER PIPING AND CONCRETE EQUIPMENT PAD HAVE BEEN INSTALLED. RESILIENT FLOORING PATCH SHALL MATCH EXISTING FLOORING. PROVIDE SEALANT AROUND PERIMETER OF EQUIPMENT PAD AND RESILIENT FLOORING.



PARTIAL GRADE PLAN

0 1' 4'



KEY PLAN

TIMOTHY J BATES REGISTERED No. 11400728 STATE OF INDIANA PROFESSIONAL ENGINEER
01/06/2025

TRENT M. MONTEMAYOR REGISTERED No. PE11200215 STATE OF INDIANA PROFESSIONAL ENGINEER
01/06/2025

Revision Number	Revision Description	Drawn By	Checked By	Date

Designed By	CDP/KAR
Drawn By	CDP/KAR
Checked By	TJB/SPG
Approved By	TJB/TMM
Filename	300SMP1.DWG
Project No.	14144
Project Date	JAN 2025

CITY OF BLOOMINGTON UTILITIES
MONROE WTP IMPROVEMENTS: CHEMICAL FEED LINE REPLACEMENT AND BACKWASH SYSTEM PUMP ADDITION AND TANK REHABILITATION - BLOOMINGTON, IN

FILTER BUILDING
PARTIAL GRADE PLAN

DONOHUE

Sheet No. 38

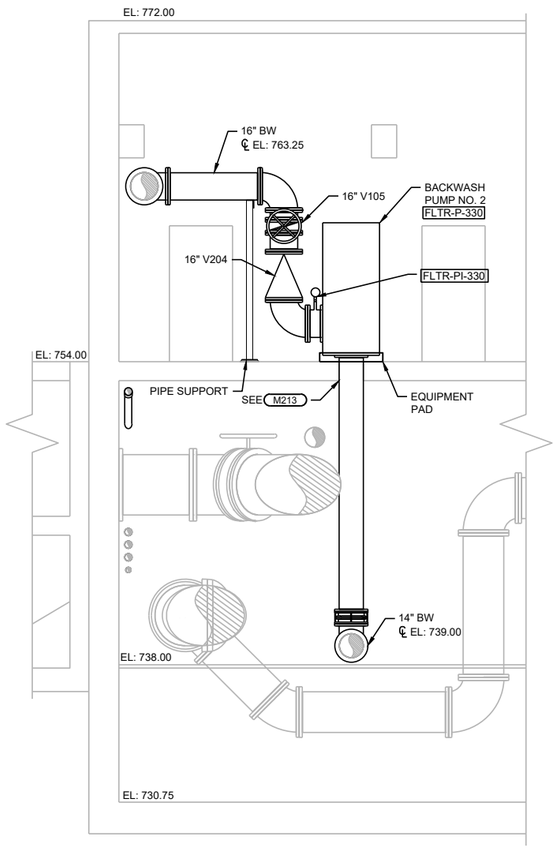
Drawing No. 300-SM-4

GENERAL NOTES:

1. CONTRACTOR SHALL FIELD VERIFY EXISTING CONDITIONS, DIMENSIONS, AND ELEVATIONS PRIOR TO CONSTRUCTION AND/OR FABRICATION.
2. SEE SPECIFICATION SECTION 01 11 00 FOR PROJECT WORK SEQUENCES AND CONSTRAINTS.
3. ALL PIPING AND EQUIPMENT WITHIN ROOMS AND SPACES IS NOT SHOWN FOR CLARITY OF DEPICTING NEW WORK.

PLAN NOTES:

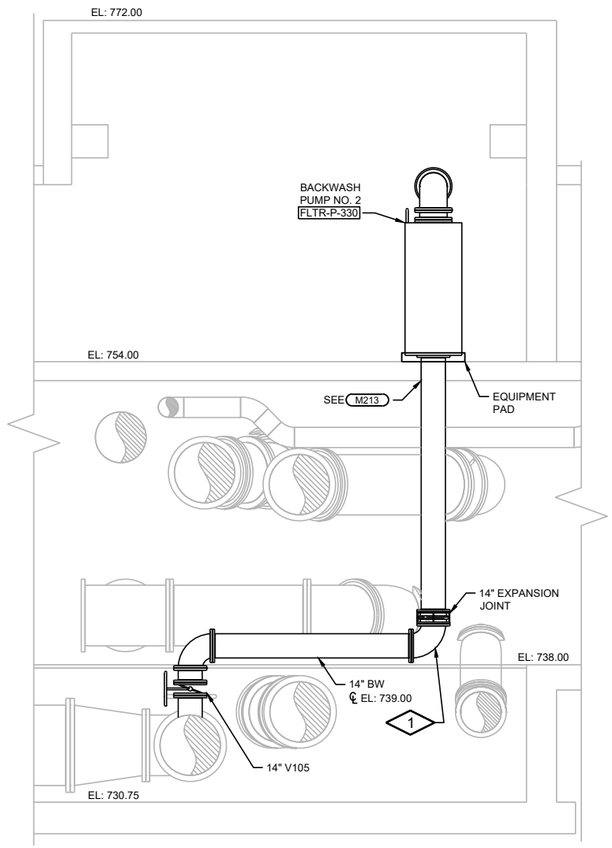
1. SUPPORT PIPING WITH A FLOOR STAND UNDER ELBOW.



SECTION A

0 1' 4'

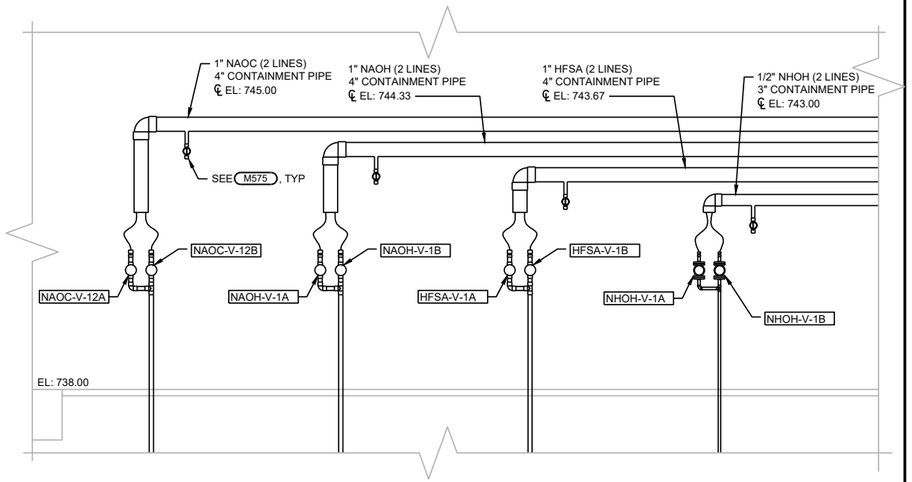
300-SM-1
300-SM-2



SECTION B

0 1' 4'

300-SM-1
300-SM-2



SECTION C

0 1' 2'

300-SM-1
300-SM-2

TIMOTHY J BATES
REGISTERED
No. 11400728
STATE OF INDIANA
PROFESSIONAL ENGINEER

01/06/2025

TRENT M. MONTEMAYOR
REGISTERED
No. PE11200215
STATE OF INDIANA
PROFESSIONAL ENGINEER

01/06/2025

Revision Number	Revision Description	Drawn By	Checked By	Date

Designed By	CDP/KAR
Drawn By	CDP/KAR
Checked By	TJB/SPG
Approved By	TJB/TMM
Filename	300SMP1.DWG
Project No.	14144
Project Date	JAN 2025

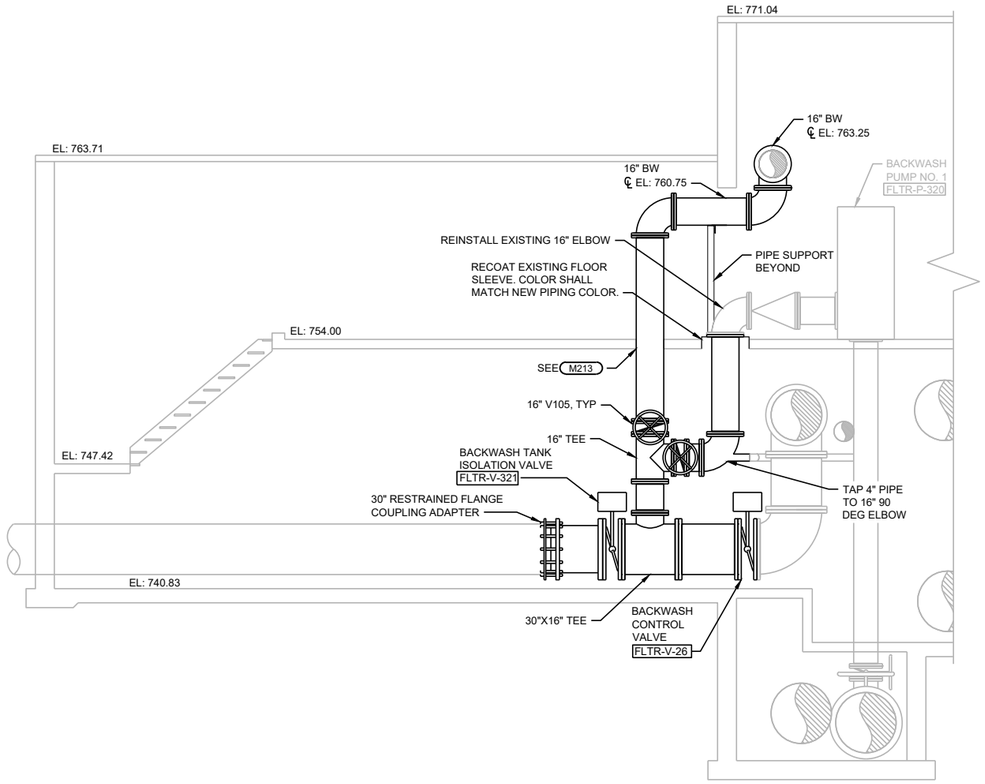
CITY OF BLOOMINGTON UTILITIES
MONROE WTP IMPROVEMENTS: CHEMICAL FEED LINE REPLACEMENT AND BACKWASH SYSTEM PUMP ADDITION AND TANK REHABILITATION - BLOOMINGTON, IN

FILTER BUILDING SECTIONS

DONOHUE

Sheet No. 39

Drawing No. 300-SM-5



SECTION **D**

0 1' 4'

300-SM-3
300-SM-4

GENERAL NOTES:

1. CONTRACTOR SHALL FIELD VERIFY EXISTING CONDITIONS, DIMENSIONS, AND ELEVATIONS PRIOR TO CONSTRUCTION AND/OR FABRICATION.
2. SEE SPECIFICATION SECTION 01 11 00 FOR PROJECT WORK SEQUENCES AND CONSTRAINTS.
3. ALL PIPING AND EQUIPMENT WITHIN ROOMS AND SPACES IS NOT SHOWN FOR CLARITY OF DEPICTING NEW WORK.

EXISTING FLOOR SLEEVE SHALL REMAIN-IN-PLACE. RECOAT EXISTING FLOOR SLEEVE. COLOR SHALL MATCH NEW PIPING COLOR.

PHOTO **1**

NTS 300-SM-4

TIMOTHY J BATES REGISTERED No. 11400728 STATE OF INDIANA PROFESSIONAL ENGINEER

01/06/2025

TRENT M. MONTEMAYOR REGISTERED No. PE11200215 STATE OF INDIANA PROFESSIONAL ENGINEER

01/06/2025

Revision Number	Revision Description	Drawn By	Checked By	Date

Designed By	CDP/KAR
Drawn By	CDP/KAR
Checked By	TJB/SPG
Approved By	TJB/TMM
Filename	300SMP1.DWG
Project No.	14144
Project Date	JAN 2025

CITY OF BLOOMINGTON UTILITIES
MONROE WTP IMPROVEMENTS: CHEMICAL FEED LINE REPLACEMENT AND BACKWASH SYSTEM PUMP ADDITION AND TANK REHABILITATION - BLOOMINGTON, IN

FILTER BUILDING SECTION AND PHOTO

DONOHUE

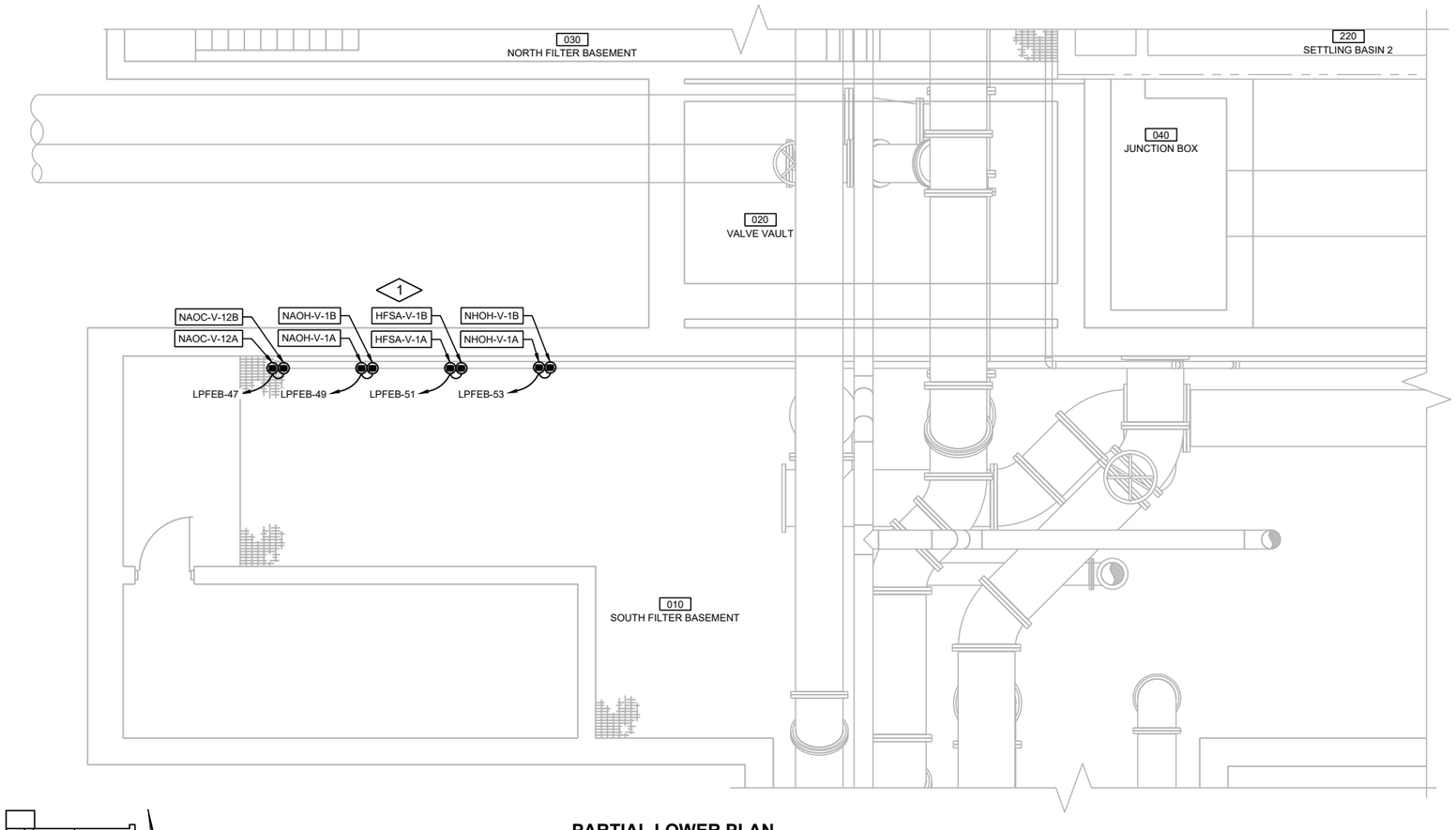
Sheet No. 40

Drawing No. **300-SM-6**

TAG NAME	DESCRIPTION	DETAIL	WIRING	DESTINATION
NAOC-V-12A	NAOC VALVE 12A	MFR	(10) #14	PLC-7B
NAOC-V-12B	NAOC VALVE 12B	MFR	(10) #14	PLC-7B
NAOH-V-1A	NAOH VALVE 1A	MFR	(10) #14	PLC-7B
NAOH-V-1B	NAOH VALVE 1B	MFR	(10) #14	PLC-7B
HFSA-V-1A	HFSA VALVE 1A	MFR	(10) #14	PLC-7B
HFSA-V-1B	HFSA VALVE 1B	MFR	(10) #14	PLC-7B
NHOH-V-1A	NHOH VALVE 1A	MFR	(10) #14	PLC-7B
NHOH-V-1B	NHOH VALVE 1B	MFR	(10) #14	PLC-7B
SEE DRAWING 999-N-1 FOR CONTROL WIRING GENERAL NOTES.				

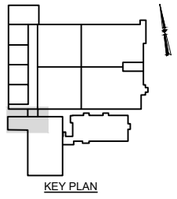
GENERAL NOTES:

1. CONTRACTOR SHALL FIELD VERIFY EXISTING CONDITIONS, DIMENSIONS, AND ELEVATIONS PRIOR TO CONSTRUCTION AND/OR FABRICATION.
2. SEE SPECIFICATION SECTION 01 11 00 FOR PROJECT WORK SEQUENCES AND CONSTRAINTS.
3. ALL PIPING AND EQUIPMENT WITHIN ROOMS AND SPACES IS NOT SHOWN FOR CLARITY OF DEPICTING NEW WORK.



PARTIAL LOWER PLAN

0 1' 4'



CHASE E. BENTON REGISTERED No. 12300012 STATE OF INDIANA PROFESSIONAL ENGINEER
01/06/2025

ARIC BERGSTROM REGISTERED No. PE11706052 STATE OF INDIANA PROFESSIONAL ENGINEER
1-6-25

Revision Number	Revision Description	Drawn By	Checked By	Date

Designed By	CEB/JCE
Drawn By	CEB/JCE
Checked By	JEF/AHB
Approved By	CEB/AHB
Filename	300ENP1.DWG
Project No.	14144
Project Date	JAN 2025

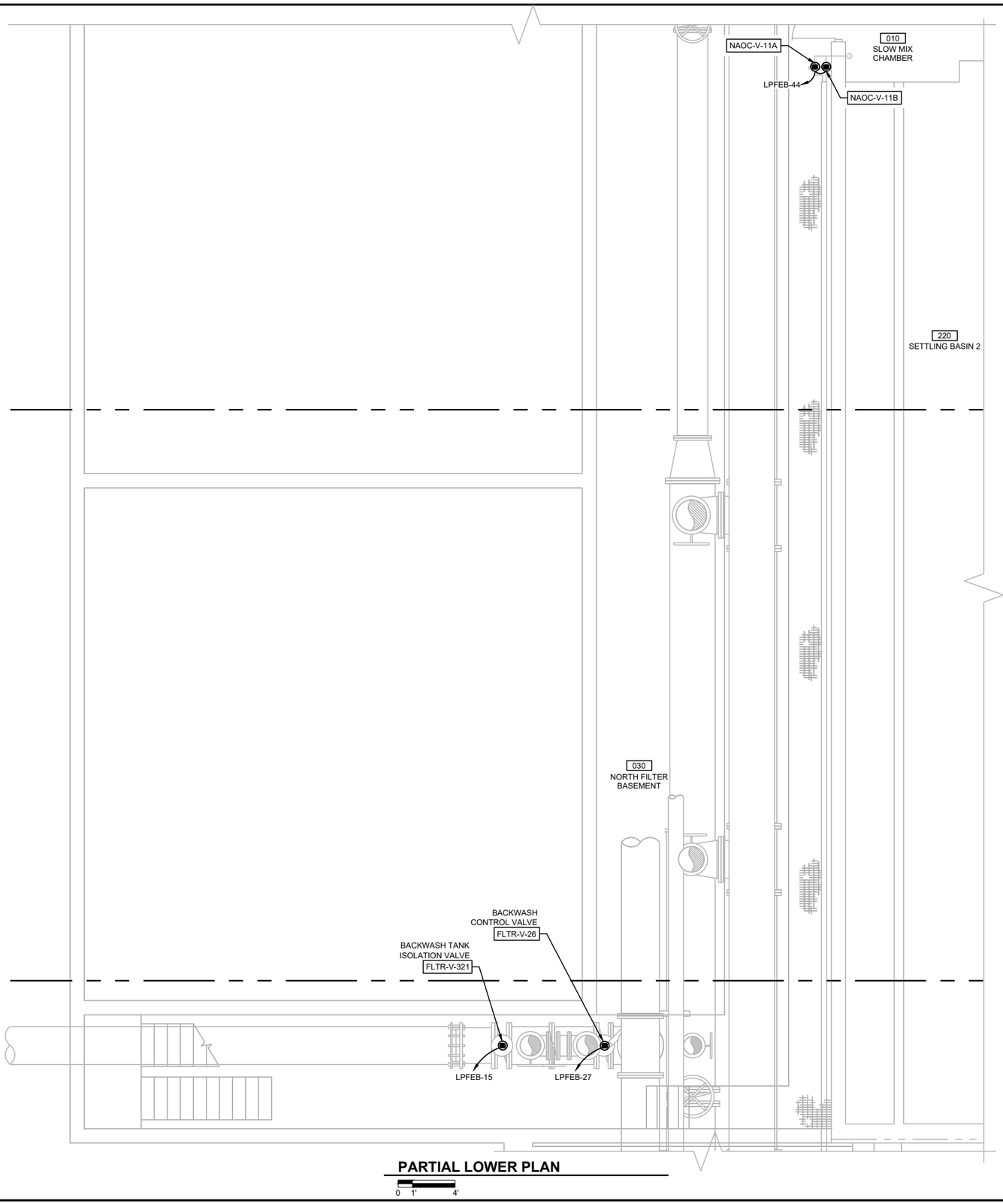
CITY OF BLOOMINGTON UTILITIES
MONROE WTP IMPROVEMENTS: CHEMICAL FEED LINE REPLACEMENT AND BACKWASH SYSTEM PUMP ADDITION AND TANK REHABILITATION - BLOOMINGTON, IN

FILTER BUILDING
PARTIAL LOWER PLAN

DONOHUE

Sheet No. 41

Drawing No. 300-EN-1



KEY PLAN

PARTIAL LOWER PLAN

0 1' 4'

GENERAL NOTES:

1. CONTRACTOR SHALL FIELD VERIFY EXISTING CONDITIONS, DIMENSIONS, AND ELEVATIONS PRIOR TO CONSTRUCTION AND/OR FABRICATION.
2. SEE SPECIFICATION SECTION 01 11 00 FOR PROJECT WORK SEQUENCES AND CONSTRAINTS.
3. ALL PIPING AND EQUIPMENT WITHIN ROOMS AND SPACES IS NOT SHOWN FOR CLARITY OF DEPICTING NEW WORK.

TAG NAME	DESCRIPTION	DETAIL	WIRING	DESTINATION
FLTR-V-11A	NAOC VALVE 11A	MFR	(10) #14	PLC-10
FLTR-V-11B	NAOC VALVE 11B	MFR	(10) #14	PLC-10
FLTR-V-321	BACKWASH HOLDING BASIN ISOLATION VALVE	MFR	(10) #14	PLC-7B
SEE DRAWING 999-N-1 FOR CONTROL WIRING GENERAL NOTES.				

CHASE E. BENTON REGISTERED No. 12300012 STATE OF INDIANA PROFESSIONAL ENGINEER
01/06/2025

ARIC BERGSTROM REGISTERED No. PE11706052 STATE OF INDIANA PROFESSIONAL ENGINEER
1-6-25

Revision Number	Revision Description	Drawn By	Checked By	Date

Designed By	CEB/JCE
Drawn By	CEB/JCE
Checked By	JEF/AHB
Approved By	CEB/AHB
Filename	300ENP1.DWG
Project No.	14144
Project Date	JAN 2025

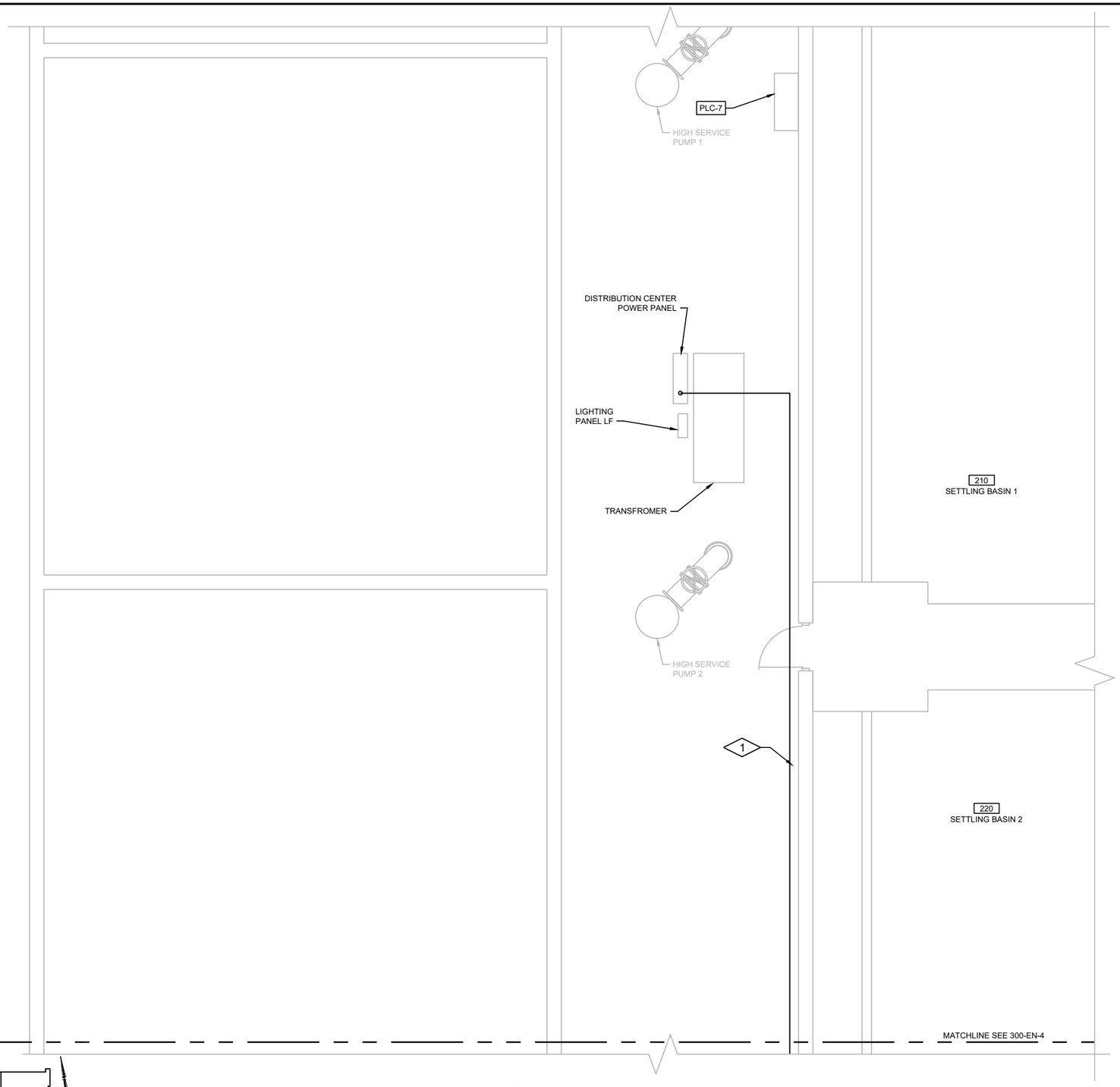
CITY OF BLOOMINGTON UTILITIES
MONROE WTP IMPROVEMENTS: CHEMICAL FEED LINE REPLACEMENT AND BACKWASH SYSTEM PUMP ADDITION AND TANK REHABILITATION - BLOOMINGTON, IN

FILTER BUILDING
PARTIAL LOWER PLAN

DONOHUE

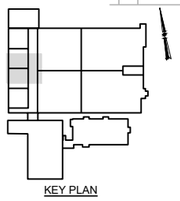
Sheet No. 42

Drawing No. 300-EN-2



PARTIAL GRADE PLAN

0 1' 4'



GENERAL NOTES:

1. CONTRACTOR SHALL FIELD VERIFY EXISTING CONDITIONS, DIMENSIONS, AND ELEVATIONS PRIOR TO CONSTRUCTION AND/OR FABRICATION.
2. SEE SPECIFICATION SECTION 01 11 00 FOR PROJECT WORK SEQUENCES AND CONSTRAINTS.
3. ALL PIPING AND EQUIPMENT WITHIN ROOMS AND SPACES IS NOT SHOWN FOR CLARITY OF DEPICTING NEW WORK.

PLAN NOTES:

1. MOTOR CIRCUIT FROM EXISTING DISTRIBUTION CENTER POWER PANEL TO BACKWASH PUMP NO. 2 STARTER. AVOID RUNNING CONDUIT ON CEILING. RUN CONDUIT ALONG WALL OR BELOW FLOOR (CEILING OF LOWER LEVEL).

CHASE E. BENTON REGISTERED No. 12300012 STATE OF INDIANA PROFESSIONAL ENGINEER
01/06/2025

ARIC BERGSTROM REGISTERED No. PE11706052 STATE OF INDIANA PROFESSIONAL ENGINEER
1-6-25

Revision Number	Revision Description	Drawn By	Checked By	Date

Designed By	CEB/JCE
Drawn By	CEB/JCE
Checked By	JEF/AHB
Approved By	CEB/AHB
Filename	300ENP1.DWG
Project No.	14144
Project Date	JAN 2025

CITY OF BLOOMINGTON UTILITIES
MONROE WTP IMPROVEMENTS: CHEMICAL FEED LINE REPLACEMENT AND BACKWASH SYSTEM PUMP ADDITION AND TANK REHABILITATION - BLOOMINGTON, IN

FILTER BUILDING
PARTIAL GRADE PLAN

DONOHUE

Sheet No. 43

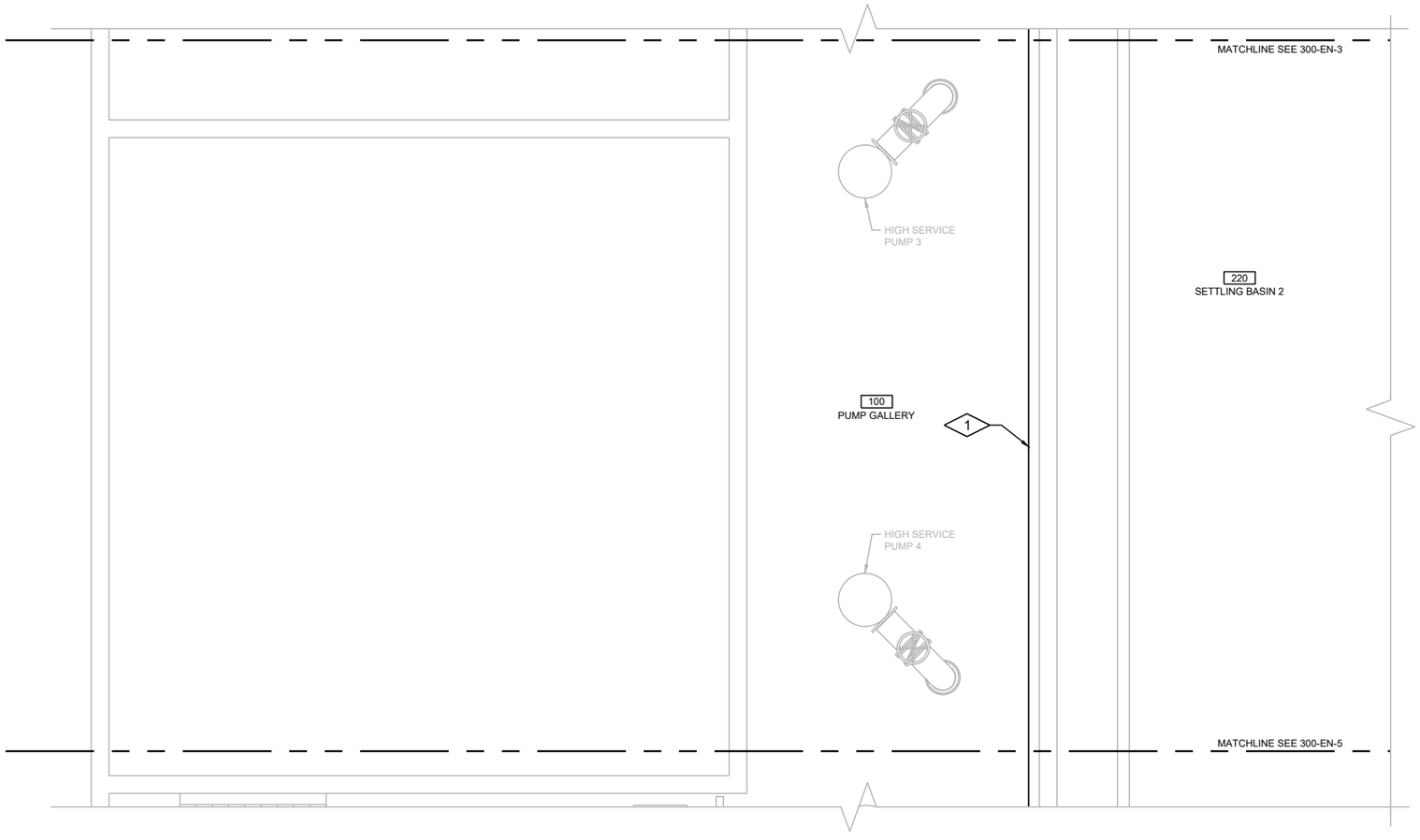
Drawing No. 300-EN-3

GENERAL NOTES:

1. CONTRACTOR SHALL FIELD VERIFY EXISTING CONDITIONS, DIMENSIONS, AND ELEVATIONS PRIOR TO CONSTRUCTION AND/OR FABRICATION.
2. SEE SPECIFICATION SECTION 01 11 00 FOR PROJECT WORK SEQUENCES AND CONSTRAINTS.
3. ALL PIPING AND EQUIPMENT WITHIN ROOMS AND SPACES IS NOT SHOWN FOR CLARITY OF DEPICTING NEW WORK.

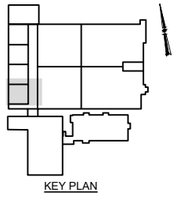
PLAN NOTES:

1. MOTOR CIRCUIT FROM EXISTING DISTRIBUTION CENTER POWER PANEL TO BACKWASH PUMP NO. 2 STARTER. AVOID RUNNING CONDUIT ON CEILING. RUN CONDUIT ALONG WALL OR BELOW FLOOR (CEILING OF LOWER LEVEL).



PARTIAL GRADE PLAN

0 1' 4'



CHASE E. BENTON REGISTERED No. 12300012 STATE OF INDIANA PROFESSIONAL ENGINEER
01/06/2025

ARIC BERGSTROM REGISTERED No. PE11706052 STATE OF INDIANA PROFESSIONAL ENGINEER
1-6-25

Revision Number	Revision Description	Drawn By	Checked By	Date

Designed By	CEB/JCE
Drawn By	CEB/JCE
Checked By	JEF/AHB
Approved By	CEB/AHB
Filename	300ENP1.DWG
Project No.	14144
Project Date	JAN 2025

CITY OF BLOOMINGTON UTILITIES
MONROE WTP IMPROVEMENTS: CHEMICAL FEED LINE REPLACEMENT AND BACKWASH SYSTEM PUMP ADDITION AND TANK REHABILITATION - BLOOMINGTON, IN

FILTER BUILDING
PARTIAL GRADE PLAN

DONOHUE

Sheet No. 44

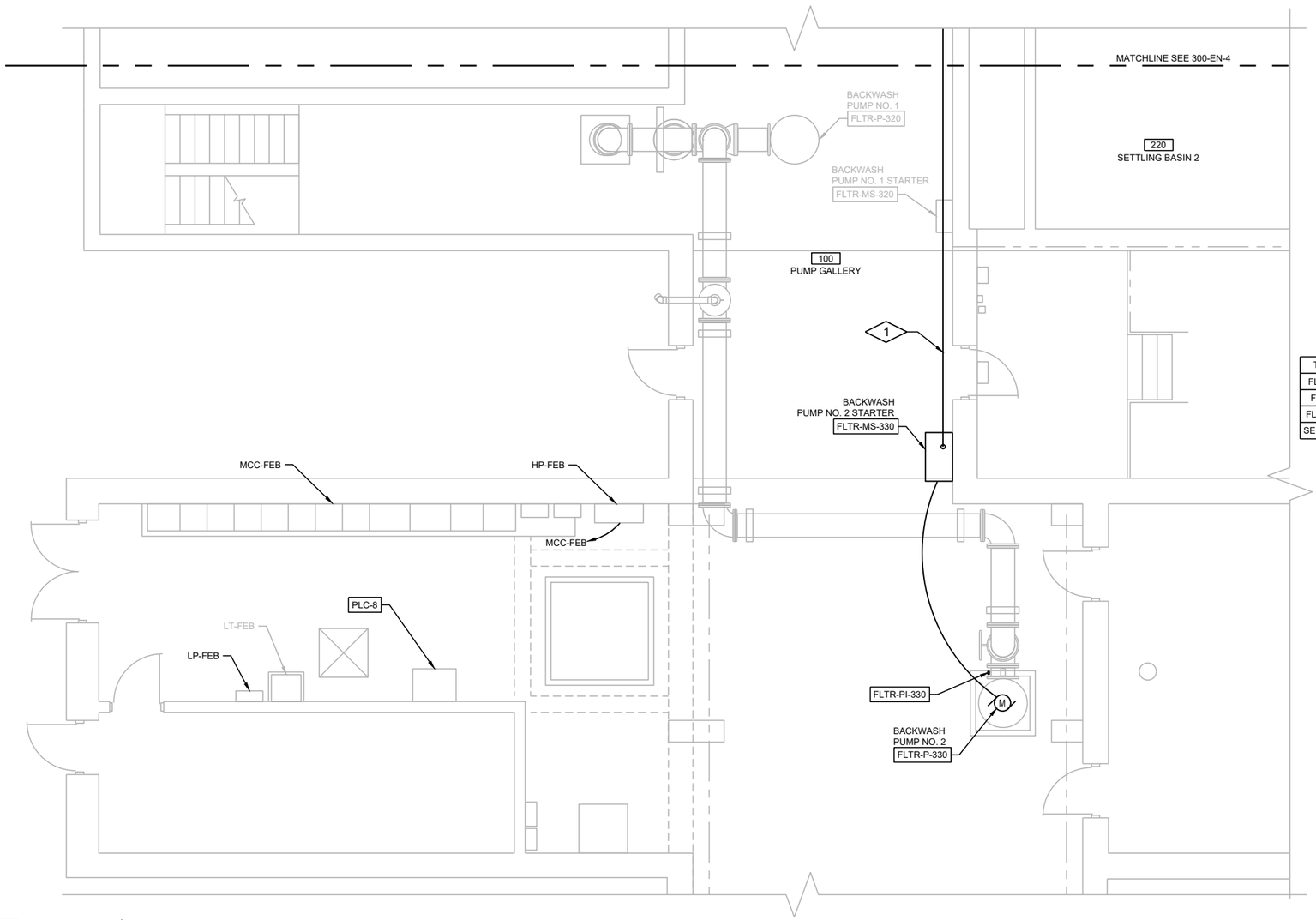
Drawing No. 300-EN-4

GENERAL NOTES:

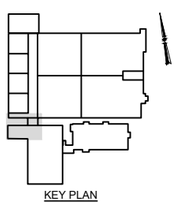
1. CONTRACTOR SHALL FIELD VERIFY EXISTING CONDITIONS, DIMENSIONS, AND ELEVATIONS PRIOR TO CONSTRUCTION AND/OR FABRICATION.
2. SEE SPECIFICATION SECTION 01 11 00 FOR PROJECT WORK SEQUENCES AND CONSTRAINTS.
3. ALL PIPING AND EQUIPMENT WITHIN ROOMS AND SPACES IS NOT SHOWN FOR CLARITY OF DEPICTING NEW WORK.

PLAN NOTES:

1. MOTOR CIRCUIT FROM EXISTING DISTRIBUTION CENTER POWER PANEL TO BACKWASH PUMP NO. 2 STARTER. AVOID RUNNING CONDUIT ON CEILING. RUN CONDUIT ALONG WALL OR BELOW FLOOR (CEILING OF LOWER LEVEL).



TAG NAME	DESCRIPTION	DETAIL	WIRING	DESTINATION
FLTR-MS-330	BACKWASH PUMP NO. 2 STARTER	MFR	(10) #14	PLC-7B
FLTR-PI-330	BACKWASH PUMP NO. 2 DISCHARGE PRESSURE GAUGE	N590	--	--
FLTR-TSH-330	BACKWASH PUMP NO. 2 MOTOR TEMPERATURE SWITCH	MFR	(2) #14	PLC-7B
SEE DRAWING 999-N-1 FOR CONTROL WIRING GENERAL NOTES.				



PARTIAL GRADE PLAN

0 1' 4'

CHASE E. BENTON REGISTERED No. 12300012 STATE OF INDIANA PROFESSIONAL ENGINEER
01/06/2025

ARC BERGSTROM REGISTERED No. PE11706052 STATE OF INDIANA PROFESSIONAL ENGINEER
1-6-25

Revision Number	Revision Description	Drawn By	Checked By	Date

Designed By	CEB/JCE
Drawn By	CEB/JCE
Checked By	JEF/AHB
Approved By	CEB/AHB
Filename	300ENP1.DWG
Project No.	14144
Project Date	JAN 2025

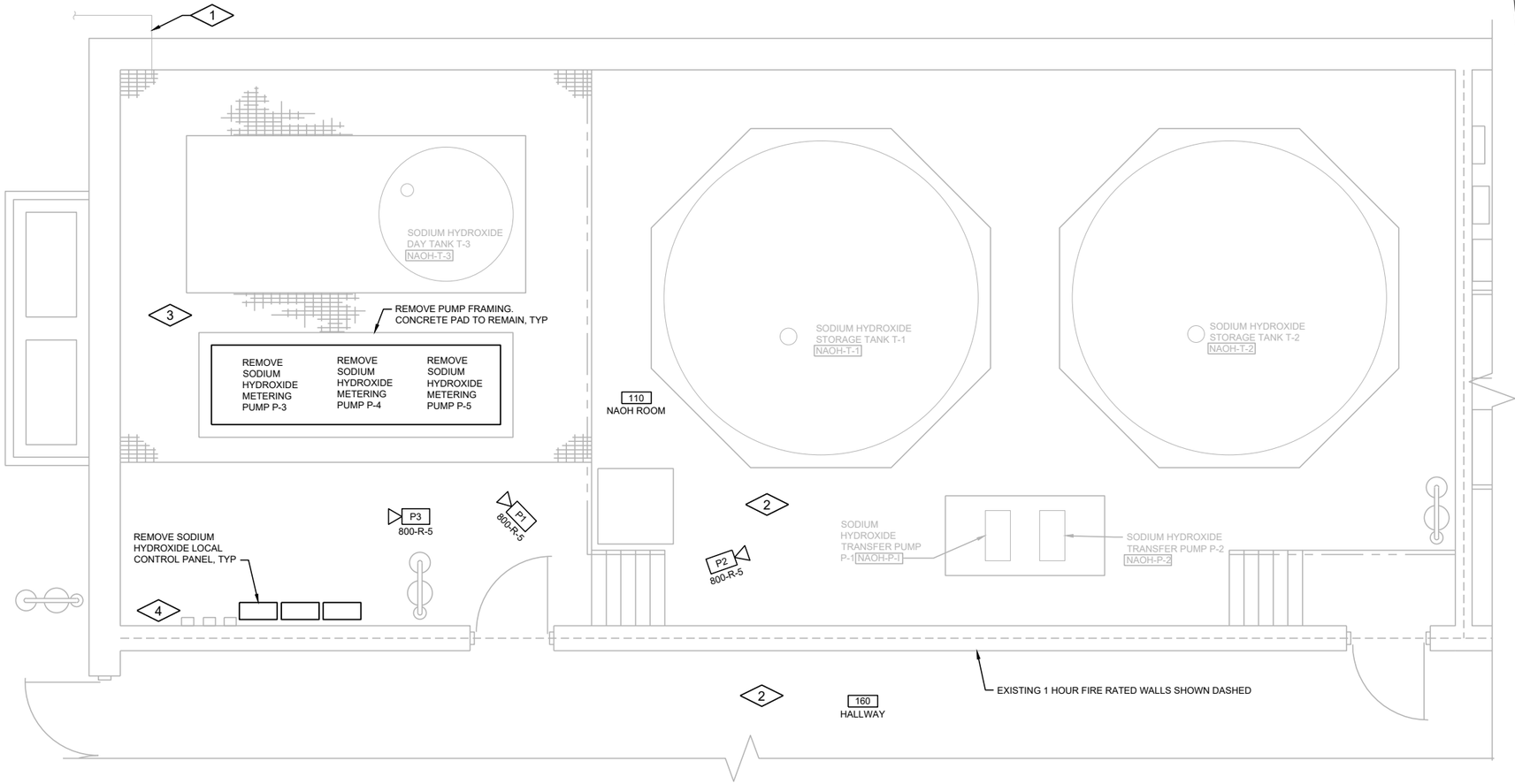
CITY OF BLOOMINGTON UTILITIES
MONROE WTP IMPROVEMENTS: CHEMICAL FEED LINE REPLACEMENT AND BACKWASH SYSTEM PUMP ADDITION AND TANK REHABILITATION - BLOOMINGTON, IN

FILTER BUILDING
PARTIAL GRADE PLAN

DONOHUE

Sheet No. 45

Drawing No. 300-EN-5



GRADE PLAN

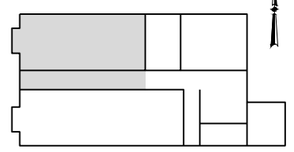
0 3' 8'

GENERAL NOTES:

1. CONTRACTOR TO FIELD VERIFY EXISTING CONDITIONS, DIMENSIONS, AND ELEVATIONS PRIOR TO CONSTRUCTION AND/OR FABRICATION.
2. FULL TONE COMPONENTS TO BE REMOVED.
3. SAWCUT AND REMOVE CONCRETE TO THE LIMITS NOTED. IN EXPOSED AREAS NOT COVERED BY NEW CONSTRUCTION, REMOVE REINFORCEMENT AND EMBEDMENTS 1" BEYOND FINISHED SURFACE AND PATCH SURFACE WITH PATCHING MORTAR TO MATCH ADJACENT FINISHED SURFACE.
4. REMOVE CONCRETE ANCHORS, ANCHOR BOLTS, AND OTHER EMBEDMENTS FOR MATERIALS AND EQUIPMENT BEING REMOVED. IN EXPOSED AREAS NOT COVERED BY NEW CONSTRUCTION, REMOVE CONCRETE ANCHORS, ANCHOR BOLTS, AND OTHER EMBEDMENTS 1" BEYOND FINISHED SURFACE AND PATCH SURFACE WITH PATCHING MORTAR. FINISH SURFACE TO MATCH ADJACENT FINISHED SURFACE.
5. WHERE EQUIPMENT IS INDICATED TO BE REMOVED, REMOVE ALL ASSOCIATED POWER AND CONTROL WIRING AND CONDUIT BACK TO SOURCE. REMOVE JUNCTION BOXES AND PULL BOXES ASSOCIATED WITH THE REMOVED CONDUITS. WHERE CONDUIT SYSTEM CONTAINS CIRCUITS TO OTHER EQUIPMENT THAT REMAINS, RETAIN THESE CIRCUITS AND RELOCATE EXISTING CONDUIT AND EXTEND EXISTING CIRCUITS AS REQUIRED FOR THE INSTALLATION OF NEW EQUIPMENT.
6. REMOVE ALL SUPPORTS ASSOCIATED WITH REMOVED PIPING, DUCTWORK, CONDUIT, AND EQUIPMENT. REMOVE RODS AND FASTENERS FROM CEILINGS, FLOORS, AND WALLS WITH CARE. WHERE SURFACE HAS BEEN MARRED, CHIPPED, SPAWLED, ETC. AS A RESULT OF REMOVAL, PATCH SURFACE WITH PATCHING MORTAR AND FINISH TO MATCH ADJACENT FINISHED SURFACE.
7. REMOVE EXISTING CONCRETE PADS OF ANY EQUIPMENT BEING REMOVED. REMOVE CONCRETE REINFORCEMENT A MINIMUM OF 1" BEYOND FINISHED SURFACE AT ANY LOCATION WHERE NEW CONCRETE PAD WILL NOT COVER ROUGH SURFACE OF REMOVED PAD. PATCH SURFACE WITH PATCHING MORTAR AND FINISH TO MATCH ADJACENT FINISHED SURFACE.
8. WHERE OPENINGS ARE LEFT IN WALLS, SLABS, OR CEILINGS DUE TO REMOVED PIPING, DUCTWORK, EQUIPMENT, OR OTHER WORK, PATCH OPENING TO MATCH ADJACENT SURFACES UNLESS NOTED OTHERWISE. THE PERIMETER OF OPENINGS IN CONCRETE WALLS AND SLABS EXPOSED TO EARTH, WEATHER, OR WATER SHALL BE LINED WITH A GASKET TYPE WATERSTOP PRIOR TO PATCHING OF THE WALL. OPENINGS IN PRECAST CONCRETE ROOF MEMBERS ARE TO BE PATCHED WITH CONCRETE AND DOWELED TO THE EXISTING ROOF MEMBERS UNLESS NOTED OTHERWISE. ROOFING SYSTEM SHALL BE PATCHED TO PREVENT ANY LEAKING AT THE OPENING.
9. REMOVAL ALL CHEMICAL, VENT, OVERFLOW, AND DRAIN PIPING, FITTINGS, VALVES, AND APPURTENANCES.

PLAN NOTES:

1. TEMPORARY CHEMICAL FEED LINES TO REMAIN. TEMPORARY CHEMICAL FEED LINES ARE LOCATED UNDER THE GRATING.
2. IF OWNER ACCEPTS ALTERNATE 2, REMOVE ALL EXISTING LIGHT FIXTURES IN THIS ROOM. CONDUIT AND WIRE TO REMAIN FOR REUSE.
3. REMOVE FRP GRATING SECTIONS AND SUPPORTS AS REQUIRED TO COMPLETE COATING WORK. SALVAGE FOR REINSTALLATION.
4. DILUTION PANEL AND RELATED PIPING, FITTING, AND APPURTENANCES TO REMAIN.



KEY PLAN

Revision Number	Revision Description	Drawn By	Checked By	Date

Designed By	KAR
Drawn By	KAR
Checked By	SPG
Approved By	TMM
Filename	800RP1.DWG
Project No.	14144
Project Date	JAN 2025

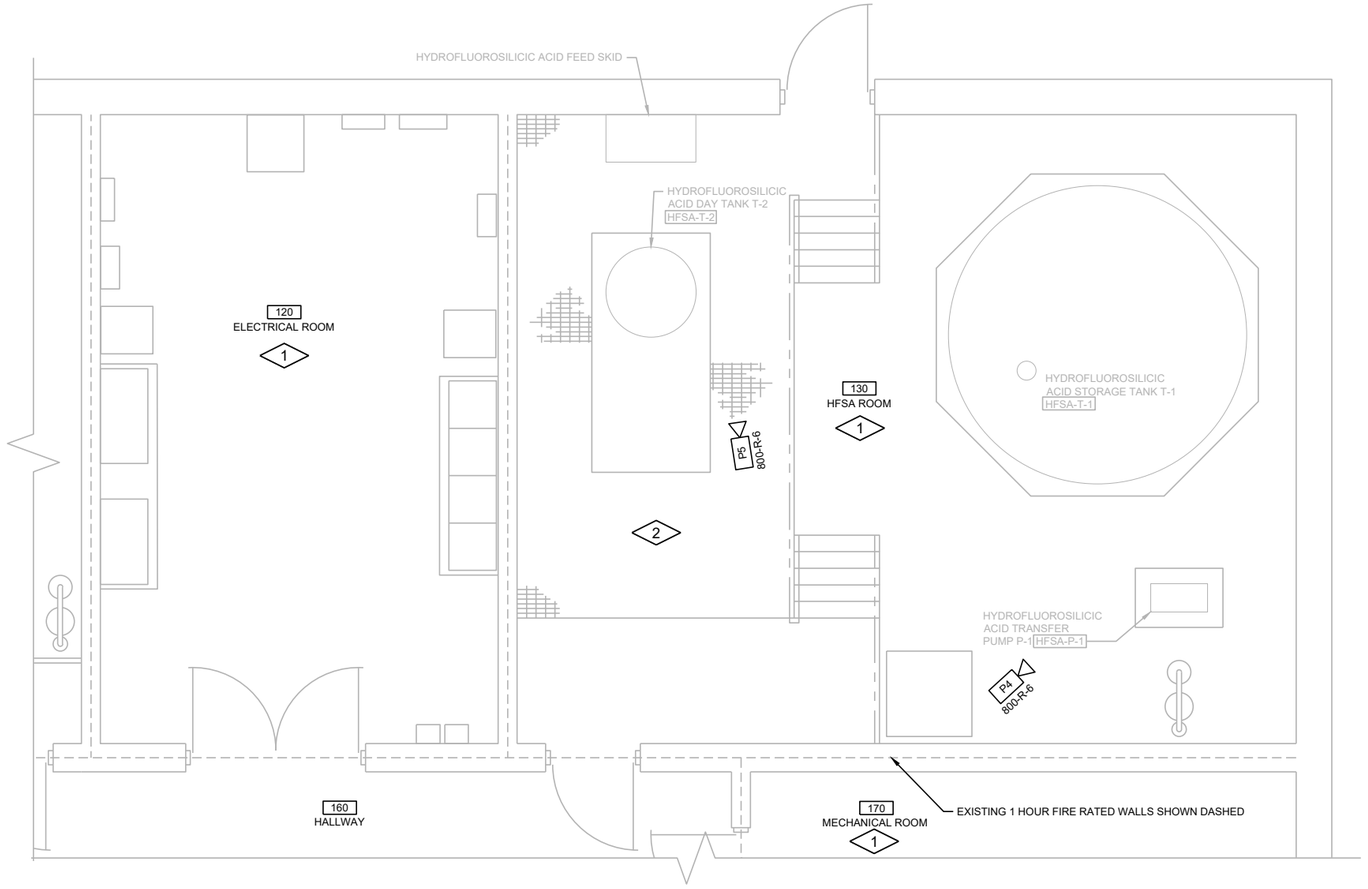
CITY OF BLOOMINGTON UTILITIES
MONROE WTP IMPROVEMENTS: CHEMICAL FEED LINE REPLACEMENT AND BACKWASH SYSTEM PUMP ADDITION AND TANK REHABILITATION - BLOOMINGTON, IN

CHEMICAL BUILDING GRADE REMOVAL PLAN

DONOHUE

Sheet No. 46

Drawing No. 800-R-1



GRADE PLAN

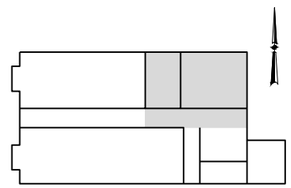
0 3' 8'

GENERAL NOTES:

1. CONTRACTOR TO FIELD VERIFY EXISTING CONDITIONS, DIMENSIONS, AND ELEVATIONS PRIOR TO CONSTRUCTION AND/OR FABRICATION.
2. FULL TONE COMPONENTS TO BE REMOVED.
3. SAWCUT AND REMOVE CONCRETE TO THE LIMITS NOTED. IN EXPOSED AREAS NOT COVERED BY NEW CONSTRUCTION, REMOVE REINFORCEMENT AND EMBEDMENTS 1" BEYOND FINISHED SURFACE AND PATCH SURFACE WITH PATCHING MORTAR TO MATCH ADJACENT FINISHED SURFACE.
4. REMOVE CONCRETE ANCHORS, ANCHOR BOLTS, AND OTHER EMBEDMENTS FOR MATERIALS AND EQUIPMENT BEING REMOVED. IN EXPOSED AREAS NOT COVERED BY NEW CONSTRUCTION, REMOVE CONCRETE ANCHORS, ANCHOR BOLTS, AND OTHER EMBEDMENTS 1" BEYOND FINISHED SURFACE AND PATCH SURFACE WITH PATCHING MORTAR. FINISH SURFACE TO MATCH ADJACENT FINISHED SURFACE.
5. WHERE EQUIPMENT IS INDICATED TO BE REMOVED, REMOVE ALL ASSOCIATED POWER AND CONTROL WIRING AND CONDUIT BACK TO SOURCE. REMOVE JUNCTION BOXES AND PULL BOXES ASSOCIATED WITH THE REMOVED CONDUITS. WHERE CONDUIT SYSTEM CONTAINS CIRCUITS TO OTHER EQUIPMENT THAT REMAINS, RETAIN THESE CIRCUITS AND RELOCATE EXISTING CONDUIT AND EXTEND EXISTING CIRCUITS AS REQUIRED FOR THE INSTALLATION OF NEW EQUIPMENT.
6. REMOVE ALL SUPPORTS ASSOCIATED WITH REMOVED PIPING, DUCTWORK, CONDUIT, AND EQUIPMENT. REMOVE RODS AND FASTENERS FROM CEILINGS, FLOORS, AND WALLS WITH CARE. WHERE SURFACE HAS BEEN MARRED, CHIPPED, SPAWLED, ETC. AS A RESULT OF REMOVAL, PATCH SURFACE WITH PATCHING MORTAR AND FINISH TO MATCH ADJACENT FINISHED SURFACE.
7. REMOVE EXISTING CONCRETE PADS OF ANY EQUIPMENT BEING REMOVED. REMOVE CONCRETE REINFORCEMENT A MINIMUM OF 1" BEYOND FINISHED SURFACE AT ANY LOCATION WHERE NEW CONCRETE PAD WILL NOT COVER ROUGH SURFACE OF REMOVED PAD. PATCH SURFACE WITH PATCHING MORTAR AND FINISH TO MATCH ADJACENT FINISHED SURFACE.
8. WHERE OPENINGS ARE LEFT IN WALLS, SLABS, OR CEILINGS DUE TO REMOVED PIPING, DUCTWORK, EQUIPMENT, OR OTHER WORK, PATCH OPENING TO MATCH ADJACENT SURFACES UNLESS NOTED OTHERWISE. THE PERIMETER OF OPENINGS IN CONCRETE WALLS AND SLABS EXPOSED TO EARTH, WEATHER, OR WATER SHALL BE LINED WITH A GASKET TYPE WATERSTOP PRIOR TO PATCHING OF THE WALL. OPENINGS IN PRECAST CONCRETE ROOF MEMBERS ARE TO BE PATCHED WITH CONCRETE AND DOWELED TO THE EXISTING ROOF MEMBERS UNLESS NOTED OTHERWISE. ROOFING SYSTEM SHALL BE PATCHED TO PREVENT ANY LEAKING AT THE OPENING.
9. REMOVAL ALL CHEMICAL, VENT, OVERFLOW, AND DRAIN PIPING, FITTINGS, VALVES, AND APPURTENANCES.
10. IF OWNER ACCEPTS ALTERNATE 1, PERFORM ALL WORK IN THE FLUORIDE ROOM.

PLAN NOTES:

1. IF OWNER ACCEPTS ALTERNATE 2, REMOVE ALL EXISTING LIGHT FIXTURES IN THIS ROOM. CONDUIT AND WIRE TO REMAIN FOR REUSE.
2. IF OWNER ACCEPTS ALTERNATE 2, REMOVE FRP GRATING SECTIONS AND SUPPORTS AS REQUIRED TO COMPLETE COATING WORK. SALVAGE FOR REINSTALLATION.



KEY PLAN

TRENT M. MONTEMAYOR REGISTERED No. PE11200215 STATE OF INDIANA PROFESSIONAL ENGINEER
01/06/2025

Revision Number	Revision Description	Drawn By	Checked By	Date

Designed By	KAR
Drawn By	KAR
Checked By	SPG
Approved By	TMM
Filename	800RP1.DWG
Project No.	14144
Project Date	JAN 2025

CITY OF BLOOMINGTON UTILITIES
MONROE WTP IMPROVEMENTS: CHEMICAL FEED LINE REPLACEMENT AND BACKWASH SYSTEM PUMP ADDITION AND TANK REHABILITATION - BLOOMINGTON, IN

CHEMICAL BUILDING GRADE REMOVAL PLAN

DONOHUE

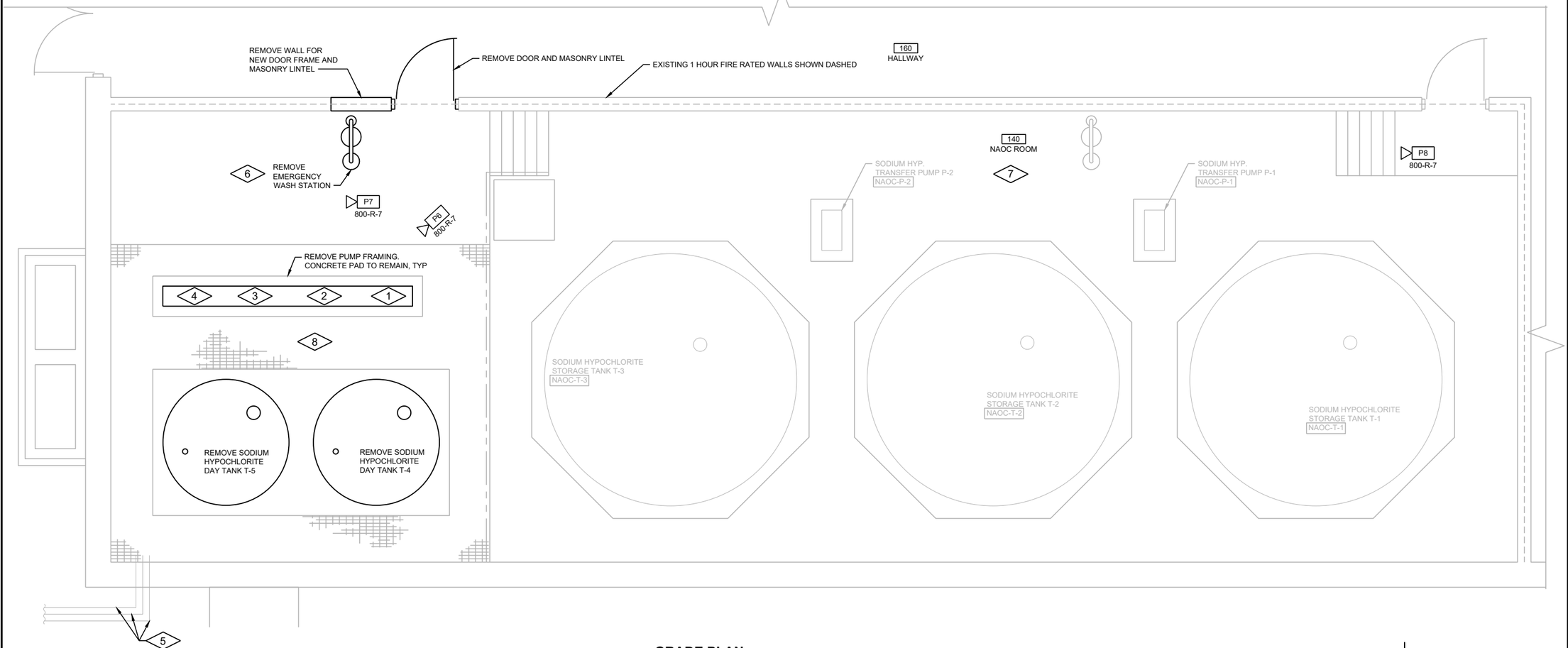
Sheet No.	47
Drawing No.	800-R-2

GENERAL NOTES:

1. CONTRACTOR TO FIELD VERIFY EXISTING CONDITIONS, DIMENSIONS, AND ELEVATIONS PRIOR TO CONSTRUCTION AND/OR FABRICATION.
2. FULL TONE COMPONENTS TO BE REMOVED.
3. SAWCUT AND REMOVE CONCRETE TO THE LIMITS NOTED. IN EXPOSED AREAS NOT COVERED BY NEW CONSTRUCTION, REMOVE REINFORCEMENT AND EMBEDMENTS 1" BEYOND FINISHED SURFACE AND PATCH SURFACE WITH PATCHING MORTAR TO MATCH ADJACENT FINISHED SURFACE.
4. REMOVE CONCRETE ANCHORS, ANCHOR BOLTS, AND OTHER EMBEDMENTS FOR MATERIALS AND EQUIPMENT BEING REMOVED. IN EXPOSED AREAS NOT COVERED BY NEW CONSTRUCTION, REMOVE CONCRETE ANCHORS, ANCHOR BOLTS, AND OTHER EMBEDMENTS 1" BEYOND FINISHED SURFACE AND PATCH SURFACE WITH PATCHING MORTAR. FINISH SURFACE TO MATCH ADJACENT FINISHED SURFACE.
5. WHERE EQUIPMENT IS INDICATED TO BE REMOVED, REMOVE ALL ASSOCIATED POWER AND CONTROL WIRING AND CONDUIT BACK TO SOURCE. REMOVE JUNCTION BOXES AND PULL BOXES ASSOCIATED WITH THE REMOVED CONDUITS. WHERE CONDUIT SYSTEM CONTAINS CIRCUITS TO OTHER EQUIPMENT THAT REMAINS, RETAIN THESE CIRCUITS AND RELOCATE EXISTING CONDUIT AND EXTEND EXISTING CIRCUITS AS REQUIRED FOR THE INSTALLATION OF NEW EQUIPMENT.
6. REMOVE ALL SUPPORTS ASSOCIATED WITH REMOVED PIPING, DUCTWORK, CONDUIT, AND EQUIPMENT. REMOVE RODS AND FASTENERS FROM CEILINGS, FLOORS, AND WALLS WITH CARE. WHERE SURFACE HAS BEEN MARRED, CHIPPED, SPAWLED, ETC. AS A RESULT OF REMOVAL, PATCH SURFACE WITH PATCHING MORTAR AND FINISH TO MATCH ADJACENT FINISHED SURFACE.
7. REMOVE EXISTING CONCRETE PADS OF ANY EQUIPMENT BEING REMOVED. REMOVE CONCRETE REINFORCEMENT A MINIMUM OF 1" BEYOND FINISHED SURFACE AT ANY LOCATION WHERE NEW CONCRETE PAD WILL NOT COVER ROUGH SURFACE OF REMOVED PAD. PATCH SURFACE WITH PATCHING MORTAR AND FINISH TO MATCH ADJACENT FINISHED SURFACE.
8. WHERE OPENINGS ARE LEFT IN WALLS, SLABS, OR CEILINGS DUE TO REMOVED PIPING, DUCTWORK, EQUIPMENT, OR OTHER WORK, PATCH OPENING TO MATCH ADJACENT SURFACES UNLESS NOTED OTHERWISE. THE PERIMETER OF OPENINGS IN CONCRETE WALLS AND SLABS EXPOSED TO EARTH, WEATHER, OR WATER SHALL BE LINED WITH A GASKET TYPE WATERSTOP PRIOR TO PATCHING OF THE WALL. OPENINGS IN PRECAST CONCRETE ROOF MEMBERS ARE TO BE PATCHED WITH CONCRETE AND DOWELED TO THE EXISTING ROOF MEMBERS UNLESS NOTED OTHERWISE. ROOFING SYSTEM SHALL BE PATCHED TO PREVENT ANY LEAKING AT THE OPENING.
9. REMOVAL ALL CHEMICAL, VENT, OVERFLOW, AND DRAIN PIPING, FITTINGS, VALVES, AND APPURTENANCES.

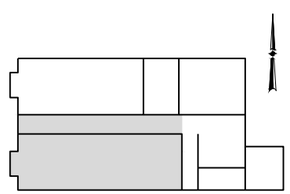
PLAN NOTES: ◇

1. REMOVE SODIUM HYP. METERING PUMP P-3.
2. REMOVE SODIUM HYP. METERING PUMP P-4.
3. REMOVE SODIUM HYP. METERING PUMP P-5.
4. REMOVE SODIUM HYP. METERING PUMP P-6.
5. TEMPORARY CHEMICAL FEED LINES TO REMAIN. TEMPORARY CHEMICAL FEED LINES ARE LOCATED UNDER THE GRATING.
6. EMERGENCY WASH STATION PIPING AND VALVES TO REMAIN EXISTING FOR REUSE.
7. IF OWNER ACCEPTS ALTERNATE 2, REMOVE ALL EXISTING LIGHT FIXTURES IN THIS ROOM. CONDUIT AND WIRE TO REMAIN FOR REUSE.
8. REMOVE FRP GRATING SECTIONS AND SUPPORTS AS REQUIRED TO COMPLETE COATING WORK. SALVAGE FOR REINSTALLATION.



GRADE PLAN

0 3' 8'



KEY PLAN

TRENT M. MONTEMAYOR REGISTERED No. PE11200215 STATE OF INDIANA PROFESSIONAL ENGINEER
01/06/2025

Revision Number	Revision Description	Drawn By	Checked By	Date

Designed By	KAR
Drawn By	KAR
Checked By	SPG
Approved By	TMM
Filename	800RP1.DWG
Project No.	14144
Project Date	JAN 2025

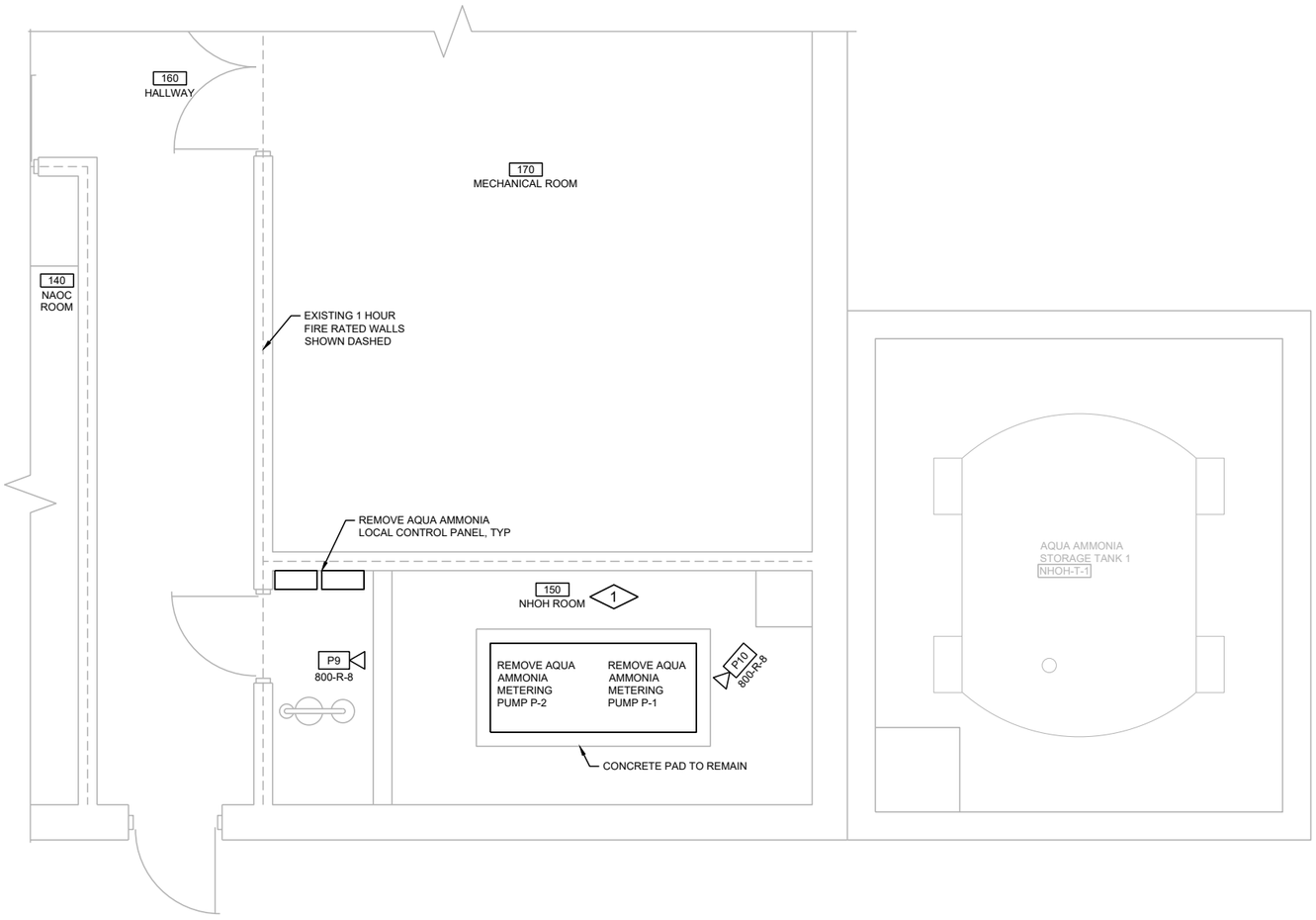
CITY OF BLOOMINGTON UTILITIES
MONROE WTP IMPROVEMENTS: CHEMICAL FEED LINE REPLACEMENT AND BACKWASH SYSTEM PUMP ADDITION AND TANK REHABILITATION - BLOOMINGTON, IN

CHEMICAL BUILDING GRADE REMOVAL PLAN

DONOHUE

Sheet No. 48

Drawing No. 800-R-3



GRADE PLAN

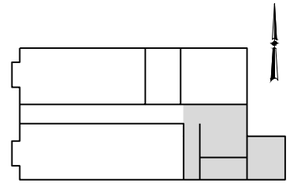
0 3' 8'

GENERAL NOTES:

1. CONTRACTOR TO FIELD VERIFY EXISTING CONDITIONS, DIMENSIONS, AND ELEVATIONS PRIOR TO CONSTRUCTION AND/OR FABRICATION.
2. FULL TONE COMPONENTS TO BE REMOVED.
3. SAWCUT AND REMOVE CONCRETE TO THE LIMITS NOTED. IN EXPOSED AREAS NOT COVERED BY NEW CONSTRUCTION, REMOVE REINFORCEMENT AND EMBEDMENTS 1" BEYOND FINISHED SURFACE AND PATCH SURFACE WITH PATCHING MORTAR TO MATCH ADJACENT FINISHED SURFACE.
4. REMOVE CONCRETE ANCHORS, ANCHOR BOLTS, AND OTHER EMBEDMENTS FOR MATERIALS AND EQUIPMENT BEING REMOVED. IN EXPOSED AREAS NOT COVERED BY NEW CONSTRUCTION, REMOVE CONCRETE ANCHORS, ANCHOR BOLTS, AND OTHER EMBEDMENTS 1" BEYOND FINISHED SURFACE AND PATCH SURFACE WITH PATCHING MORTAR. FINISH SURFACE TO MATCH ADJACENT FINISHED SURFACE.
5. WHERE EQUIPMENT IS INDICATED TO BE REMOVED, REMOVE ALL ASSOCIATED POWER AND CONTROL WIRING AND CONDUIT BACK TO SOURCE. REMOVE JUNCTION BOXES AND PULL BOXES ASSOCIATED WITH THE REMOVED CONDUITS. WHERE CONDUIT SYSTEM CONTAINS CIRCUITS TO OTHER EQUIPMENT THAT REMAINS, RETAIN THESE CIRCUITS AND RELOCATE EXISTING CONDUIT AND EXTEND EXISTING CIRCUITS AS REQUIRED FOR THE INSTALLATION OF NEW EQUIPMENT.
6. REMOVE ALL SUPPORTS ASSOCIATED WITH REMOVED PIPING, DUCTWORK, CONDUIT, AND EQUIPMENT. REMOVE RODS AND FASTENERS FROM CEILINGS, FLOORS, AND WALLS WITH CARE. WHERE SURFACE HAS BEEN MARRED, CHIPPED, SPAWLED, ETC. AS A RESULT OF REMOVAL, PATCH SURFACE WITH PATCHING MORTAR AND FINISH TO MATCH ADJACENT FINISHED SURFACE.
7. REMOVE EXISTING CONCRETE PADS OF ANY EQUIPMENT BEING REMOVED. REMOVE CONCRETE REINFORCEMENT A MINIMUM OF 1" BEYOND FINISHED SURFACE AT ANY LOCATION WHERE NEW CONCRETE PAD WILL NOT COVER ROUGH SURFACE OF REMOVED PAD. PATCH SURFACE WITH PATCHING MORTAR AND FINISH TO MATCH ADJACENT FINISHED SURFACE.
8. WHERE OPENINGS ARE LEFT IN WALLS, SLABS, OR CEILINGS DUE TO REMOVED PIPING, DUCTWORK, EQUIPMENT, OR OTHER WORK, PATCH OPENING TO MATCH ADJACENT SURFACES UNLESS NOTED OTHERWISE. THE PERIMETER OF OPENINGS IN CONCRETE WALLS AND SLABS EXPOSED TO EARTH, WEATHER, OR WATER SHALL BE LINED WITH A GASKET TYPE WATERSTOP PRIOR TO PATCHING OF THE WALL. OPENINGS IN PRECAST CONCRETE ROOF MEMBERS ARE TO BE PATCHED WITH CONCRETE AND DOWELED TO THE EXISTING ROOF MEMBERS UNLESS NOTED OTHERWISE. ROOFING SYSTEM SHALL BE PATCHED TO PREVENT ANY LEAKING AT THE OPENING.
9. REMOVAL ALL CHEMICAL, VENT, OVERFLOW, AND DRAIN PIPING, FITTINGS, VALVES, AND APPURTENANCES.

PLAN NOTES:

1. IF OWNER ACCEPTS ALTERNATE 2, REMOVE ALL EXISTING LIGHT FIXTURES IN THIS ROOM. CONDUIT AND WIRE TO REMAIN FOR REUSE.



KEY PLAN

TRENT M. MONTEMAYOR REGISTERED No. PE11200215 STATE OF INDIANA PROFESSIONAL ENGINEER
01/06/2025

Revision Number	Revision Description	Drawn By	Checked By	Date

Designed By	KAR
Drawn By	KAR
Checked By	SPG
Approved By	TMM
Filename	800RP1.DWG
Project No.	14144
Project Date	JAN 2025

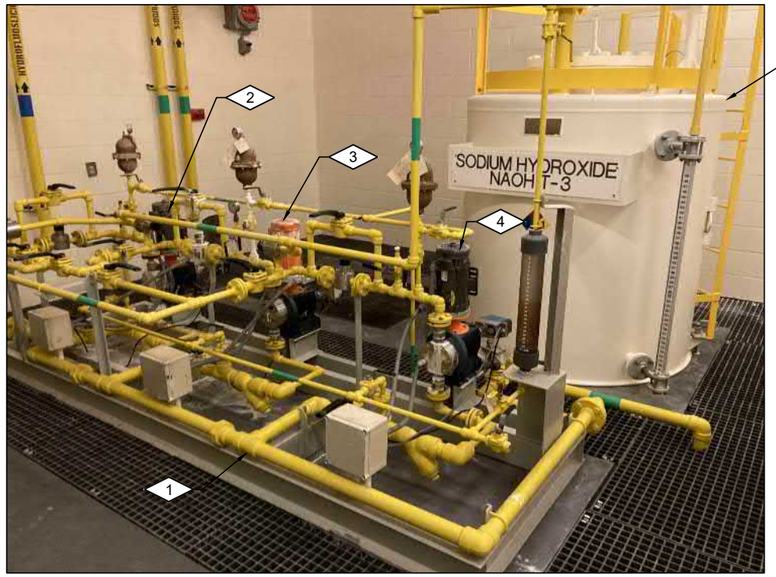
CITY OF BLOOMINGTON UTILITIES
MONROE WTP IMPROVEMENTS: CHEMICAL FEED LINE REPLACEMENT AND BACKWASH SYSTEM PUMP ADDITION AND TANK REHABILITATION - BLOOMINGTON, IN

CHEMICAL BUILDING
GRADE REMOVAL PLAN

DONOHUE

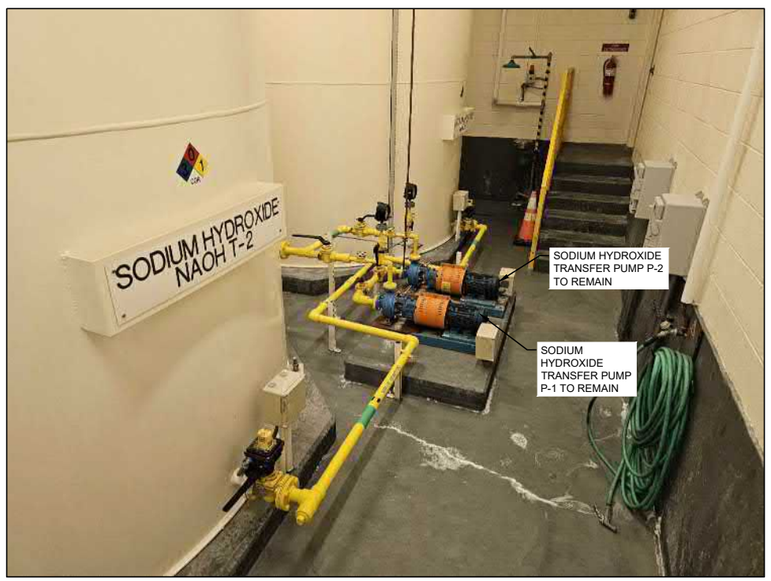
Sheet No. 49

Drawing No. 800-R-4



SODIUM HYDROXIDE DAY TANK T-3 TO REMAIN

PHOTO 1
NTS 800-R-1



SODIUM HYDROXIDE TRANSFER PUMP P-2 TO REMAIN

SODIUM HYDROXIDE TRANSFER PUMP P-1 TO REMAIN

PHOTO 2
NTS 800-R-1

PHOTO 3
NTS 800-R-1

GENERAL NOTES:

1. CONTRACTOR TO FIELD VERIFY EXISTING CONDITIONS, DIMENSIONS, AND ELEVATIONS PRIOR TO CONSTRUCTION AND/OR FABRICATION.
2. FULL TONE COMPONENTS TO BE REMOVED.
3. SAWCUT AND REMOVE CONCRETE TO THE LIMITS NOTED. IN EXPOSED AREAS NOT COVERED BY NEW CONSTRUCTION, REMOVE REINFORCEMENT AND EMBEDMENTS 1" BEYOND FINISHED SURFACE AND PATCH SURFACE WITH PATCHING MORTAR TO MATCH ADJACENT FINISHED SURFACE.
4. REMOVE CONCRETE ANCHORS, ANCHOR BOLTS, AND OTHER EMBEDMENTS FOR MATERIALS AND EQUIPMENT BEING REMOVED. IN EXPOSED AREAS NOT COVERED BY NEW CONSTRUCTION, REMOVE CONCRETE ANCHORS, ANCHOR BOLTS, AND OTHER EMBEDMENTS 1" BEYOND FINISHED SURFACE AND PATCH SURFACE WITH PATCHING MORTAR. FINISH SURFACE TO MATCH ADJACENT FINISHED SURFACE.
5. WHERE EQUIPMENT IS INDICATED TO BE REMOVED, REMOVE ALL ASSOCIATED POWER AND CONTROL WIRING AND CONDUIT BACK TO SOURCE. REMOVE JUNCTION BOXES AND PULL BOXES ASSOCIATED WITH THE REMOVED CONDUITS. WHERE CONDUIT SYSTEM CONTAINS CIRCUITS TO OTHER EQUIPMENT THAT REMAINS, RETAIN THESE CIRCUITS AND RELOCATE EXISTING CONDUIT AND EXTEND EXISTING CIRCUITS AS REQUIRED FOR THE INSTALLATION OF NEW EQUIPMENT.
6. REMOVE ALL SUPPORTS ASSOCIATED WITH REMOVED PIPING, DUCTWORK, CONDUIT, AND EQUIPMENT. REMOVE RODS AND FASTENERS FROM CEILINGS, FLOORS, AND WALLS WITH CARE. WHERE SURFACE HAS BEEN MARRED, CHIPPED, SPAWLED, ETC. AS A RESULT OF REMOVAL, PATCH SURFACE WITH PATCHING MORTAR AND FINISH TO MATCH ADJACENT FINISHED SURFACE.
7. REMOVE EXISTING CONCRETE PADS OF ANY EQUIPMENT BEING REMOVED. REMOVE CONCRETE REINFORCEMENT A MINIMUM OF 1" BEYOND FINISHED SURFACE AT ANY LOCATION WHERE NEW CONCRETE PAD WILL NOT COVER ROUGH SURFACE OF REMOVED PAD. PATCH SURFACE WITH PATCHING MORTAR AND FINISH TO MATCH ADJACENT FINISHED SURFACE.
8. WHERE OPENINGS ARE LEFT IN WALLS, SLABS, OR CEILINGS DUE TO REMOVED PIPING, DUCTWORK, EQUIPMENT, OR OTHER WORK, PATCH OPENING TO MATCH ADJACENT SURFACES UNLESS NOTED OTHERWISE. THE PERIMETER OF OPENINGS IN CONCRETE WALLS AND SLABS EXPOSED TO EARTH, WEATHER, OR WATER SHALL BE LINED WITH A GASKET TYPE WATERSTOP PRIOR TO PATCHING OF THE WALL. OPENINGS IN PRECAST CONCRETE ROOF MEMBERS ARE TO BE PATCHED WITH CONCRETE AND DOWELED TO THE EXISTING ROOF MEMBERS UNLESS NOTED OTHERWISE. ROOFING SYSTEM SHALL BE PATCHED TO PREVENT ANY LEAKING AT THE OPENING.

PLAN NOTES:

1. REMOVAL ALL CHEMICAL, VENT, OVERFLOW, AND DRAIN PIPING, FITTINGS, VALVES, AND APPURTENANCES.
2. REMOVE SODIUM HYDROXIDE METERING PUMP P-3.
3. REMOVE SODIUM HYDROXIDE METERING PUMP P-4.
4. REMOVE SODIUM HYDROXIDE METERING PUMP P-5.

TRENT M. MONTENAYOR REGISTERED No. PE11200215 STATE OF INDIANA PROFESSIONAL ENGINEER
01/06/2025

Revision Number	Revision Description	Drawn By	Checked By	Date

Designed By	KAR
Drawn By	KAR
Checked By	SPG
Approved By	TMM
Filename	800RP1.DWG
Project No.	14144
Project Date	JAN 2025

CITY OF BLOOMINGTON UTILITIES
MONROE WTP IMPROVEMENTS: CHEMICAL FEED LINE REPLACEMENT AND BACKWASH SYSTEM PUMP ADDITION AND TANK REHABILITATION - BLOOMINGTON, IN

CHEMICAL BUILDING REMOVAL PHOTOS

DONOHUE

Sheet No. 50

Drawing No. 800-R-5

PHOTO 4
NTS 800-R-2

PHOTO 5
NTS 800-R-2

GENERAL NOTES:

1. CONTRACTOR TO FIELD VERIFY EXISTING CONDITIONS, DIMENSIONS, AND ELEVATIONS PRIOR TO CONSTRUCTION AND/OR FABRICATION.
2. FULL TONE COMPONENTS TO BE REMOVED.
3. SAWCUT AND REMOVE CONCRETE TO THE LIMITS NOTED. IN EXPOSED AREAS NOT COVERED BY NEW CONSTRUCTION, REMOVE REINFORCEMENT AND EMBEDMENTS 1" BEYOND FINISHED SURFACE AND PATCH SURFACE WITH PATCHING MORTAR TO MATCH ADJACENT FINISHED SURFACE.
4. REMOVE CONCRETE ANCHORS, ANCHOR BOLTS, AND OTHER EMBEDMENTS FOR MATERIALS AND EQUIPMENT BEING REMOVED. IN EXPOSED AREAS NOT COVERED BY NEW CONSTRUCTION, REMOVE CONCRETE ANCHORS, ANCHOR BOLTS, AND OTHER EMBEDMENTS 1" BEYOND FINISHED SURFACE AND PATCH SURFACE WITH PATCHING MORTAR. FINISH SURFACE TO MATCH ADJACENT FINISHED SURFACE.
5. WHERE EQUIPMENT IS INDICATED TO BE REMOVED, REMOVE ALL ASSOCIATED POWER AND CONTROL WIRING AND CONDUIT BACK TO SOURCE. REMOVE JUNCTION BOXES AND PULL BOXES ASSOCIATED WITH THE REMOVED CONDUITS. WHERE CONDUIT SYSTEM CONTAINS CIRCUITS TO OTHER EQUIPMENT THAT REMAINS, RETAIN THESE CIRCUITS AND RELOCATE EXISTING CONDUIT AND EXTEND EXISTING CIRCUITS AS REQUIRED FOR THE INSTALLATION OF NEW EQUIPMENT.
6. REMOVE ALL SUPPORTS ASSOCIATED WITH REMOVED PIPING, DUCTWORK, CONDUIT, AND EQUIPMENT. REMOVE RODS AND FASTENERS FROM CEILINGS, FLOORS, AND WALLS WITH CARE. WHERE SURFACE HAS BEEN MARRED, CHIPPED, SPAWLED, ETC. AS A RESULT OF REMOVAL, PATCH SURFACE WITH PATCHING MORTAR AND FINISH TO MATCH ADJACENT FINISHED SURFACE.
7. REMOVE EXISTING CONCRETE PADS OF ANY EQUIPMENT BEING REMOVED. REMOVE CONCRETE REINFORCEMENT A MINIMUM OF 1" BEYOND FINISHED SURFACE AT ANY LOCATION WHERE NEW CONCRETE PAD WILL NOT COVER ROUGH SURFACE OF REMOVED PAD. PATCH SURFACE WITH PATCHING MORTAR AND FINISH TO MATCH ADJACENT FINISHED SURFACE.
8. WHERE OPENINGS ARE LEFT IN WALLS, SLABS, OR CEILINGS DUE TO REMOVED PIPING, DUCTWORK, EQUIPMENT, OR OTHER WORK, PATCH OPENING TO MATCH ADJACENT SURFACES UNLESS NOTED OTHERWISE. THE PERIMETER OF OPENINGS IN CONCRETE WALLS AND SLABS EXPOSED TO EARTH, WEATHER, OR WATER SHALL BE LINED WITH A GASKET TYPE WATERSTOP PRIOR TO PATCHING OF THE WALL. OPENINGS IN PRECAST CONCRETE ROOF MEMBERS ARE TO BE PATCHED WITH CONCRETE AND DOWELED TO THE EXISTING ROOF MEMBERS UNLESS NOTED OTHERWISE. ROOFING SYSTEM SHALL BE PATCHED TO PREVENT ANY LEAKING AT THE OPENING.
9. REMOVAL ALL CHEMICAL, VENT, OVERFLOW, AND DRAIN PIPING, FITTINGS, VALVES, AND APPURTENANCES.
10. IF OWNER ACCEPTS ALTERNATE 1, PERFORM ALL WORK IN THE FLUORIDE ROOM.

PLAN NOTES:

1. REMOVAL ALL CHEMICAL, VENT, OVERFLOW, AND DRAIN PIPING, FITTINGS, VALVES, AND APPURTENANCES.

Revision Number	Revision Description	Drawn By	Checked By	Date

Designed By	KAR
Drawn By	KAR
Checked By	SPG
Approved By	TMM
Filename	800RP1.DWG
Project No.	14144
Project Date	JAN 2025

CITY OF BLOOMINGTON UTILITIES
MONROE WTP IMPROVEMENTS: CHEMICAL FEED LINE
REPLACEMENT AND BACKWASH SYSTEM PUMP ADDITION
AND TANK REHABILITATION - BLOOMINGTON, IN

CHEMICAL BUILDING
REMOVAL PHOTOS

TRENT M. MONTEMAYOR REGISTERED No. PE11200215 STATE OF INDIANA PROFESSIONAL ENGINEER
01/06/2025

DONOHUE

Sheet No. 51

Drawing No. 800-R-6

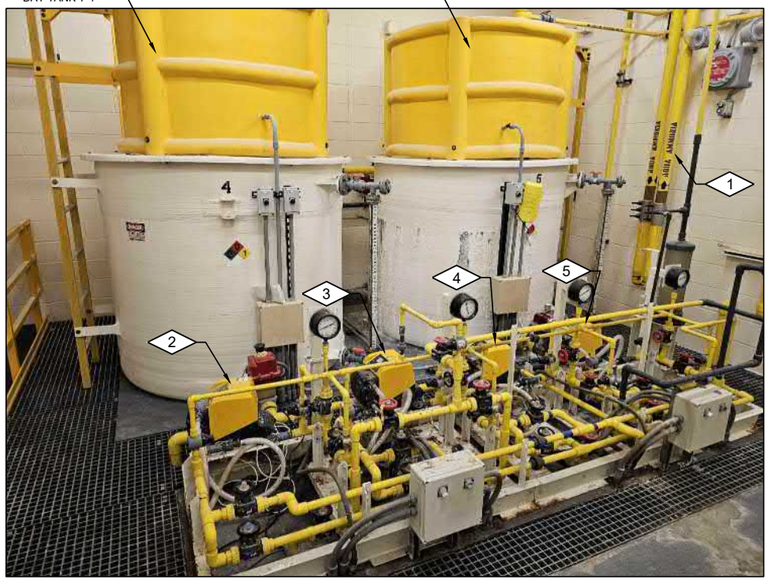


PHOTO 6
NTS 800-R-3

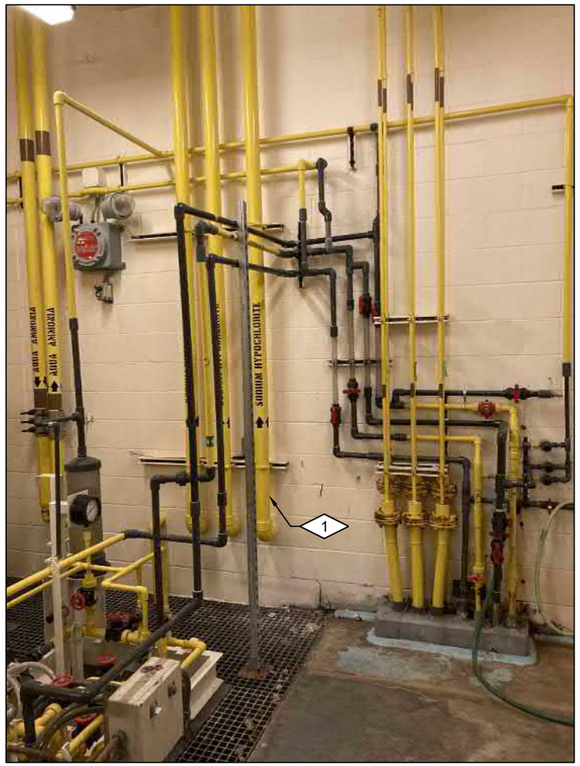


PHOTO 7
NTS 800-R-3

PHOTO 8
NTS 800-R-3

GENERAL NOTES:

1. CONTRACTOR TO FIELD VERIFY EXISTING CONDITIONS, DIMENSIONS, AND ELEVATIONS PRIOR TO CONSTRUCTION AND/OR FABRICATION.
2. FULL TONE COMPONENTS TO BE REMOVED.
3. SAWCUT AND REMOVE CONCRETE TO THE LIMITS NOTED. IN EXPOSED AREAS NOT COVERED BY NEW CONSTRUCTION, REMOVE REINFORCEMENT AND EMBEDMENTS 1" BEYOND FINISHED SURFACE AND PATCH SURFACE WITH PATCHING MORTAR TO MATCH ADJACENT FINISHED SURFACE.
4. REMOVE CONCRETE ANCHORS, ANCHOR BOLTS, AND OTHER EMBEDMENTS FOR MATERIALS AND EQUIPMENT BEING REMOVED. IN EXPOSED AREAS NOT COVERED BY NEW CONSTRUCTION, REMOVE CONCRETE ANCHORS, ANCHOR BOLTS, AND OTHER EMBEDMENTS 1" BEYOND FINISHED SURFACE AND PATCH SURFACE WITH PATCHING MORTAR. FINISH SURFACE TO MATCH ADJACENT FINISHED SURFACE.
5. WHERE EQUIPMENT IS INDICATED TO BE REMOVED, REMOVE ALL ASSOCIATED POWER AND CONTROL WIRING AND CONDUIT BACK TO SOURCE. REMOVE JUNCTION BOXES AND PULL BOXES ASSOCIATED WITH THE REMOVED CONDUITS. WHERE CONDUIT SYSTEM CONTAINS CIRCUITS TO OTHER EQUIPMENT THAT REMAINS, RETAIN THESE CIRCUITS AND RELOCATE EXISTING CONDUIT AND EXTEND EXISTING CIRCUITS AS REQUIRED FOR THE INSTALLATION OF NEW EQUIPMENT.
6. REMOVE ALL SUPPORTS ASSOCIATED WITH REMOVED PIPING, DUCTWORK, CONDUIT, AND EQUIPMENT. REMOVE RODS AND FASTENERS FROM CEILINGS, FLOORS, AND WALLS WITH CARE. WHERE SURFACE HAS BEEN MARRED, CHIPPED, SPAWLED, ETC. AS A RESULT OF REMOVAL, PATCH SURFACE WITH PATCHING MORTAR AND FINISH TO MATCH ADJACENT FINISHED SURFACE.
7. REMOVE EXISTING CONCRETE PADS OF ANY EQUIPMENT BEING REMOVED. REMOVE CONCRETE REINFORCEMENT A MINIMUM OF 1" BEYOND FINISHED SURFACE AT ANY LOCATION WHERE NEW CONCRETE PAD WILL NOT COVER ROUGH SURFACE OF REMOVED PAD. PATCH SURFACE WITH PATCHING MORTAR AND FINISH TO MATCH ADJACENT FINISHED SURFACE.
8. WHERE OPENINGS ARE LEFT IN WALLS, SLABS, OR CEILINGS DUE TO REMOVED PIPING, DUCTWORK, EQUIPMENT, OR OTHER WORK, PATCH OPENING TO MATCH ADJACENT SURFACES UNLESS NOTED OTHERWISE. THE PERIMETER OF OPENINGS IN CONCRETE WALLS AND SLABS EXPOSED TO EARTH, WEATHER, OR WATER SHALL BE LINED WITH A GASKET TYPE WATERSTOP PRIOR TO PATCHING OF THE WALL. OPENINGS IN PRECAST CONCRETE ROOF MEMBERS ARE TO BE PATCHED WITH CONCRETE AND DOWELED TO THE EXISTING ROOF MEMBERS UNLESS NOTED OTHERWISE. ROOFING SYSTEM SHALL BE PATCHED TO PREVENT ANY LEAKING AT THE OPENING.

PLAN NOTES:

1. REMOVAL ALL CHEMICAL, VENT, OVERFLOW, AND DRAIN PIPING, FITTINGS, VALVES, AND APPURTENANCES.
2. REMOVE SODIUM HYP. METERING PUMP P-3.
3. REMOVE SODIUM HYP. METERING PUMP P-4.
4. REMOVE SODIUM HYP. METERING PUMP P-5.
5. REMOVE SODIUM HYP. METERING PUMP P-6.

TRENT M. MONTEMAYOR REGISTERED No. PE11200215 STATE OF INDIANA PROFESSIONAL ENGINEER
01/06/2025

Revision Number	Revision Description	Drawn By	Checked By	Date

Designed By	KAR
Drawn By	KAR
Checked By	SPG
Approved By	TMM
Filename	800RP1.DWG
Project No.	14144
Project Date	JAN 2025

CITY OF BLOOMINGTON UTILITIES
MONROE WTP IMPROVEMENTS: CHEMICAL FEED LINE REPLACEMENT AND BACKWASH SYSTEM PUMP ADDITION AND TANK REHABILITATION - BLOOMINGTON, IN

CHEMICAL BUILDING REMOVAL PHOTOS

DONOHUE

Sheet No. 52

Drawing No. 800-R-7

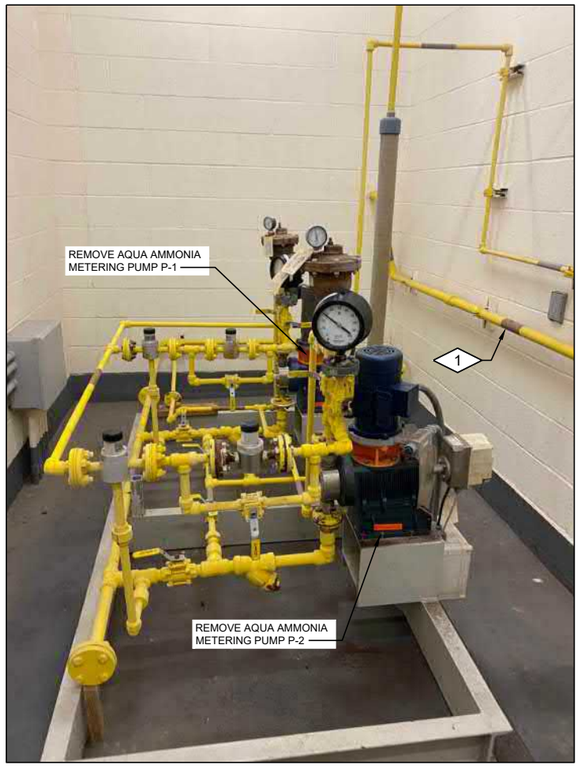


PHOTO 9
NTS 800-R-4

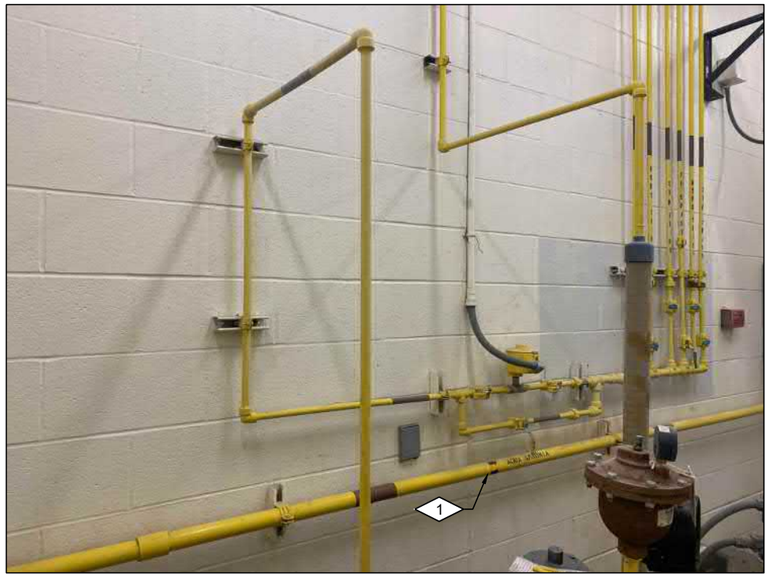


PHOTO 10
NTS 800-R-4

GENERAL NOTES:

1. CONTRACTOR TO FIELD VERIFY EXISTING CONDITIONS, DIMENSIONS, AND ELEVATIONS PRIOR TO CONSTRUCTION AND/OR FABRICATION.
2. FULL TONE COMPONENTS TO BE REMOVED.
3. SAWCUT AND REMOVE CONCRETE TO THE LIMITS NOTED. IN EXPOSED AREAS NOT COVERED BY NEW CONSTRUCTION, REMOVE REINFORCEMENT AND EMBEDMENTS 1" BEYOND FINISHED SURFACE AND PATCH SURFACE WITH PATCHING MORTAR TO MATCH ADJACENT FINISHED SURFACE.
4. REMOVE CONCRETE ANCHORS, ANCHOR BOLTS, AND OTHER EMBEDMENTS FOR MATERIALS AND EQUIPMENT BEING REMOVED. IN EXPOSED AREAS NOT COVERED BY NEW CONSTRUCTION, REMOVE CONCRETE ANCHORS, ANCHOR BOLTS, AND OTHER EMBEDMENTS 1" BEYOND FINISHED SURFACE AND PATCH SURFACE WITH PATCHING MORTAR. FINISH SURFACE TO MATCH ADJACENT FINISHED SURFACE.
5. WHERE EQUIPMENT IS INDICATED TO BE REMOVED, REMOVE ALL ASSOCIATED POWER AND CONTROL WIRING AND CONDUIT BACK TO SOURCE. REMOVE JUNCTION BOXES AND PULL BOXES ASSOCIATED WITH THE REMOVED CONDUITS. WHERE CONDUIT SYSTEM CONTAINS CIRCUITS TO OTHER EQUIPMENT THAT REMAINS, RETAIN THESE CIRCUITS AND RELOCATE EXISTING CONDUIT AND EXTEND EXISTING CIRCUITS AS REQUIRED FOR THE INSTALLATION OF NEW EQUIPMENT.
6. REMOVE ALL SUPPORTS ASSOCIATED WITH REMOVED PIPING, DUCTWORK, CONDUIT, AND EQUIPMENT. REMOVE RODS AND FASTENERS FROM CEILINGS, FLOORS, AND WALLS WITH CARE. WHERE SURFACE HAS BEEN MARRED, CHIPPED, SPAWLED, ETC. AS A RESULT OF REMOVAL, PATCH SURFACE WITH PATCHING MORTAR AND FINISH TO MATCH ADJACENT FINISHED SURFACE.
7. REMOVE EXISTING CONCRETE PADS OF ANY EQUIPMENT BEING REMOVED. REMOVE CONCRETE REINFORCEMENT A MINIMUM OF 1" BEYOND FINISHED SURFACE AT ANY LOCATION WHERE NEW CONCRETE PAD WILL NOT COVER ROUGH SURFACE OF REMOVED PAD. PATCH SURFACE WITH PATCHING MORTAR AND FINISH TO MATCH ADJACENT FINISHED SURFACE.
8. WHERE OPENINGS ARE LEFT IN WALLS, SLABS, OR CEILINGS DUE TO REMOVED PIPING, DUCTWORK, EQUIPMENT, OR OTHER WORK, PATCH OPENING TO MATCH ADJACENT SURFACES UNLESS NOTED OTHERWISE. THE PERIMETER OF OPENINGS IN CONCRETE WALLS AND SLABS EXPOSED TO EARTH, WEATHER, OR WATER SHALL BE LINED WITH A GASKET TYPE WATERSTOP PRIOR TO PATCHING OF THE WALL. OPENINGS IN PRECAST CONCRETE ROOF MEMBERS ARE TO BE PATCHED WITH CONCRETE AND DOWELED TO THE EXISTING ROOF MEMBERS UNLESS NOTED OTHERWISE. ROOFING SYSTEM SHALL BE PATCHED TO PREVENT ANY LEAKING AT THE OPENING.

PLAN NOTES: ◇

1. REMOVAL ALL CHEMICAL, VENT, OVERFLOW, AND DRAIN PIPING, FITTINGS, VALVES, AND APPURTENANCES.

Revision Number	Revision Description	Drawn By	Checked By	Date

Designed By	KAR
Drawn By	KAR
Checked By	SPG
Approved By	TMM
Filename	800RP1.DWG
Project No.	14144
Project Date	JAN 2025

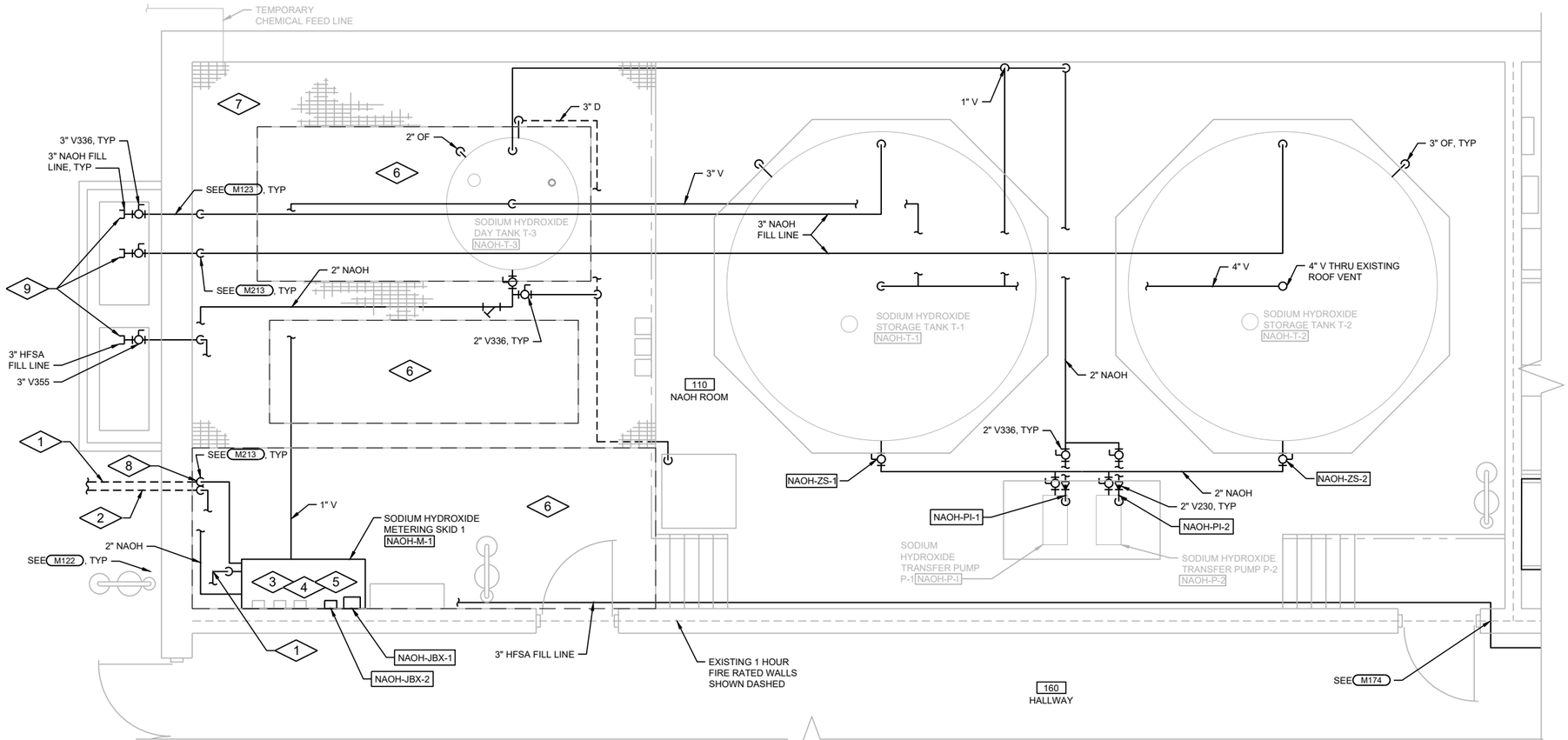
CITY OF BLOOMINGTON UTILITIES
MONROE WTP IMPROVEMENTS: CHEMICAL FEED LINE REPLACEMENT AND BACKWASH SYSTEM PUMP ADDITION AND TANK REHABILITATION - BLOOMINGTON, IN

CHEMICAL BUILDING REMOVAL PHOTOS

DONOHUE

Sheet No.	53
Drawing No.	800-R-8

TRENT M. MONTEMAYOR REGISTERED No. PE11200215 STATE OF INDIANA PROFESSIONAL ENGINEER
01/06/2025



PARTIAL GRADE PLAN

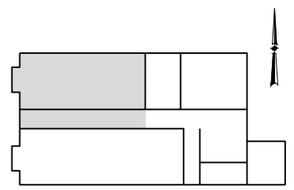
0 3' 8'

GENERAL NOTES:

1. CONTRACTOR SHALL FIELD VERIFY EXISTING CONDITIONS, DIMENSIONS, AND ELEVATIONS PRIOR TO CONSTRUCTION AND/OR FABRICATION.
2. SEE SPECIFICATION SECTION 01 11 00 FOR PROJECT WORK SEQUENCES AND CONSTRAINTS.
3. MATCH ORIGINAL PIPE ELEVATIONS.

PLAN NOTES:

1. 1" NAOH FEED LINE (1 LINE). 1" NAOH SPARE (1 LINE).
2. 1" NAOC FEED LINE (1 LINE). 1" NAOC SPARE (1 LINE).
3. SODIUM HYDROXIDE METERING PUMP P-3 NAOH-P-3
4. SODIUM HYDROXIDE METERING PUMP P-4 NAOH-P-4
5. SODIUM HYDROXIDE METERING PUMP P-5 NAOH-P-5
6. FLOOR AREAS INDICATED WITH DASHED LINES SHALL BE SURFACE PREPPED AND RECOATED PER SPECIFICATION 09 96 00. RECOAT WITH SYSTEM 21. EXISTING SODIUM HYDROXIDE DAY TANK SHALL REMAIN IN PLACE DURING FLOOR SURFACE PREP AND COATING APPLICATION. APPLY FLOOR COATING ON EXPOSED CONCRETE SURFACES AROUND BASE OF DAY TANK PER COATING MANUFACTURER'S RECOMMENDATION. FLOOR SURFACES SHALL BE COATED PRIOR TO MOUNTING EQUIPMENT.
7. REINSTALL FRP GRATING SECTIONS AND SUPPORTS AS REQUIRED AFTER COATING WORK HAS BEEN COMPLETED.
8. IN THE VERTICAL. INSTALL 1" V336 ON THE NAOH FEED AND SPARE LINES. INSTALL PIPING SO THERE IS AN AIR GAP BETWEEN THE 1" V336 AND THE LINES LEAVING THE BUILDING. CAP THE NAOH FEED AND SPARE LINES LEAVING THE BUILDING.
9. HEAT TRACE AND INSULATE EXTERIOR NAOH AND HFSA FILL LINES.



KEY PLAN

TIMOTHY J BATES
REGISTERED
No. 11400728
STATE OF INDIANA
PROFESSIONAL ENGINEER

01/06/2025

TRENT M. MONTEMAYOR
REGISTERED
No. PE11200215
STATE OF INDIANA
PROFESSIONAL ENGINEER

01/06/2025

Revision Number	Revision Description	Drawn By	Checked By	Date

Designed By	CDP/KAR
Drawn By	CDP/KAR
Checked By	TJB/SPG
Approved By	TJB/TMM
Filename	800SMP1.DWG
Project No.	14144
Project Date	JAN 2025

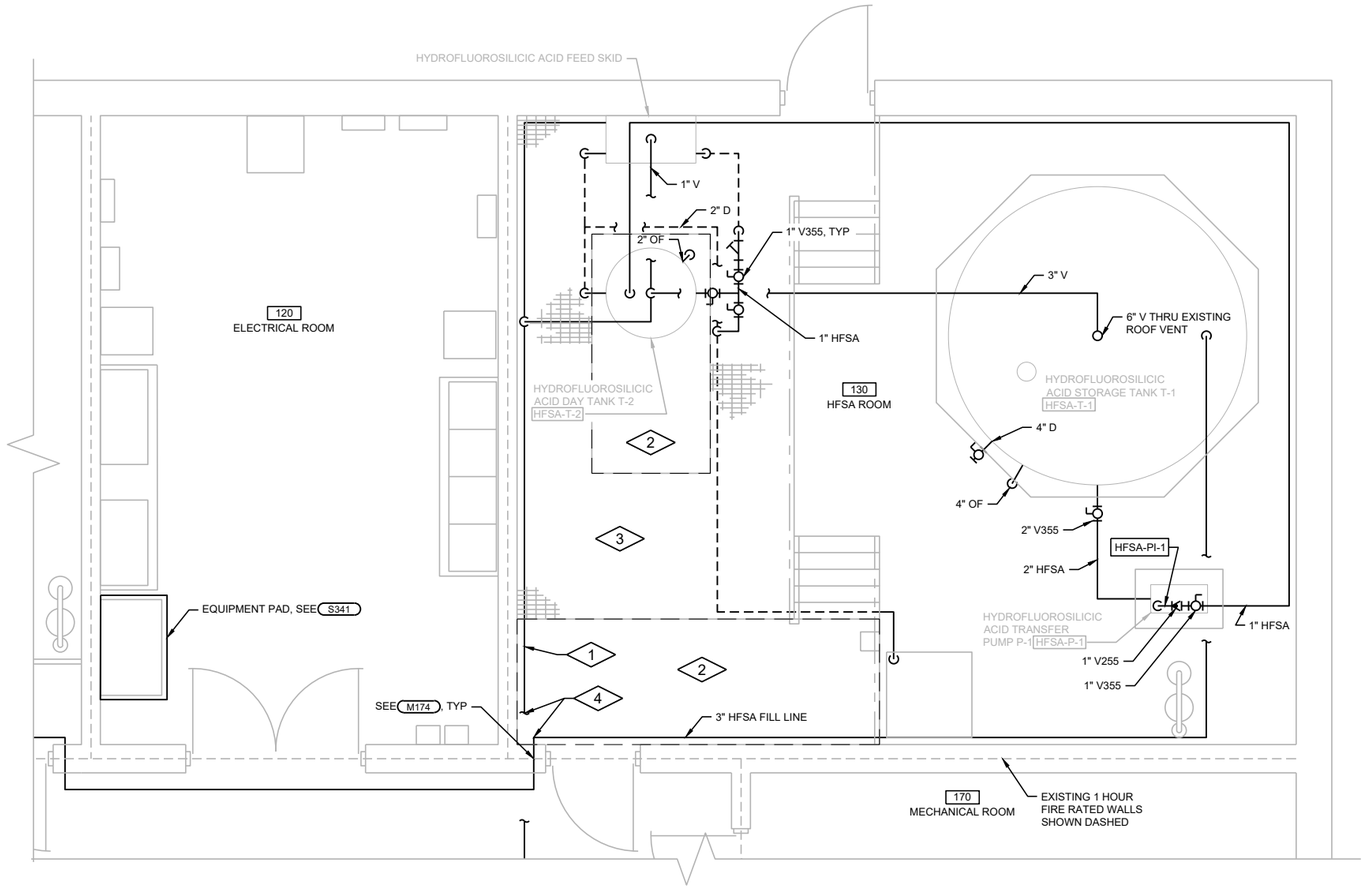
CITY OF BLOOMINGTON UTILITIES
MONROE WTP IMPROVEMENTS: CHEMICAL FEED LINE REPLACEMENT AND BACKWASH SYSTEM PUMP ADDITION AND TANK REHABILITATION - BLOOMINGTON, IN

CHEMICAL BUILDING
PARTIAL GRADE PLAN

DONOHUE

Sheet No. 54

Drawing No. 800-SM-1



PARTIAL GRADE PLAN

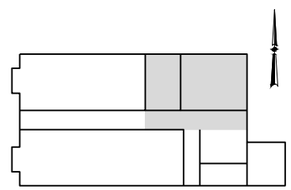
0 3' 8'

GENERAL NOTES:

1. CONTRACTOR SHALL FIELD VERIFY EXISTING CONDITIONS, DIMENSIONS, AND ELEVATIONS PRIOR TO CONSTRUCTION AND/OR FABRICATION.
2. SEE SPECIFICATION SECTION 01 11 00 FOR PROJECT WORK SEQUENCES AND CONSTRAINTS.
3. MATCH ORIGINAL PIPE ELEVATIONS.
4. IF OWNER ACCEPTS ALTERNATE 1, PERFORM ALL WORK IN THE FLUORIDE ROOM.

PLAN NOTES:

1. 1" HFSA FEED LINE (1 LINE). 1" HFSA SPARE (1 LINE).
2. IF OWNER ACCEPTS ALTERNATE 2, FLOOR AREAS INDICATED WITH DASHED LINES SHALL BE SURFACE PREPPED AND RECOATED PER SPECIFICATION 09 96 00. RECOAT WITH SYSTEM 21. EXISTING HYDROFLUOROSILICIC ACID DAY TANK SHALL REMAIN IN PLACE DURING FLOOR SURFACE PREP AND COATING APPLICATION. APPLY FLOOR COATING ON EXPOSED CONCRETE SURFACES AROUND BASE OF DAY TANK PER COATING MANUFACTURER'S RECOMMENDATION. FLOOR SURFACES SHALL BE COATED PRIOR TO MOUNTING EQUIPMENT.
3. IF OWNER ACCEPTS ALTERNATE 2, REINSTALL FRP GRATING SECTIONS AND SUPPORTS AS REQUIRED AFTER COATING WORK HAS BEEN COMPLETED.
4. IF OWNER DOES NOT ACCEPT ALTERNATE 1, STUB THE HFSA FILL AND FEED LINES INTO THE ROOM. PERFORM NO OTHER WORK IN THE FLUORIDE ROOM.



KEY PLAN

TIMOTHY J BATES REGISTERED No. 11400728 STATE OF INDIANA PROFESSIONAL ENGINEER
01/06/2025

TRENT M. MONTEMAYOR REGISTERED No. PE11200215 STATE OF INDIANA PROFESSIONAL ENGINEER
01/06/2025

Revision Number	Revision Description	Drawn By	Checked By	Date

Designed By	CDP/KAR
Drawn By	CDP/KAR
Checked By	TJB/SPG
Approved By	TJB/TMM
Filename	800SMP1.DWG
Project No.	14144
Project Date	JAN 2025

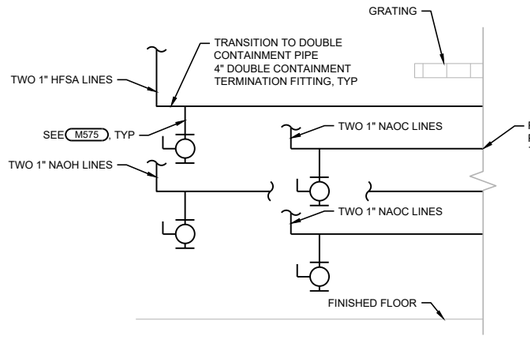
CITY OF BLOOMINGTON UTILITIES
MONROE WTP IMPROVEMENTS: CHEMICAL FEED LINE REPLACEMENT AND BACKWASH SYSTEM PUMP ADDITION AND TANK REHABILITATION - BLOOMINGTON, IN

CHEMICAL BUILDING PARTIAL GRADE PLAN

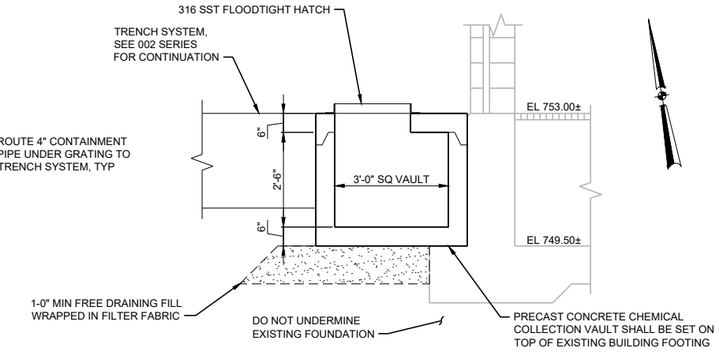
DONOHUE

Sheet No. 55

Drawing No. 800-SM-2



DETAIL 1
NTS 800-SM-3



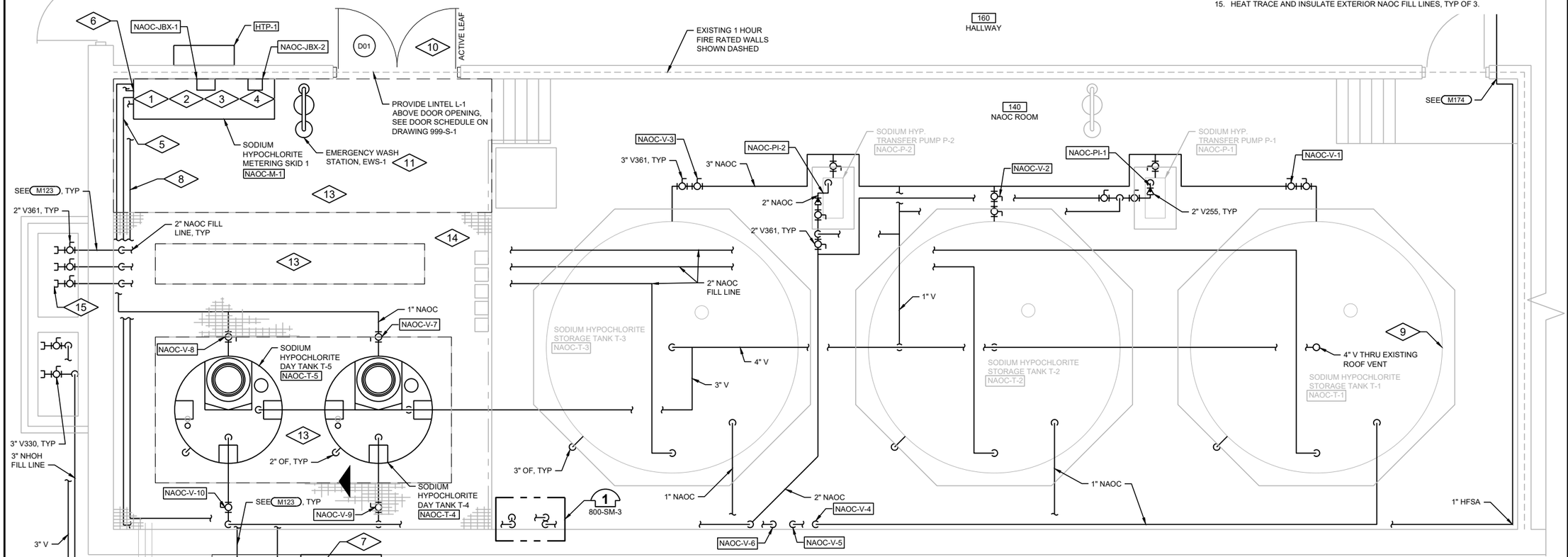
SECTION A
NTS 800-SM-3

GENERAL NOTES:

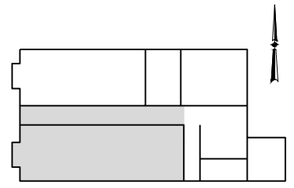
1. CONTRACTOR SHALL FIELD VERIFY EXISTING CONDITIONS, DIMENSIONS, AND ELEVATIONS PRIOR TO CONSTRUCTION AND/OR FABRICATION.
2. SEE SPECIFICATION SECTION 01 11 00 FOR PROJECT WORK SEQUENCES AND CONSTRAINTS.
3. ALL NAOC BALL VALVES SHALL BE VENTED.

PLAN NOTES:

1. SODIUM HYP. METERING PUMP P-3 NAOC-P-3
2. SODIUM HYP. METERING PUMP P-4 NAOC-P-4
3. SODIUM HYP. METERING PUMP P-5 NAOC-P-5
4. SODIUM HYP. METERING PUMP P-6 NAOC-P-6
5. 1" NAOC FEED LINES (2 LINES). 1" NAOC SPARES (2 LINES).
6. 1" NAOC FEED LINE. 1" NAOC SPARE.
7. 1/2" NHOH FEED LINE (1 LINE). 1/2" NHOH SPARE (1 LINE).
8. 1" NAOH FEED LINE (1 LINE). 1" NAOH SPARE (1 LINE).
9. REHABILITATE STORAGE TANK T-1.
10. COAT MASONRY WALL SURFACES DAMAGED AND REPLACED FROM INSTALLATION OF NEW DOOR AND FRAME AND LINTEL TO MATCH EXISTING WALLS. SEE SPECIFICATION 09 96 00.
11. USE EXISTING VALVES AND BACKFLOW PREVENTER RELATED TO THE EXISTING EMERGENCY WASH STATION. CONNECT TO EXISTING WATER PIPING.
12. MATCH ORIGINAL PIPE ELEVATIONS.
13. FLOOR AREAS INDICATED WITH DASHED LINES SHALL BE SURFACE PREPPED AND RECOATED PER SPECIFICATION 09 96 00. RECOAT WITH SYSTEM 21. FLOOR SURFACES SHALL BE COATED PRIOR TO MOUNTING EQUIPMENT.
14. REINSTALL FRP GRATING SECTIONS AND SUPPORTS AS REQUIRED AFTER COATING WORK HAS BEEN COMPLETED.
15. HEAT TRACE AND INSULATE EXTERIOR NAOC FILL LINES, TYP OF 3.



PARTIAL GRADE PLAN
0 3' 8'



KEY PLAN

01/06/2025

01/06/2025

Revision Number	Revision Description	Drawn By	Checked By	Date

Designed By	CDP/KAR
Drawn By	CDP/KAR
Checked By	TJB/SPG
Approved By	TJB/TMM
Filename	800SMP1.DWG
Project No.	14144
Project Date	JAN 2025

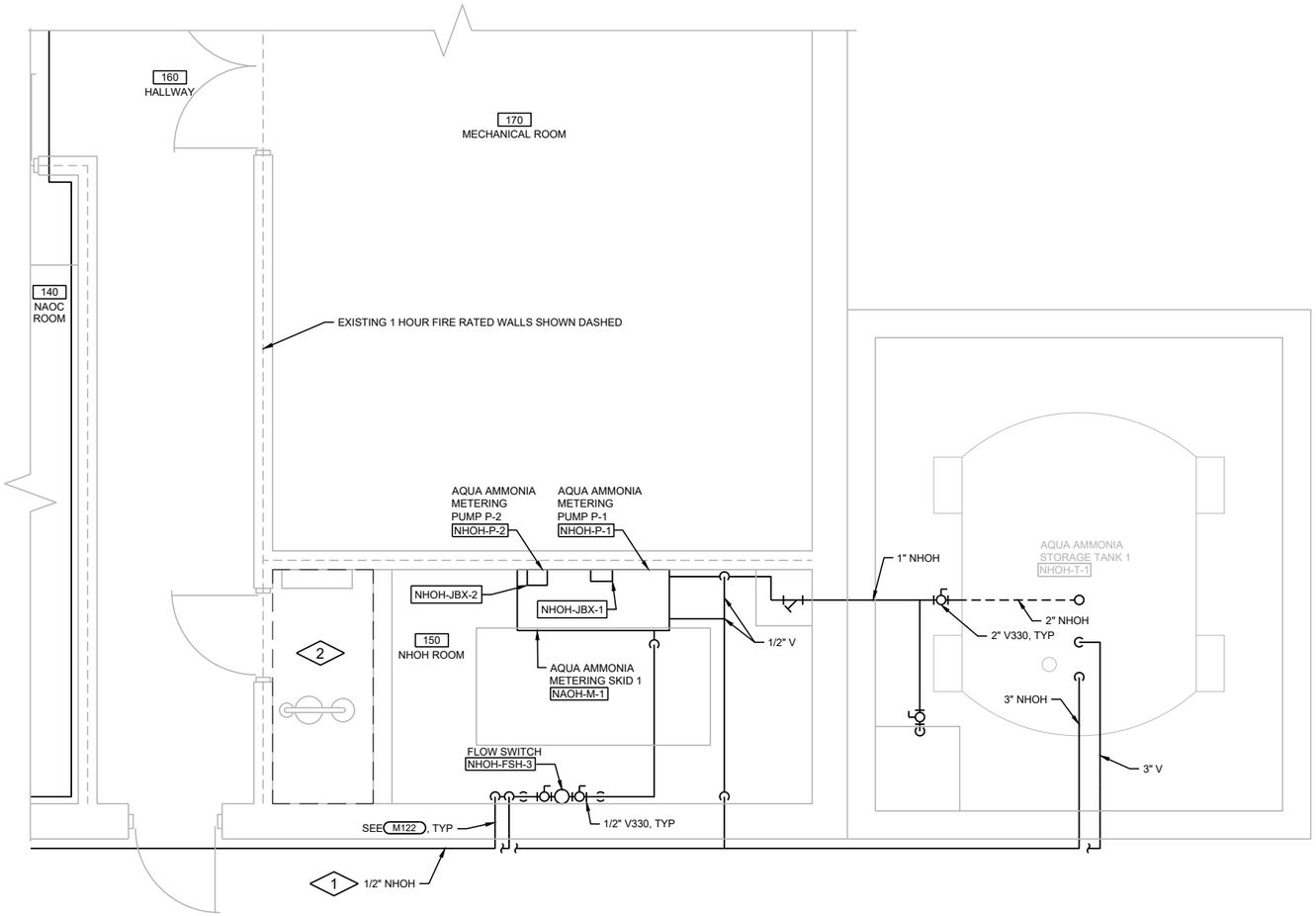
CITY OF BLOOMINGTON UTILITIES
MONROE WTP IMPROVEMENTS: CHEMICAL FEED LINE REPLACEMENT AND BACKWASH SYSTEM PUMP ADDITION AND TANK REHABILITATION - BLOOMINGTON, IN

CHEMICAL BUILDING PARTIAL GRADE PLAN

DONOHUE

Sheet No. 56

Drawing No. **800-SM-3**



PARTIAL GRADE PLAN

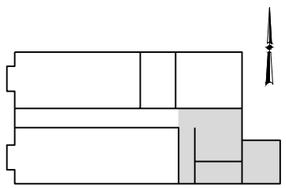
0 3' 8'

GENERAL NOTES:

1. CONTRACTOR SHALL FIELD VERIFY EXISTING CONDITIONS, DIMENSIONS, AND ELEVATIONS PRIOR TO CONSTRUCTION AND/OR FABRICATION.
2. SEE SPECIFICATION SECTION 01 11 00 FOR PROJECT WORK SEQUENCES AND CONSTRAINTS.
3. ALL NHOH BALL BALL VALVES SHALL BE VENTED.
4. MATCH ORIGINAL PIPE ELEVATIONS.

PLAN NOTES:

1. 1/2" NHOH FEED LINE (1 LINES). 1/2" NHOH SPARE (1 LINES).
2. FLOOR AREAS INDICATED WITH DASHED LINES SHALL BE SURFACE PREPPED AND RECOATED PER SPECIFICATION 09 96 00. RECOAT WITH SYSTEM 21. FLOOR SURFACES SHALL BE COATED PRIOR TO MOUNTING EQUIPMENT.



KEY PLAN

TIMOTHY J BATES REGISTERED No. 11400728 STATE OF INDIANA PROFESSIONAL ENGINEER
01/06/2025

TRENT M. MONTEMAYOR REGISTERED No. PE11200215 STATE OF INDIANA PROFESSIONAL ENGINEER
01/06/2025

Revision Number	Revision Description	Drawn By	Checked By	Date

Designed By	CDP/KAR
Drawn By	CDP/KAR
Checked By	TJB/SPG
Approved By	TJB/TMM
Filename	800SMP1.DWG
Project No.	14144
Project Date	JAN 2025

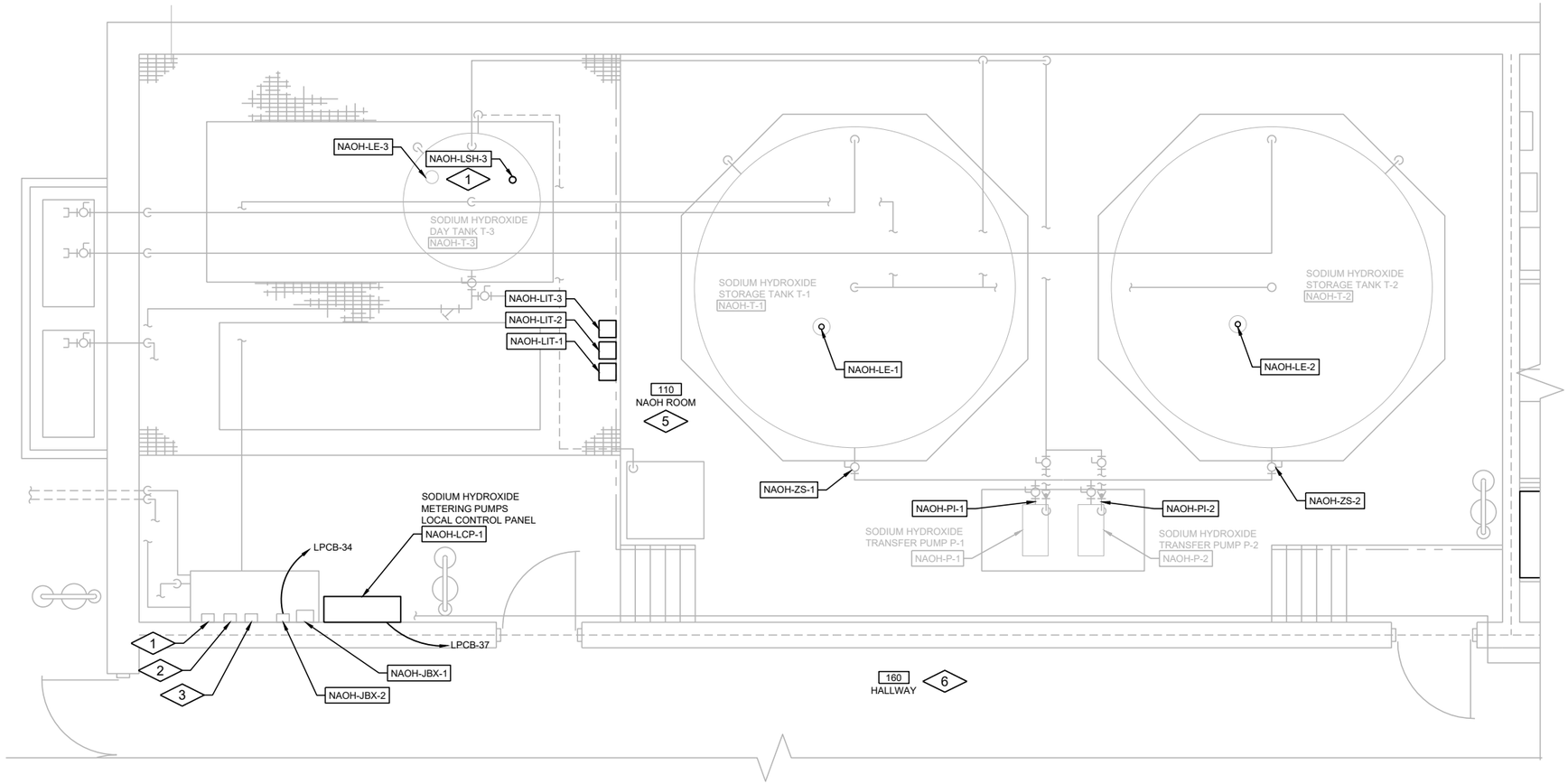
CITY OF BLOOMINGTON UTILITIES
MONROE WTP IMPROVEMENTS: CHEMICAL FEED LINE REPLACEMENT AND BACKWASH SYSTEM PUMP ADDITION AND TANK REHABILITATION - BLOOMINGTON, IN

CHEMICAL BUILDING
PARTIAL GRADE PLAN

DONOHUE

Sheet No. 57

Drawing No. 800-SM-4



PARTIAL GRADE PLAN

0 3' 8'

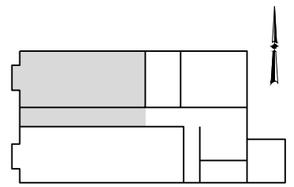
TAG NAME	DESCRIPTION	DETAIL	WIRING	DESTINATION
NAOH-LCP-1	SODIUM HYDROXIDE METERING PUMP LOCAL CONTROL PANEL	N170	(24) #14	PLC-10
			(6) STP	PLC-10
NAOH-JBX-1	SODIUM HYDROXIDE METERING SKID 1 JUNCTION BOX	MFR	(24) #14	NAOH-LCP-1
			(6) STP	NAOH-LCP-1
			(3) 3C-S	NAOH-LCP-1
NAOH-LIT-1	SODIUM HYDROXIDE STORAGE TANK T-1 LEVEL TRANSMITTER	N141	(1) STP	PLC-10
NAOH-LE-1	SODIUM HYDROXIDE STORAGE TANK T-1 LEVEL SENSOR	N230	(1) VFC	NAOH-LIT-1
NAOH-LIT-2	SODIUM HYDROXIDE STORAGE TANK T-2 LEVEL TRANSMITTER	N141	(1) STP	PLC-10
NAOH-LE-2	SODIUM HYDROXIDE STORAGE TANK T-2 LEVEL SENSOR	N230	(1) VFC	NAOH-LIT-2
NAOH-LIT-3	SODIUM HYDROXIDE DAY TANK T-3 LEVEL TRANSMITTER	N141	(1) STP	PLC-10
NAOH-LE-3	SODIUM HYDROXIDE DAY TANK T-3 LEVEL SENSOR	N230	(1) VFC	NAOH-LIT-3
NAOH-LSH-3	SODIUM HYDROXIDE DAY TANK T-3 HIGH LEVEL FLOAT SWITCH	N274	(2) #14	PLC-10
NAOH-PI-1	SODIUM HYPOCHLORITE TRANSFER PUMP 1 DISCHARGE PRESSURE GAUGE	N590	--	--
NAOH-PI-2	SODIUM HYPOCHLORITE TRANSFER PUMP 2 DISCHARGE PRESSURE GAUGE	N590	--	--
NAOH-ZS-1	SODIUM HYDROXIDE STORAGE TANK T-1 VALVE	MFR	(4) #14	PLC-10
NAOH-ZS-2	SODIUM HYDROXIDE STORAGE TANK T-2 VALVE	MFR	(4) #14	PLC-10
SEE DRAWING 999-N-1 FOR CONTROL WIRING GENERAL NOTES.				

GENERAL NOTES:

1. CONTRACTOR SHALL FIELD VERIFY EXISTING CONDITIONS, DIMENSIONS, AND ELEVATIONS PRIOR TO CONSTRUCTION AND/OR FABRICATION.
2. SEE SPECIFICATION SECTION 01 11 00 FOR PROJECT WORK SEQUENCES AND CONSTRAINTS.
3. IF OWNER ACCEPTS ALTERNATE 2, PERFORM ALL WORK ASSOCIATED WITH LIGHTING IN BUILDING 800.
4. ALL SIGNALS TO PLC-10 FROM EXISTING EQUIPMENT SHALL BE ROUTED VIA 10-JBX-1. NEW EQUIPMENT SHALL BE WIRED DIRECTLY TO PLC-10.
5. REUSE EXISTING CONDUIT AND SIGNAL WIRING WHENEVER POSSIBLE, ELSE PROVIDE NEW.

PLAN NOTES:

1. SODIUM HYDROXIDE METERING PUMP P-3 NAOH-P-3
2. SODIUM HYDROXIDE METERING PUMP P-4 NAOH-P-4
3. SODIUM HYDROXIDE METERING PUMP P-5 NAOH-P-5
4. CONTRACTOR TO MODIFY EXISTING TANK AND PROVIDE 3" FLANGE FOR NEW LEVEL SWITCH INSTALLATION.
5. REMOVE ALL EXISTING LIGHT FIXTURES IN ROOM 110 (16 TOTAL), AND REPLACE WITH TYPE "L1" FIXTURES, INCLUDE A MINIMUM OF 4 TYPE "L1X" FIXTURES (BATTERY BACK-UP) AS A PART OF THE REPLACEMENT. BACK-UP BATTERY FIXTURES SHALL PROVIDE A PATH OF EGRESS. LOCATE NEW FIXTURES IS SAME LOCATION OF EXISTING FIXTURES. RE-USE EXISTING WIRE AND CONDUIT.
6. REMOVE ALL EXISTING LIGHT FIXTURES IN ROOM 160 (12 TOTAL), AND REPLACE WITH TYPE "L2" FIXTURES, INCLUDE A MINIMUM OF 3 TYPE "L2X" FIXTURES (BATTERY BACK-UP) AS A PART OF THE REPLACEMENT. BACK-UP BATTERY FIXTURES SHALL PROVIDE A PATH OF EGRESS. LOCATE NEW FIXTURES IS SAME LOCATION OF EXISTING FIXTURES. RE-USE EXISTING WIRE AND CONDUIT.



KEY PLAN

CHASE E. BENTON REGISTERED No. 12300012 STATE OF INDIANA PROFESSIONAL ENGINEER
01/06/2025

ARIC BERGSTROM REGISTERED No. PE11706G52 STATE OF INDIANA PROFESSIONAL ENGINEER
1-6-25

Revision Number	Revision Description	Drawn By	Checked By	Date

Designed By	CEB/JCE
Drawn By	CEB/JCE
Checked By	JEF/AHB
Approved By	CEB/AHB
Filename	800ENP1.DWG
Project No.	14144
Project Date	JAN 2025

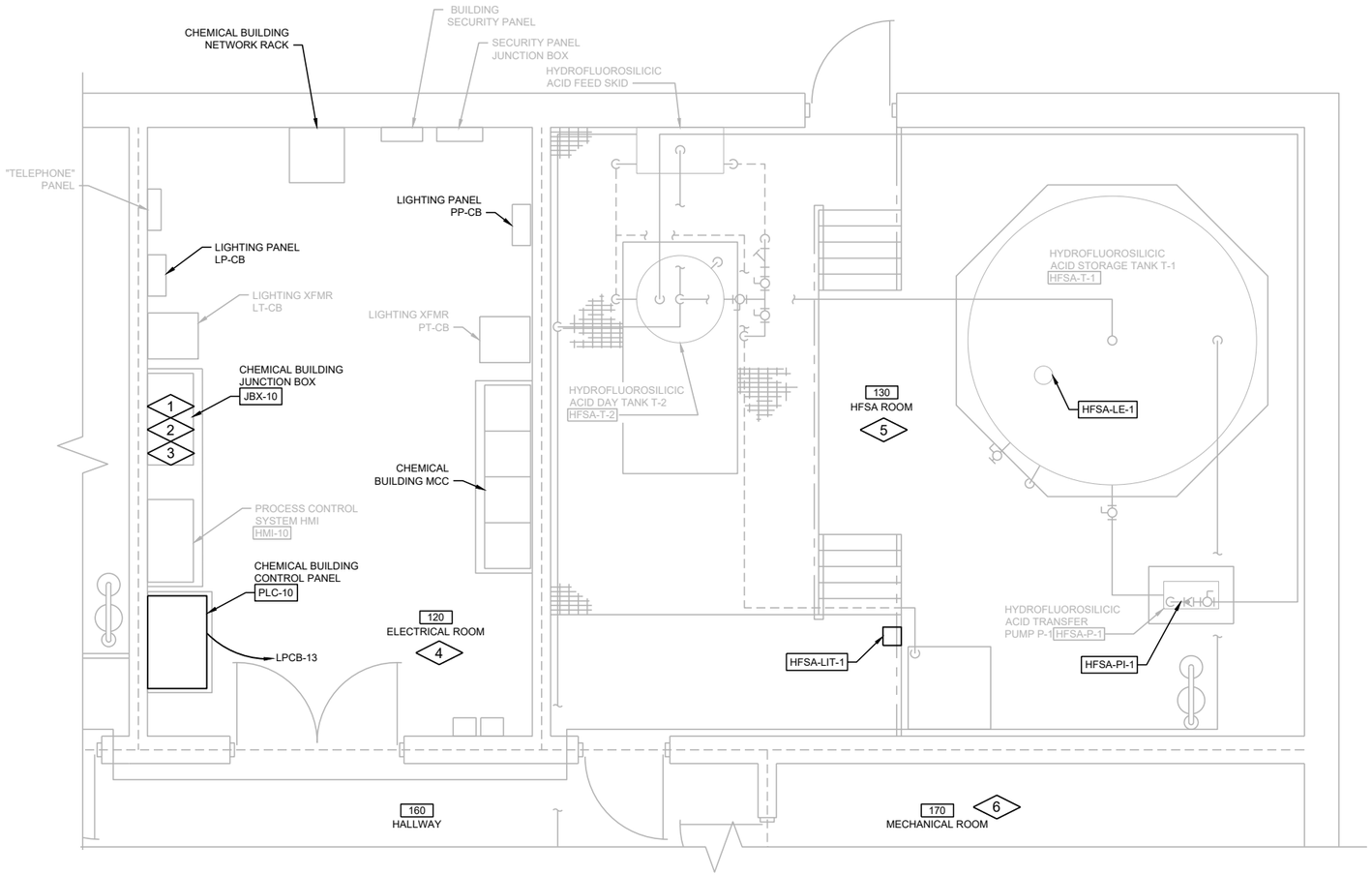
CITY OF BLOOMINGTON UTILITIES
MONROE WTP IMPROVEMENTS: CHEMICAL FEED LINE REPLACEMENT AND BACKWASH SYSTEM PUMP ADDITION AND TANK REHABILITATION - BLOOMINGTON, IN

CHEMICAL BUILDING
PARTIAL GRADE PLAN

DONOHUE

Sheet No. 58

Drawing No. 800-EN-1



PARTIAL GRADE PLAN

0 3' 8'

TAG NAME	DESCRIPTION	DETAIL	WIRING	DESTINATION
PLC-10	CHEMICAL BUILDING CONTROL PANEL	N180	(1) CE	NETWORK RACK
JBX-10	CHEMICAL BUILDING CONTROL JUNCTION BOX	--	(302) #14	PLC-10
			(29) STP	PLC-10
HFSA-LIT-1	HYFROFLUOSILICIC ACID STORAGE TANK T-1 RADAR LEVEL TRANSMITTER	N150	EXISTING	JBX-10
HFSA-LE-1	HYFROFLUOSILICIC ACID STORAGE TANK T-1 RADAR LEVEL SENSOR	N230	(1) VFC	HFSA-LIT-1
HFSA-PI-1	HYDROFLUOSILICIC ACID TRANSFER PUMP P-1 DISCHARGE PRESSURE GAUGE	N590	--	--
SEE DRAWING 999-N-1 FOR CONTROL WIRING GENERAL NOTES.				

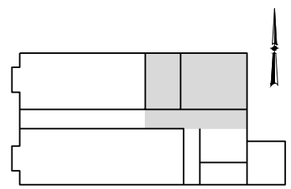
3

GENERAL NOTES:

1. CONTRACTOR SHALL FIELD VERIFY EXISTING CONDITIONS, DIMENSIONS, AND ELEVATIONS PRIOR TO CONSTRUCTION AND/OR FABRICATION.
2. SEE SPECIFICATION SECTION 01 11 00 FOR PROJECT WORK SEQUENCES AND CONSTRAINTS.
3. IF OWNER ACCEPTS ALTERNATE 1, PERFORM ALL WORK IN THE FLUORIDE ROOM.
4. IF OWNER ACCEPTS ALTERNATE 2, PERFORM ALL WORK ASSOCIATED WITH LIGHTING IN BUILDING 800.
5. ALL SIGNALS TO PLC-10 SHALL BE ROUTED VIA 10-JBX-1.
6. REUSE EXISTING CONDUIT AND SIGNAL WIRING WHENEVER POSSIBLE, ELSE PROVIDE NEW.

PLAN NOTES:

1. PROVIDE TERMINAL STRIPS FOR CONTROL WRING EXTENSION. TERMINATE NEW AND EXISTING CONDUCTORS ON TERMINAL STRIPS. SPLICING SIGNAL CONDUCTORS ARE NOT PERMITTED.
2. PROVIDE NEW PANEL NAMEPLATE AS SHOWN AND IN ACCORDANCE WITH SECTION 40 67 15.
3. ANY AND ALL SIGNALS IN THIS ENCLOSURE SHALL BE EXTENDED TO NEW PLC-10 ENCLOSURE.
4. REMOVE ALL EXISTING LIGHT FIXTURES IN ROOM 120 (6 TOTAL), AND REPLACE WITH TYPE "L1" FIXTURES, INCLUDE A MINIMUM OF 2 TYPE "L1X" FIXTURES (BATTERY BACK-UP) AS A PART OF THE REPLACEMENT. BACK-UP BATTERY FIXTURES SHALL PROVIDE A PATH OF EGRESS. LOCATE NEW FIXTURES IS SAME LOCATION OF EXISTING FIXTURES. RE-USE EXISTING WIRE AND CONDUIT.
5. REMOVE ALL EXISTING LIGHT FIXTURES IN ROOM 130 (7 TOTAL), AND REPLACE WITH TYPE "L1" FIXTURES, INCLUDE A MINIMUM OF 2 TYPE "L1X" FIXTURES (BATTERY BACK-UP) AS A PART OF THE REPLACEMENT. BACK-UP BATTERY FIXTURES SHALL PROVIDE A PATH OF EGRESS. LOCATE NEW FIXTURES IS SAME LOCATION OF EXISTING FIXTURES. RE-USE EXISTING WIRE AND CONDUIT.
6. REMOVE ALL EXISTING LIGHT FIXTURES IN MECHANICAL ROOM (9 TOTAL), AND REPLACE WITH TYPE "L1" FIXTURES, INCLUDE A MINIMUM OF 3 TYPE "L1X" FIXTURES (BATTERY BACK-UP) AS A PART OF THE REPLACEMENT. BACK-UP BATTERY FIXTURES SHALL PROVIDE A PATH OF EGRESS. LOCATE NEW FIXTURES IS SAME LOCATION OF EXISTING FIXTURES. RE-USE EXISTING WIRE AND CONDUIT.



KEY PLAN

CHASE E. BENTON REGISTERED No. 12300012 STATE OF INDIANA PROFESSIONAL ENGINEER
01/06/2025

ARIC BERGSTROM REGISTERED No. PE11706052 STATE OF INDIANA PROFESSIONAL ENGINEER
1-6-25

Revision Number	Revision Description	Drawn By	Checked By	Date

Designed By	CEB/JCE
Drawn By	CEB/JCE
Checked By	JEF/AHB
Approved By	CEB/AHB
Filename	800ENP1.DWG
Project No.	14144
Project Date	JAN 2025

CITY OF BLOOMINGTON UTILITIES
MONROE WTP IMPROVEMENTS: CHEMICAL FEED LINE REPLACEMENT AND BACKWASH SYSTEM PUMP ADDITION AND TANK REHABILITATION - BLOOMINGTON, IN

CHEMICAL BUILDING PARTIAL GRADE PLAN

DONOHUE

Sheet No. 59

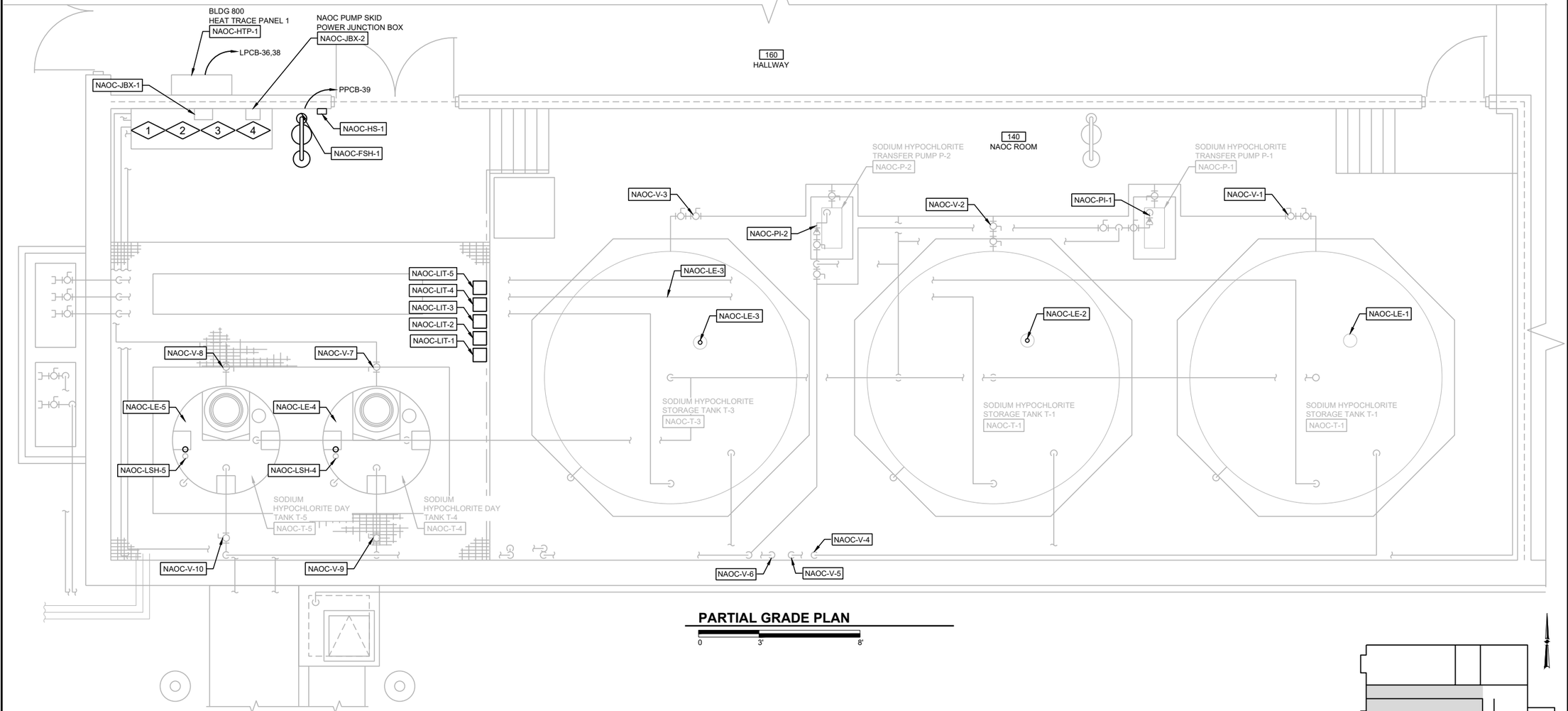
Drawing No. 800-EN-2

GENERAL NOTES:

1. CONTRACTOR SHALL FIELD VERIFY EXISTING CONDITIONS, DIMENSIONS, AND ELEVATIONS PRIOR TO CONSTRUCTION AND/OR FABRICATION.
2. SEE SPECIFICATION SECTION 01 11 00 FOR PROJECT WORK SEQUENCES AND CONSTRAINTS.
3. IF OWNER ACCEPTS ALTERNATE 2, PERFORM ALL WORK ASSOCIATED WITH LIGHTING IN BUILDING 800.
4. ALL SIGNALS TO PLC-10 SHALL BE ROUTED VIA 10-JBX-1.
5. REUSE EXISTING CONDUIT AND SIGNAL WIRING WHENEVER POSSIBLE, ELSE PROVIDE NEW.

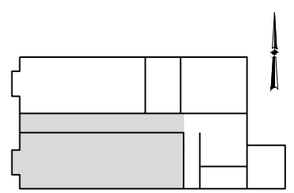
PLAN NOTES:

1. SODIUM HYP. METERING PUMP P-3 NAOC-P-3
2. SODIUM HYP. METERING PUMP P-4 NAOC-P-4
3. SODIUM HYP. METERING PUMP P-5 NAOC-P-5
4. SODIUM HYP. METERING PUMP P-6 NAOC-P-6
5. REMOVE ALL EXISTING LIGHT FIXTURES IN ROOM 140 (20 TOTAL), AND REPLACE WITH TYPE "L1" FIXTURES, INCLUDE A MINIMUM OF 5 TYPE "L1X" FIXTURES (BATTERY BACK-UP) AS A PART OF THE REPLACEMENT. BACK-UP BATTERY FIXTURES SHALL PROVIDE A PATH OF EGRESS. LOCATE NEW FIXTURES IS SAME LOCATION OF EXISTING FIXTURES. RE-USE EXISTING WIRE AND CONDUIT.



PARTIAL GRADE PLAN

0 3' 8'



KEY PLAN

TAG NAME	DESCRIPTION	DETAIL	WIRING	DESTINATION
NAOC-LIT-1	SODIUM HYPOCHLORITE STORAGE TANK 1 LEVEL TRANSMITTER	N141	(1) STP	PLC-10
NAOC-LE-1	SODIUM HYPOCHLORITE STORAGE TANK 1 LEVEL SENSOR	N230	(1) VFC	NAOH-LIT-1
NAOC-LIT-2	SODIUM HYPOCHLORITE STORAGE TANK 2 LEVEL TRANSMITTER	N141	(1) STP	PLC-10
NAOC-LE-2	SODIUM HYPOCHLORITE STORAGE TANK 2 LEVEL SENSOR	N230	(1) VFC	NAOH-LIT-1
NAOC-LIT-3	SODIUM HYPOCHLORITE STORAGE TANK 3 LEVEL TRANSMITTER	N141	(1) STP	PLC-10
NAOC-LE-3	SODIUM HYPOCHLORITE STORAGE TANK 3 LEVEL SENSOR	N230	(1) VFC	NAOH-LIT-1
NAOC-LIT-4	SODIUM HYPOCHLORITE DAY TANK 4 LEVEL TRANSMITTER	N141	(1) STP	PLC-10
NAOC-LE-4	SODIUM HYPOCHLORITE DAY TANK 4 LEVEL SENSOR	N230	(1) VFC	NAOH-LIT-1
NAOC-LSH-4	SODIUM HYPOCHLORITE DAY TANK 4 HIGH-LEVEL FLOAT SWITCH	N274	(2) #14	PLC-10
NAOC-LIT-5	SODIUM HYPOCHLORITE DAY TANK 5 LEVEL TRANSMITTER	N141	(1) STP	PLC-10
NAOC-LE-5	SODIUM HYPOCHLORITE DAY TANK 5 LEVEL SENSOR	N230	(1) VFC	NAOH-LIT-1
NAOC-LSH-5	SODIUM HYPOCHLORITE DAY TANK 5 HIGH-LEVEL FLOAT SWITCH	N274	(2) #14	PLC-10
NAOC-V-1	NAOC VALVE 1	MFR	(10) #14	PLC-10
NAOC-V-2	NAOC VALVE 2	MFR	(10) #14	PLC-10

TAG NAME	DESCRIPTION	DETAIL	WIRING	DESTINATION
NAOC-V-3	NAOC VALVE 3	MFR	(10) #14	PLC-10
NAOC-V-4	NAOC VALVE 4	MFR	(10) #14	PLC-10
NAOC-V-5	NAOC VALVE 5	MFR	(10) #14	PLC-10
NAOC-V-6	NAOC VALVE 6	MFR	(10) #14	PLC-10
NAOC-V-7	NAOC VALVE 7	MFR	(10) #14	PLC-10
NAOC-V-8	NAOC VALVE 8	MFR	(10) #14	PLC-10
NAOC-V-9	NAOC VALVE 9	MFR	(10) #14	PLC-10
NAOC-V-10	NAOC VALVE 10	MFR	(10) #14	PLC-10
NAOC-PI-1	SODIUM HYPOCHLORITE TRANSFER PUMP 1 DISCHARGE PRESSURE GAUGE	N590	--	--
NAOC-PI-2	SODIUM HYPOCHLORITE TRANSFER PUMP 2 DISCHARGE PRESSURE GAUGE	N590	--	--
NAOC-HS-1	SODIUM HYPOCHLORITE EMERGENCY WASH STATION RESET SWITCH	N171	(2) #14	PLC-10
NAOC-FSH-1	SODIUM HYPOCHLORITE EMERGENCY WASH STATION FLOW SWITCH	N370	(2) #14	NAOC-HS-1
NAOC-JBX-1	SODIUM HYPOCHLORITE METERING SKID 1 JUNCTION BOX	MFR	(32) #14 (8) STP	PLC-10 PLC-10
NAOC-HTP-1	BUILDING 800 HEAT TRACE PANEL	N170	(12) #14	PLC-10

CHASE E. BENTON REGISTERED No. 12300012 STATE OF INDIANA PROFESSIONAL ENGINEER
01/06/2025

ARIC BERGSTROM REGISTERED No. PE11706652 STATE OF INDIANA PROFESSIONAL ENGINEER
1-6-25

Revision Number	Revision Description	Drawn By	Checked By	Date

Designed By	CEB/JCE
Drawn By	CEB/JCE
Checked By	JEF/AHB
Approved By	CEB/AHB
Filename	800ENP1.DWG
Project No.	14144
Project Date	JAN 2025

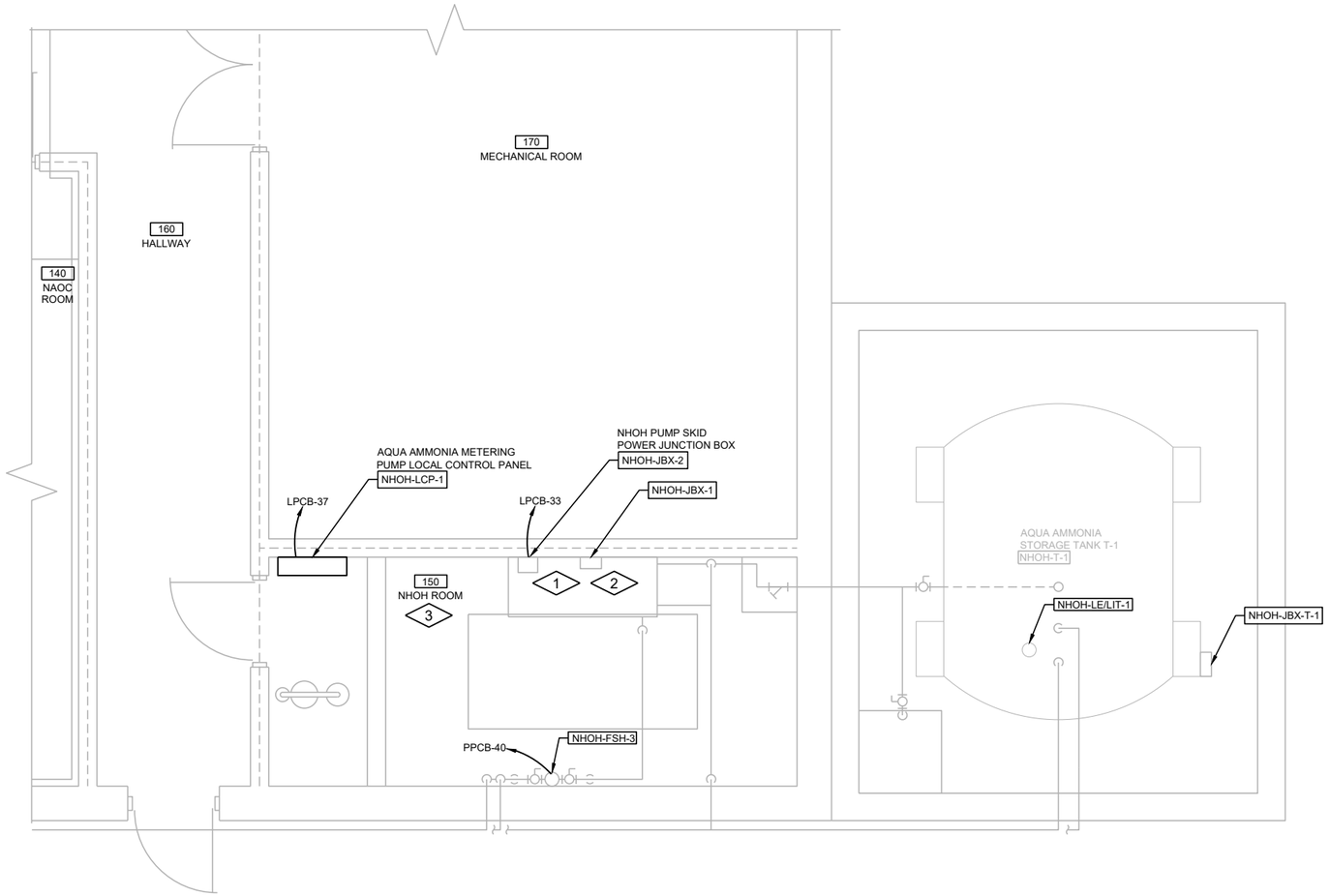
CITY OF BLOOMINGTON UTILITIES
MONROE WTP IMPROVEMENTS: CHEMICAL FEED LINE REPLACEMENT AND BACKWASH SYSTEM PUMP ADDITION AND TANK REHABILITATION - BLOOMINGTON, IN

CHEMICAL BUILDING
PARTIAL GRADE PLAN

DONOHUE

Sheet No. 60

Drawing No. 800-EN-3



PARTIAL GRADE PLAN

0 3' 8'

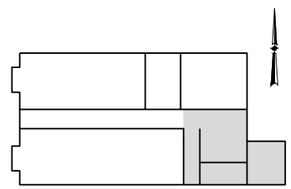
TAG NAME	DESCRIPTION	DETAIL	WIRING	DESTINATION
NHOH-LCP-1	AQUA AMMONIA METERING PUMP LOCAL CONTROL PANEL	N170	(8) #14	PLC-10
			(4) STP	PLC-10
NHOH-JBX-1	AQUA AMMONIA METERING SKID 1 JUNCTION BOX 1	MFR	(16) #14	NHOH-LCP-1
			(4) STP	NHOH-LCP-1
			(2) 3C-S	NHOH-LCP-1
NHOH-LIT-1	AQUA AMMONIA STORAGE TANK 1 LEVEL TRANSMITTER	--	(1) STP	NAOH-LCP-1
NHOH-JBX-T-1	AQUA AMMONIA STORAGE TANK T-1 JUNCTION BOX	--	(1) STP	NHOH-LIT-1
NHOH-LE-1	AQUA AMMONIA STORAGE TANK T-1 LEVEL ELEMENT	--	(1) VFC	NHOH-JBX-T-1
NHOH-FSH-3	AQUA AMMONIA METERING SKID 1 FLOW SWITCH	MFR	(4) #14	PLC-10
SEE DRAWING 999-N-1 FOR CONTROL WIRING GENERAL NOTES.				

GENERAL NOTES:

1. CONTRACTOR SHALL FIELD VERIFY EXISTING CONDITIONS, DIMENSIONS, AND ELEVATIONS PRIOR TO CONSTRUCTION AND/OR FABRICATION.
2. SEE SPECIFICATION SECTION 01 11 00 FOR PROJECT WORK SEQUENCES AND CONSTRAINTS.
3. IF OWNER ACCEPTS ALTERNATE 2, PERFORM ALL WORK ASSOCIATED WITH LIGHTING IN BUILDING 800.
4. ALL SIGNALS TO PLC-10 SHALL BE ROUTED VIA 10-JBX-1.
5. REUSE EXISTING CONDUIT AND SIGNAL WIRING WHENEVER POSSIBLE, ELSE PROVIDE NEW.

PLAN NOTES: ◇

1. AQUA AMMONIA METERING PUMP P-1 NHOH-P-1
2. AQUA AMMONIA METERING PUMP P-2 NHOH-P-2
3. REMOVE ALL EXISTING LIGHT FIXTURES IN ROOM 150 (4 TOTAL), AND REPLACE WITH TYPE "L1" FIXTURES, INCLUDE A MINIMUM OF 1 TYPE "L1X" FIXTURE (BATTERY BACK-UP) AS A PART OF THE REPLACEMENT. BACK-UP BATTERY FIXTURES SHALL PROVIDE A PATH OF EGRESS. LOCATE NEW FIXTURES IS SAME LOCATION OF EXISTING FIXTURES. RE-USE EXISTING WIRE AND CONDUIT.



KEY PLAN

CHASE E. BENTON
REGISTERED
No. 12300012
STATE OF INDIANA
PROFESSIONAL ENGINEER
01/06/2025

ARC BERGSTROM
REGISTERED
No. PE11706G52
STATE OF INDIANA
PROFESSIONAL ENGINEER
1-6-25

Revision Number	Revision Description	Drawn By	Checked By	Date

Designed By	CEB/JCE
Drawn By	CEB/JCE
Checked By	JEF/AHB
Approved By	CEB/AHB
Filename	800ENP1.DWG
Project No.	14144
Project Date	JAN 2025

CITY OF BLOOMINGTON UTILITIES
MONROE WTP IMPROVEMENTS: CHEMICAL FEED LINE REPLACEMENT AND BACKWASH SYSTEM PUMP ADDITION AND TANK REHABILITATION - BLOOMINGTON, IN

CHEMICAL BUILDING
PARTIAL GRADE PLAN

DONOHUE

Sheet No. 61

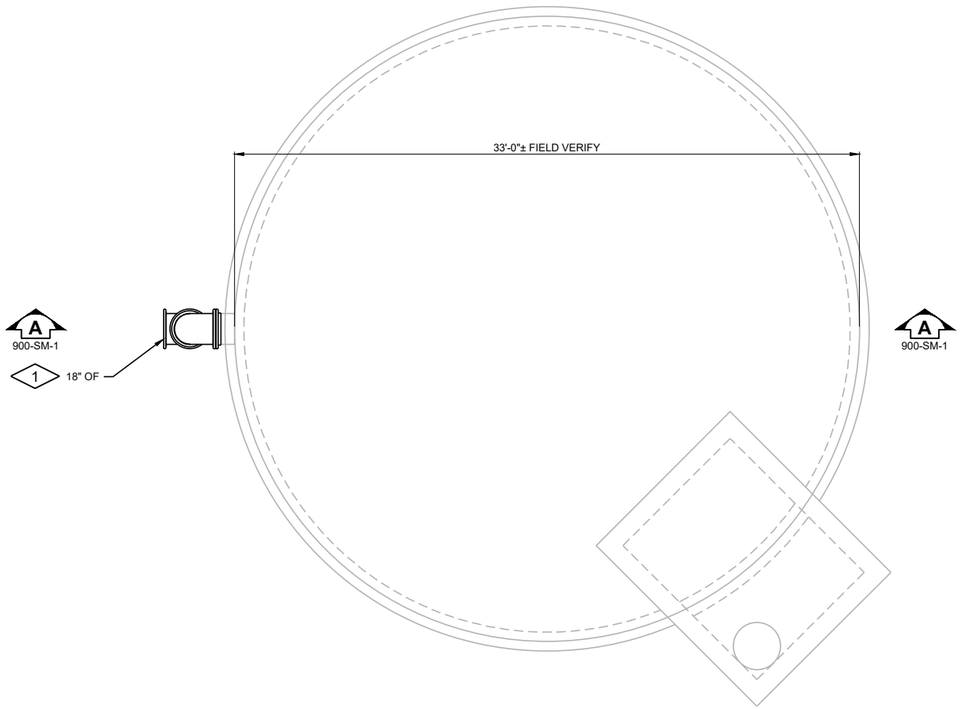
Drawing No. 800-EN-4

GENERAL NOTES:

1. CONTRACTOR SHALL FIELD VERIFY EXISTING CONDITIONS, DIMENSIONS, AND ELEVATIONS PRIOR TO CONSTRUCTION AND/OR FABRICATION.
2. SEE SPECIFICATION SECTION 01 11 00 FOR PROJECT WORK SEQUENCES AND CONSTRAINTS.

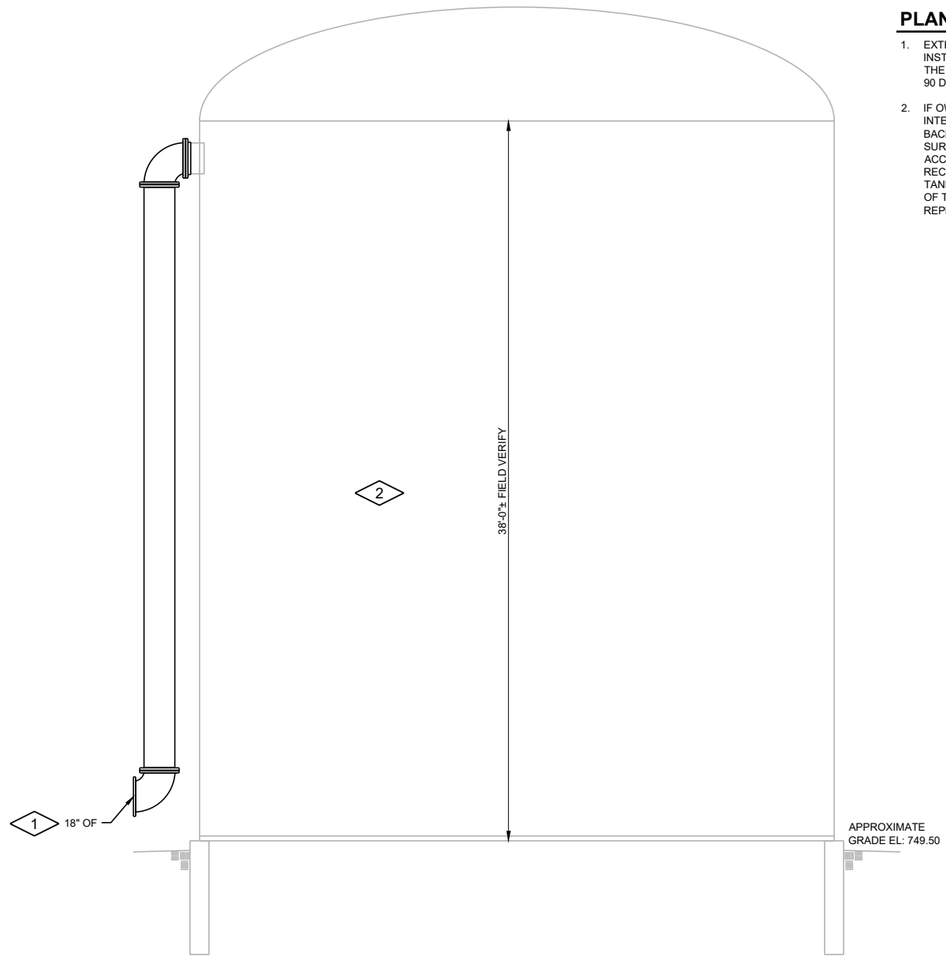
PLAN NOTES:

1. EXTEND THE 18" OF PIPE TO 18" ABOVE GRADE. INSTALL A PVC BIRD SCREEN ON THE END OF THE PIPE. ADD A PEDESTAL SUPPORT AT THE 90 DEGREE ELBOW.
2. IF OWNER ACCEPTS ALTERNATE 3, ALL INTERIOR AND EXTERIOR SURFACES OF THE BACKWASH TANK SHALL BE SAND BLASTED, SURFACE PREPPED AND RECOATED IN ACCORDANCE WITH SPECIFICATION 09 96 00. RECOAT THE INTERIOR OF THE BACKWASH TANK WITH SYSTEM 27. RECOAT THE EXTERIOR OF THE BACKWASH TANK WITH SYSTEM 9. REPLACE GASKET ON MANWAY.



GRADE PLAN

0 1' 4'



SECTION A

900-SM-1

0 1' 4'

TIMOTHY J BATES REGISTERED No. 11400728 STATE OF INDIANA PROFESSIONAL ENGINEER

01/06/2025

TRENT M. MONTEMAYOR REGISTERED No. PE11200215 STATE OF INDIANA PROFESSIONAL ENGINEER

01/06/2025

Revision Number	Revision Description	Drawn By	Checked By	Date

Designed By	CDP/KAR
Drawn By	CDP/KAR
Checked By	TJB/SPG
Approved By	TJB/TMM
Filename	900SMP1.DWG
Project No.	14144
Project Date	JAN 2025

CITY OF BLOOMINGTON UTILITIES
MONROE WTP IMPROVEMENTS: CHEMICAL FEED LINE REPLACEMENT AND BACKWASH SYSTEM PUMP ADDITION AND TANK REHABILITATION - BLOOMINGTON, IN

BACKWASH TANK PLAN AND SECTION

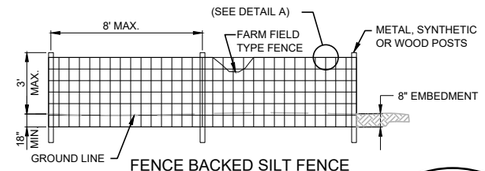
DONOHUE

Sheet No. 62

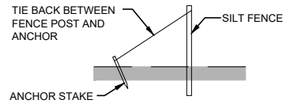
Drawing No. 900-SM-1

GENERAL NOTES

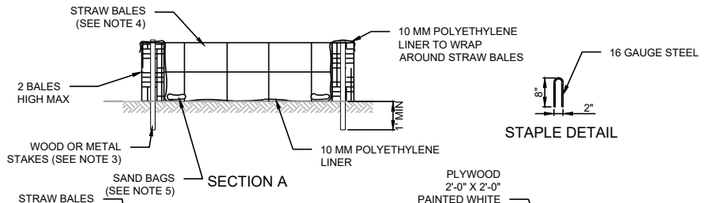
1. THE TOPOGRAPHIC MAPPING SHOWN IS BASED ON A SURVEY BY BLEDSOE RIGGERT COOPER JAMES IN OCTOBER 2022. THE HORIZONTAL DATUM IS NAD83 INDIANA STATE PLANE COORDINATES, WEST ZONE. THE VERTICAL DATUM IS NAVD-88.
2. DIMENSIONS OR COORDINATES TAKE PRECEDENCE OVER SCALE. CONTRACTORS TO VERIFY ALL DIMENSIONS AND COORDINATES IN THE FIELD FOR PROPER FIT AND ALIGNMENT.
3. THE CONTRACTOR SHALL CONTACT INDIANA 811 AT 1-800-382-5544 A MINIMUM OF 72 HOURS PRIOR TO PERFORMING ANY EARTH MOVING OR EXCAVATION ACTIVITIES. THE CONTRACTOR SHALL ALSO CONTACT ANY OTHER UTILITIES WHICH MAY BE PRESENT WHICH ARE NOT PART OF THE ONE CALL SYSTEM. NOTIFY PLANT STAFF ONE WEEK IN ADVANCE OF PLANT UTILITY LOCATION NEEDS TO ALLOW ADEQUATE RESPONSE TIME FOR PLANT STAFF.
4. EXISTING BURIED UTILITIES SHOWN IN PLAN AND PROFILE ARE INDICATED IN ACCORDANCE WITH THE AVAILABLE RECORDS AND FIELD INFORMATION AVAILABLE TO THE ENGINEER. OTHER UTILITIES MAY ALSO BE PRESENT. THE CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING FROM THE OWNERS OF THE EXISTING UTILITIES THE LOCATION OF THEIR BURIED FACILITIES. ANY UTILITIES DAMAGED OR DESTROYED BY THE CONTRACTOR'S OPERATIONS WHETHER SHOWN ON THE DRAWINGS OR NOT, SHALL BE REPLACED OR REPAIRED TO THE UTILITY'S SATISFACTION AT NO COST TO THE OWNER.
5. IF UTILITY FACILITIES OTHER THAN THOSE SHOWN ARE LOCATED, OR IF UTILITIES ARE LOCATED WHICH ARE NOT IN ACCORDANCE WITH THE LOCATION SHOWN ON THE DRAWINGS, THE ENGINEER SHALL BE NOTIFIED TO DETERMINE IF PLAN REVISIONS ARE NEEDED. CONTRACTOR IS REQUIRED TO FIELD LOCATE ALL CROSSING UTILITIES SUFFICIENTLY IN ADVANCE OF CONSTRUCTION ACTIVITIES TO ALLOW ENGINEER TO REVISE LOCATIONS OF NEW FACILITIES TO AVOID CONFLICTS WITHOUT ADDITIONAL COST TO OWNER.
6. ACCESS CONSTRAINTS TO BE PLACED ON THE CONTRACTOR FOR THE PROJECT ARE SPECIFIED IN SECTION 01 11 00 OF THE SPECIFICATIONS.
7. CONTRACTOR SHALL MAINTAIN ACCESS TO ALL SITE FACILITIES DURING CONSTRUCTION. CONTRACTOR SHALL PLAN ITS WORK SEQUENCE AND ACTIVITIES TO ENSURE THAT ITS WORK DOES NOT INTERFERE WITH PUBLIC NEEDS OR PUBLIC FACILITIES OPERATIONS, DELIVERIES, PICKUPS OR OTHER ACCESS NEEDS.
8. THE CONTRACTOR SHALL COORDINATE THE ACTIVITIES OF ITS PERSONNEL, SUBCONTRACTORS, AND UTILITIES PERFORMING WORK ON THIS PROJECT. THE CONTRACTOR SHALL ALSO COORDINATE WITH CITY CREWS AND OTHER CONTRACTORS WORKING IN OR NEAR THE PROJECT AREA.
9. THE CONTRACTOR SHALL MAINTAIN ON FILE WITH THE OWNER AND ENGINEER A CURRENT LIST OF EMERGENCY TELEPHONE NUMBERS FOR THE CONTRACTORS SUPERVISORY PERSONNEL ASSIGNED TO THIS PROJECT. NO LESS THAN 2 NAMES WITH 24 HOUR PHONE NUMBERS SHALL BE INCLUDED.
10. ELEVATIONS CALLED OUT ON THE DRAWINGS ARE TYPICALLY AT THE "INVERT" OR BOTTOM OF PIPES AND STRUCTURES, ALONG THE FLOW LINE IN GUTTERS AND SWALES, AND AT THE "RIM" OR TOP (FINISHED GRADE) OF THE FRAME AND COVERS. OTHER ELEVATIONS ARE SPECIFICALLY NOTED.
11. UNLESS NOTED OTHERWISE RESTORATION OF EXISTING SANITARY SEWERS AND SERVICE LINES, WATER MAINS AND SERVICE LINES, STORM SEWERS, OTHER UTILITIES, SIDEWALKS, CURBS, DRIVEWAYS, STREETS OR OTHER IMPROVEMENTS NOT SHOWN AS BEING REMOVED, REPLACED OR MODIFIED BY THE PROJECT IS REQUIRED ONLY TO THE EXTENT THEY ARE DAMAGED OR DISTURBED BY CONSTRUCTION ACTIVITIES. THE CONTRACTOR SHALL RESTORE ALL DAMAGED AND DISTURBED IMPROVEMENTS TO THE IMPROVEMENT OWNERS AND ENGINEERS SATISFACTION.
12. WHERE NEW WORK ABUTS EXISTING CURBS, SIDEWALK, DRIVES, OR OTHER PAVEMENTS WHICH ARE TO REMAIN IN PLACE, THE CONTRACTOR SHALL PROVIDE NEAT SAWCUTS, FULL DEPTH AT THE LIMIT OF CONSTRUCTION.
13. CONTRACTOR SHALL PROVIDE SUPPORT AND SHALL MAINTAIN SERVICE TO ALL ABOVE AND BELOW GRADE UTILITIES INCLUDING POLES, CABLES, WIRES, WATER, GAS, STORM , AND SANITARY FACILITIES, OR WITH THE WRITTEN CONCURRENCE OF THE UTILITY OWNER, MAY REMOVE, STORE, REINSTALL AND REPLACE AS NECESSARY.
14. CONTRACTOR IS RESPONSIBLE FOR SITE SAFETY DURING CONSTRUCTION OF THE PROJECT.
15. THE CONTRACTOR SHALL PROTECT ALL PROPERTY PINS (STEEL REBARS, PIPES, CAPPED PINS, ETC.) WHICH WERE FOUND OR LOCATED ON THE PROJECT SITE WHETHER SHOWN ON THE PLANS OR ENCOUNTERED DURING CONSTRUCTION FROM BEING DAMAGED, DESTROYED OR MOVED. IF PROPERTY PINS ARE DAMAGED, DESTROYED OR MOVED, THE CONTRACTOR SHALL PROVIDE THE SERVICES OF A REGISTERED INDIANA LAND SURVEYOR TO REPLACE THEM AT NO COST TO THE OWNER.
16. AS PART OF THE CONTRACTORS RESPONSIBILITIES A DETAILED SET OF RECORD DRAWINGS SHALL BE KEPT TO RECORD CHANGES OR DEVIATIONS FROM THE PLANS AND TO SHOW EXISTING UNDERGROUND UTILITIES OR OTHER FEATURES ENCOUNTERED DURING CONSTRUCTION.



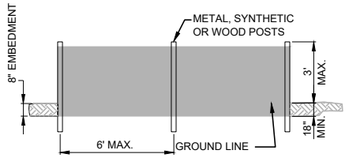
FENCE BACKED SILT FENCE



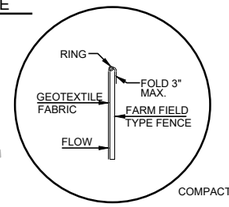
TIE BACK DETAIL



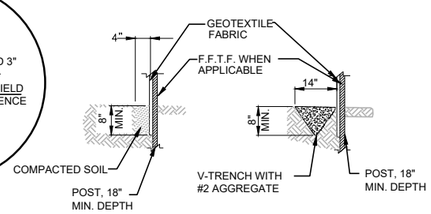
STAPLE DETAIL



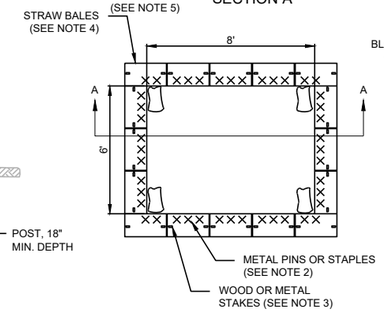
UNSUPPORTED SILT FENCE



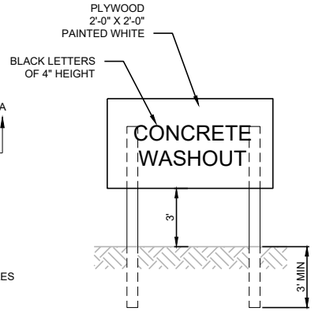
DETAIL A



TRENCH DETAIL



PLAN

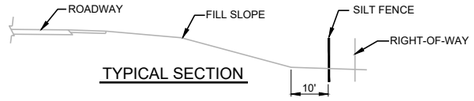


CONCRETE WASHOUT DETAIL

NOTES:
1. THE CONCRETE WASHOUT SIGN SHALL BE INSTALLED WITHIN 10 FT OF THE CONCRETE WASHOUT SIGN.
2. THE POLYETHYLENE LINER SHALL BE SECURED TO STRAW BALES WITH METAL PINS OR STAPLES.
3. WOOD OR METAL STAKES TO SECURE THE STRAW BALES (2 PER BALE)
4. ALTERNATIVE MATERIALS CAN BE SUBSTITUTED FOR THE STRAW BALES TO PROVIDE STRUCTURAL CONTAINMENT WITH PRIOR APPROVAL FROM ENGINEER.
5. SANDBAGS, GRAVEL-FILLED BAGS OR OTHER APPROPRIATE ANCHORING SYSTEM SHALL BE USED TO HOLD POLYETHYLENE LINING DOWN.
6. PREFABRICATED WASHOUT SYSTEMS MAY BE USED WITH PRIOR APPROVAL FROM ENGINEER.

CONCRETE WASHOUT DETAIL C036

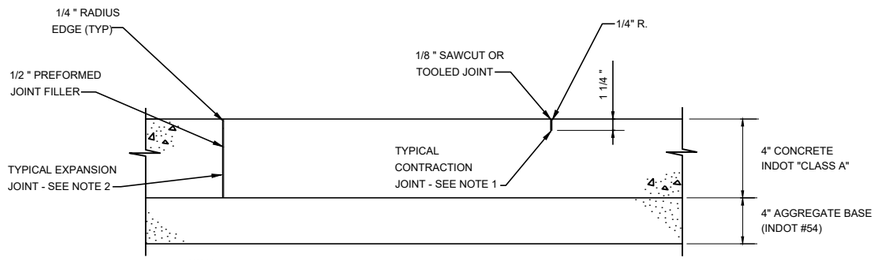
NTS



TYPICAL SECTION

SILT FENCE C033

NTS

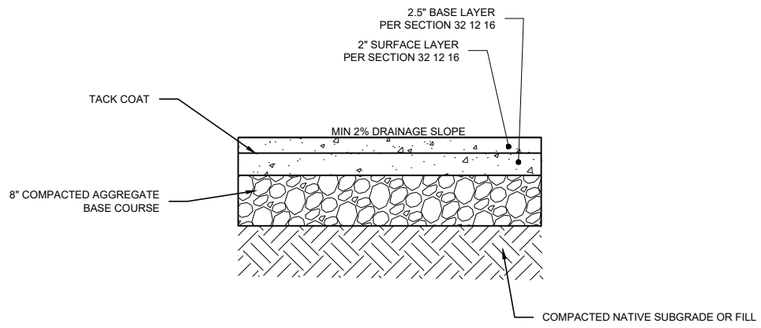


NOTE:

1. CONTRACTION JOINTS TO BE SPACED 6'-0" O.C. MAXIMUM EACH DIRECTION
2. EXPANSION JOINTS TO BE SPACED AT 50' MAXIMUM EACH DIRECTION AND WHERE SIDEWALK MEETS BUILDINGS, CURBS, AND EXISTING SIDEWALKS WHICH REMAIN IN PLACE.
3. ALL MATERIALS AND WORKMANSHIP TO BE IN ACCORDANCE WITH SPECIFICATION 32 16 23 AND INDOT STANDARD SPECIFICATIONS.
4. LONGITUDIAL SLOPES TO MATCH EXISTING, CROSS SLOPE OF NEW SIDEWALK TO BE 0.5% MINIMUM AND 1.5% MAXIMUM.

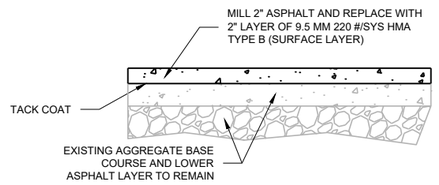
UNREINFORCED CONCRETE SIDEWALK C150

NTS



ASPHALT PAVEMENT TYPICAL SECTION C115

NTS



ASPHALT PAVEMENT - MILLED SECTION C116

NTS

MICHAEL AREND STYF REGISTERED PE 1200351 STATE OF INDIANA PROFESSIONAL ENGINEER
1/6/25

Revision Number	Revision Description	Drawn By	Checked By	Date

Designed By	REK
Drawn By	REK
Checked By	MAS
Approved By	MAS
Filename	999CD1.DWG
Project No.	14144
Project Date	JAN 2025

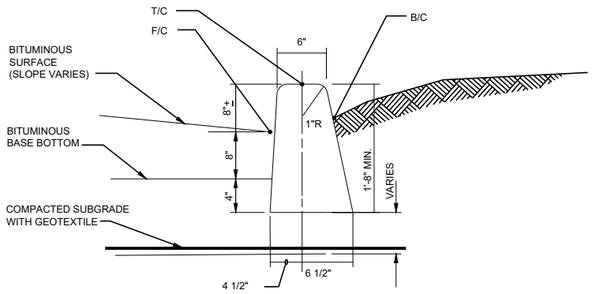
CITY OF BLOOMINGTON UTILITIES
MONROE WTP IMPROVEMENTS: CHEMICAL FEED LINE REPLACEMENT AND BACKWASH SYSTEM PUMP ADDITION AND TANK REHABILITATION - BLOOMINGTON, IN

GENERAL NOTES, SCHEDULES, AND STANDARDS DETAILS CIVIL

DONOHUE

Sheet No. 63

Drawing No. 999-C-1

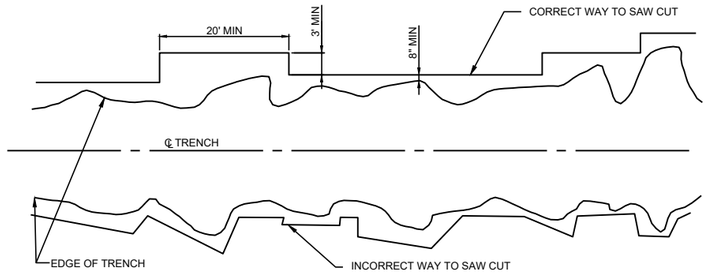


6" CONCRETE BARRIER CURB C160

NTS

NOTES:

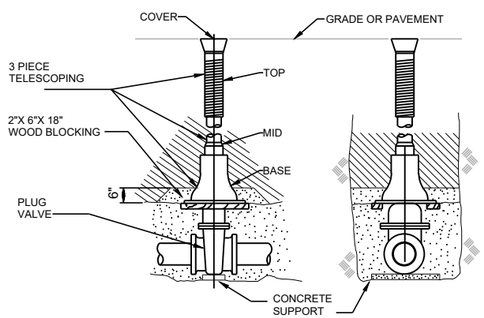
1. PLACE 2" DEEP SAWED CONTRACTION JOINT EVERY 10'.
2. PLACE 1" WIDE EXPANSION JOINT EVERY 50 LINEAR FEET. INSERT 1" JOINT FILLER.



NOTE:
WHEN SAW CUTTING THE PAVEMENT FOR TRENCH RESTORATION FOLLOWING CONSTRUCTION, ALL SAW CUTS SHALL BE MADE PARALLEL, OR PERPENDICULAR, TO THE CENTERLINE OF THE TRENCH. PARALLEL CUTS SHALL BE A MINIMUM LENGTH OF 20 FT. AND PERPENDICULAR CUTS SHALL BE A MINIMUM OF 3 FT. IN LENGTH.

PAVEMENT SAWCUTTING C180

NTS

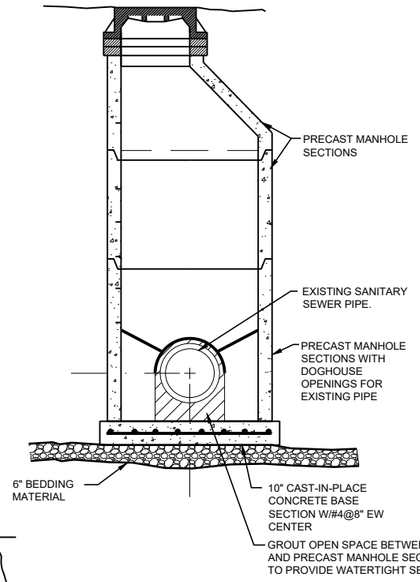


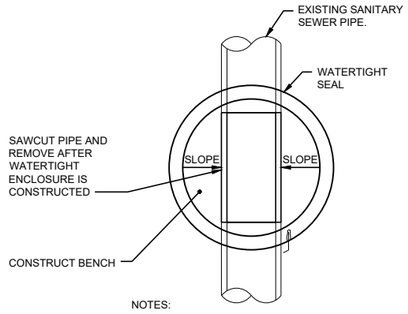
PIPE DIA. INCHES	X=SETTING INCHES
2	6
3	7
4	8
6	12
8	13
12	21

SIDE VIEW FRONT VIEW

VALVE IN A BOX DETAIL C405

NTS



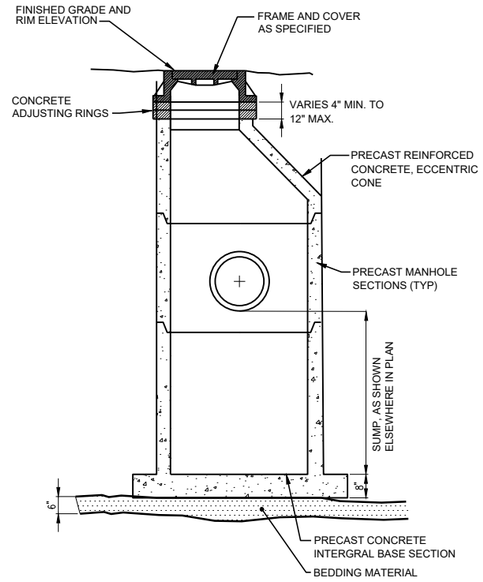


NOTES:

1. SUPPORT SANITARY SEWER PIPE WHILE MANHOLE IS UNDER CONSTRUCTION TO PREVENT CRACKING OR SEPARATION AT PIPE JOINTS

MANHOLE CONSTRUCTION OVER EXISTING SEWER C205

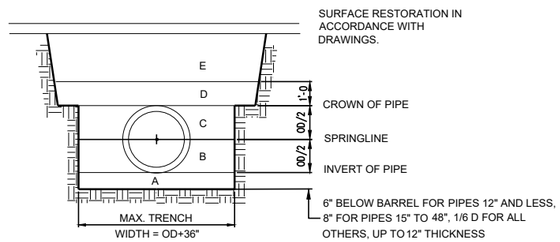
NTS



NOTE:
CONTRACTOR SHALL ADJUST SURROUNDING GRADES TO BLEND INTO MANHOLE FRAME AND COVER. FRAME AND COVER TO REMAIN LEVEL.

48-INCH MANHOLE SUMP & EXTENDED BASE C380

NTS



TRENCH BEDDING AND COVER MATERIALS:

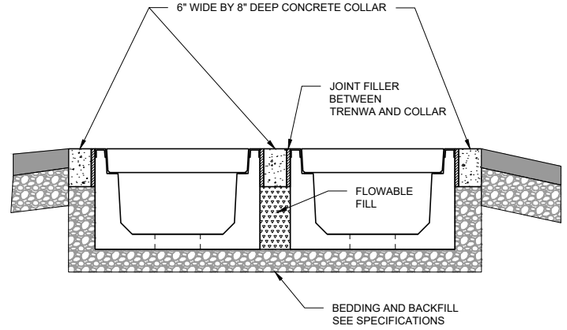
A	B	C	D	E
INDOT #8 OR #11	INDOT #8 OR #11	INDOT #8 OR #11	INDOT #8 OR #11	STRUCTURAL BACKFILL

NOTES (FOR PIPE INSTALLATION):

1. THE MAXIMUM TRENCH WIDTH FOR ALL PIPE INSTALLATION SHALL BE PIPE OD PLUS 36". INSTALLATION BASED ON WIDER/NARROWER TRENCH WIDTHS SHALL NOT BE ALLOWED UNLESS PIPE STRENGTH/DESIGN CALCULATIONS FOR SUCH WIDER/NARROWER TRENCH WIDTHS HAVE BEEN APPROVED BY THE DESIGN ENGINEER.
2. PIPE SHALL NOT BE INSTALLED IN A TRENCH WHICH HAS ANY FLOWING WATER OR STANDING WATER IN EXCESS OF 1" DEPTH WITHIN PIPE BEDDING.
3. SHEETING AND SHORING TRENCH PROTECTION SHALL NOT EXTEND BELOW THE TOP OF PIPE UNLESS THE CONTRACTOR SPECIFIES AND THE ENGINEER AGREES WITH THE PROPOSED METHOD OF HOW THE SIDES WILL BE COMPACTED FOLLOWING SHEETING AND SHORING REMOVAL.

TRENCH, BEDDING, COVER, AND BACKFILL DETAIL C501

NTS



TRENCH BEDDING/PAVING C550

NTS

MICHAEL AREND STYE REGISTERED PE11200351 STATE OF INDIANA PROFESSIONAL ENGINEER
1/6/25

Revision Number	Revision Description	Drawn By	Checked By	Date

Designed By	REK
Drawn By	REK
Checked By	MAS
Approved By	MAS
Filename	999CD1.DWG
Project No.	14144
Project Date	JAN 2025

CITY OF BLOOMINGTON UTILITIES
MONROE WTP IMPROVEMENTS: CHEMICAL FEED LINE REPLACEMENT AND BACKWASH SYSTEM PUMP ADDITION AND TANK REHABILITATION - BLOOMINGTON, IN

GENERAL NOTES, SCHEDULES, AND STANDARDS DETAILS CIVIL

DONOHUE

Sheet No. 64

Drawing No. 999-C-2

GENERAL STRUCTURAL NOTES

GENERAL

1. THE GENERAL STRUCTURAL NOTES AND STANDARD STRUCTURAL DETAILS APPLY TO THE ENTIRE PROJECT UNLESS SPECIFICALLY NOTED OTHERWISE.

DESIGN CRITERIA

1. DESIGN AND CONSTRUCT IN CONFORMANCE WITH THE INDIANA BUILDING CODE, BASED ON THE INTERNATIONAL BUILDING CODE, 2012 EDITION WITH INDIANA AMENDMENTS.

2. SUPERIMPOSED DESIGN LOADS

A. CHEMICAL CONTAINMENT PIPING DEAD LOAD	30 PSF
B. SNOW LOAD:	
1. GROUND SNOW LOAD, Pg	20 PSF
2. SNOW EXPOSURE FACTOR, Ce	1.0
3. SNOW LOAD IMPORTANCE FACTOR, I	1.1
4. THERMAL FACTOR, Ct	1.0
C. WIND LOAD:	
1. ULTIMATE DESIGN WIND SPEED, Vult	120
2. NOMINAL DESIGN WIND SPEED, Vasd	93 MPH
3. RISK CATEGORY	III
4. WIND EXPOSURE	C
5. INTERNAL PRESSURE COEFFICIENT, GCpi	+/- 0.18 PSI
6. COMPONENTS AND CLADDING WIND PRESSURES	+/- 30 PSF MIN

3. SEISMIC DESIGN DATA:

A. RISK CATEGORY	III
B. IMPORTANCE FACTOR, I	1.25
C. MAPPED SPECTRAL RESPONSE ACCELERATIONS	
1. Ss	0.241g
2. S1	0.104g
D. SITE CLASS	D
E. SPECTRAL RESPONSE COEFFICIENTS	
1. Sds	0.257g
2. Sd1	0.165g
F. SEISMIC DESIGN CATEGORY	C
G. ANALYSIS PROCEDURE	EQUIVALENT LATERAL FORCE PROCEDURE

FOUNDATIONS

1. GEOTECHNICAL INVESTIGATION BY TERRACON CONSULTANTS, INC

A. NET ALLOWABLE SOIL BEARING CAPACITIES:	2000 PSF

2. PLACE FOOTINGS ON NATURAL UNDISTURBED EARTH OR STRUCTURAL FILL.
3. TO MINIMIZE LATERAL FORCES AGAINST THE STRUCTURE DUE TO WEDGING ACTION OF THE SOIL, BEGIN COMPACTION OF EACH LAYER AT THE STRUCTURE WALL.

REINFORCEMENT

1. REINFORCEMENT STEEL
   A. DEFORMED BARS: ASTM A615 - GRADE 60
2. UNLESS NOTED OTHERWISE PROVIDE CLEAR COVER FOR REINFORCEMENT AS FOLLOWS:
   A. CAST AGAINST:
      1. EARTH: 3 INCHES
      2. MUD SLAB: 2 INCHES
   B. EXPOSED TO EARTH, WEATHER, OR WATER
      1. SLABS, FOOTINGS, AND WALLS: 2 INCHES
   C. NOT EXPOSED TO EARTH, WEATHER, OR WATER
      1. SLABS AND WALLS 1 INCH
3. PLACE DOWELS BEFORE PLACING CONCRETE.
4. DO NOT FIELD WELD OR FIELD BEND REINFORCING BARS.

CONCRETE

1. DESIGN STRENGTH
   A. INTERIOR EQUIPMENT BASES AND WHERE SPECIFICALLY NOTED CLASS B: F'C = 3000 PSI
   B. ALL LOCATIONS, EXCEPT WHERE CLASS B SPECIFIED CLASS A: F'C = 4500 PSI
2. UNLESS NOTED OTHERWISE, CONSTRUCTION JOINTS SHOWN ARE OPTIONAL CONSTRUCTION JOINTS NOT SHOWN SHALL BE APPROVED BY ENGINEER.
3. BEFORE CONCRETE IS PLACED, CONSTRUCTION JOINTS SHALL BE CLEANED, LAITANCE REMOVED, AND SURFACE WETTED. REMOVE STANDING WATER.
4. CONSTRUCTION JOINTS SHALL HAVE ROUGHENED SURFACES. SURFACE SHALL HAVE AMPLITUDE OF 1/4 IN. MIN.
5. PROVIDE 3/4 IN. CHAMFER ON EXTERNAL CORNERS OF EXPOSED EDGES OF CONSTRUCTION JOINTS.
6. VERIFY EQUIPMENT PAD LOCATIONS, DIMENSIONS, AND ELEVATIONS WITH EQUIPMENT MANUFACTURERS.

MASONRY

1. MASONRY ASSEMBLY NET COMPRESSIVE STRENGTH: F'M = 2,500 POUNDS PER SQUARE INCH (MINIMUM)
2. CONCRETE MASONRY UNIT COMPRESSIVE STRENGTH: F'CMU = 3,250 POUNDS PER SQUARE INCH (MINIMUM)
3. MORTAR: ASTM C270, PROPERTY SPECIFICATION TYPE S, 1,800 POUNDS PER SQUARE INCH (MINIMUM)
4. MASONRY GROUT: ASTM C476, 2,500 POUNDS PER SQUARE INCH (MINIMUM)

METALS

1. STEEL

A. W SHAPES	ASTM A992
B. S, C, AND MC SHAPES	ASTM A36
C. SQUARE OR RECTANGULAR TUBE:	ASTM A500, GRADE B, 46 KSI
D. PIPE:	ASTM A53
E. PLATES AND BARS	ASTM A36
F. BOLTED CONNECTIONS FOR STEEL MEMBERS:	ASTM F3125 GRADE A325, GALVANIZED
G. BOLTED CONNECTIONS FOR ALUMINUM MEMBERS:	STAINLESS STEEL
H. STAINLESS STEEL	
1. EXTERIOR AND SUBMERGED USES	AISI, TYPE 316
2. INTERIOR AND ARCHITECTURAL USES	AISI, TYPE 304
3. CAST-IN-PLACE ANCHOR BOLTS	AISI, TYPE 316

2. ALUMINUM
   A. SHAPES AND PLATES: ALLOY 6061-T6 OR 6063-T6
3. ANCHOR RODS, 1/2" MINIMUM DIA:
   A. DRY LOCATIONS ASTM F1554, GRADE 36, GALVANIZED
   B. ALL OTHER LOCATIONS STAINLESS STEEL
4. WELD STRUCTURAL STEEL WITH E70XX ELECTRODES IN ACCORDANCE WITH AWS REQUIREMENTS.
5. WELD ALUMINUM IN ACCORDANCE WITH AWS AND AA REQUIREMENTS.
6. COAT ALUMINUM SURFACES IN CONTACT WITH CONCRETE IN ACCORDANCE WITH AA REQUIREMENTS. UNDER NO CIRCUMSTANCES SHALL ALUMINUM CONTACT DISSIMILAR METALS.

MISCELLANEOUS

1. VERIFY PERTINENT EXISTING CONDITIONS AND DIMENSIONS BEFORE STARTING CONSTRUCTION AND/OR FABRICATION.
2. DO NOT FIELD CUT PRESTRESSING STRANDS IN PRECAST PRESTRESSED CONCRETE MEMBERS WITHOUT WRITTEN APPROVAL OF FABRICATOR AND ENGINEER.
3. FOR ADDITIONAL OPENINGS, ANCHORS, AND EMBEDDED ITEMS SEE PROCESS AND ELECTRICAL DRAWINGS.

REMOVALS

1. REMOVE ALL CONCRETE ANCHORS, ANCHOR BOLTS AND OTHER EMBEDMENTS A MINIMUM OF 1" BEYOND FINISHED SURFACE AND PATCH SURFACE WITH PATCHING MORTAR TO MATCH EXISTING.
2. REMOVE EXISTING CONCRETE PADS OF ANY EQUIPMENT BEING REMOVED. REMOVE CONCRETE AND REINFORCEMENT A MINIMUM OF 1" BEYOND FINISHED SURFACE AT ANY LOCATION WHERE NEW CONCRETE PAD WILL NOT COVER ROUGH SURFACE OF REMOVAL. PATCH BACK TO FINISHED SURFACE WITH PATCHING MORTAR.
3. SAWCUT AND REMOVE CONCRETE TO LIMITS NOTED. REMOVE CONCRETE AND REINFORCEMENT A MINIMUM 1" BEYOND FINISHED SURFACE AT ANY LOCATION WHERE NEW CONCRETE WILL NOT COVER ROUGH SURFACE OF REMOVAL. PATCH BACK TO FINISHED SURFACE WITH PATCHING MORTAR.

MINIMUM REINFORCEMENT BAR SPLICE AND ANCHORAGE LENGTH (INCHES) S010

BAR SIZE	LAPPED SPLICE LENGTH		EMBEDMENT LENGTH		
	TOP BARS	OTHERS	TOP BARS	OTHERS	
3	16	16	12	12	
4	19	16	14	12	
5	27	21	21	16	
6	38	29	29	22	

NOTES:

1. TOP BARS ARE HORIZONTAL BARS SO PLACED THAT MORE THAN 12" OF CONCRETE IS CAST IN THE MEMBER BELOW THE BAR.
2. FOR BARS SPACED LESS THAN 6 BAR DIAMETER OC INCREASE LENGTH BY 25%.
3. WHEN LAPPING TWO DIFFERENT SIZE BARS USE THE LAP LENGTH OF THE SMALLER BAR UNLESS NOTED OTHERWISE.
4. EMBEDMENT LENGTH IS MINIMUM LENGTH OF EMBEDMENT FOR STRAIGHT DOWELS WHERE END HOOK IS NOT SHOWN, UNLESS OTHERWISE NOTED.
5. HOOKS SHALL BE ACI STANDARD UNLESS OTHERWISE NOTED.

DOOR SCHEDULE S100

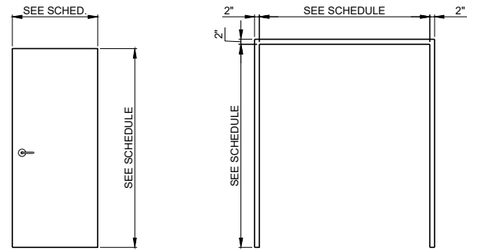
STRUC. NO.	DOOR NO.	DOOR ✱ TYPE	LINTEL	SIZE WIDTH X HEIGHT	SIZE THK	MATL.	FINISH	H.W.SET	FRAME TYPE	FRAME MATL.	FRAME FINISH	REMARKS
800	D01	1	L-1	(2) 3'-0"x7'-2"	1 3/4"	FRP	-	1	1	FRP	-	L-1 = 8" MASONRY LINTEL REINFORCED W/ 2-#5. PROVIDE 8" BEARING ON EACH END. GROUT WALL CELLS SOLID AT BEARING LOCATIONS.

KEY

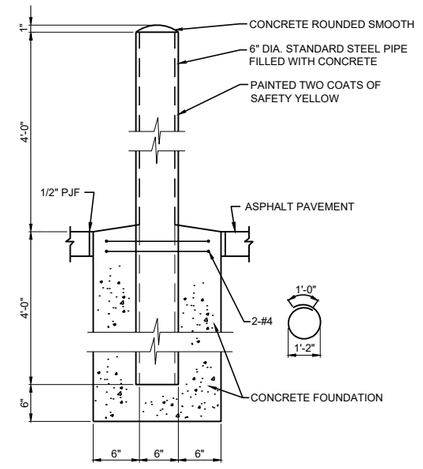
FRP = FIBERGLASS REINFORCED PLASTIC

DOOR AND FRAME NOTES:

1. ALL DOORS ARE TO BE INSULATED.
2. FIELD VERIFY EXISTING OPENING SIZES PRIOR TO FABRICATION.



DOOR TYPE= ⓧ FRAME TYPE= △X



SECTION

GUARD POST DETAIL S101

NTS

TIMOTHY J. BATES REGISTERED No. 11400728 STATE OF INDIANA PROFESSIONAL ENGINEER

01/06/2025

Revision Number	Revision Description	Drawn By	Checked By	Date

Designed By	CDP
Drawn By	CDP
Checked By	TJB
Approved By	TJB
Filename	999SD1.DWG
Project No.	14144
Project Date	JAN 2025

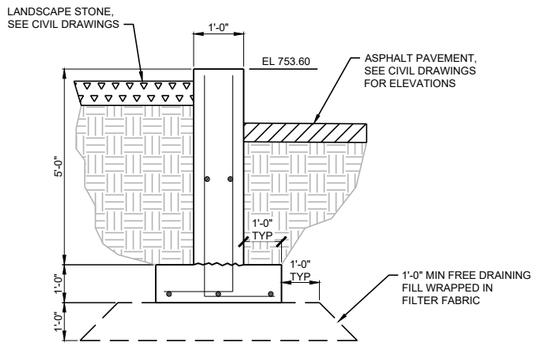
CITY OF BLOOMINGTON UTILITIES
MONROE WTP IMPROVEMENTS: CHEMICAL FEED LINE REPLACEMENT AND BACKWASH SYSTEM PUMP ADDITION AND TANK REHABILITATION - BLOOMINGTON, IN

GENERAL NOTES, SCHEDULES, AND STANDARDS DETAILS
DOOR SCHEDULE AND STRUCTURAL DETAILS

DONOHUE

Sheet No. 65

Drawing No. 999-S-1

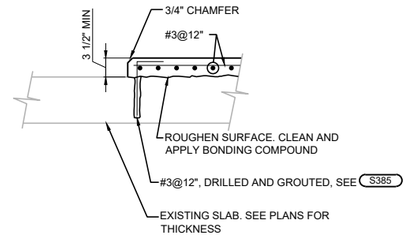


NOTES:

1. REINFORCEMENT SHOWN #5@9".
2. DRILL AND GROUT DOWELS INTO EXISTING WALLS OF STRUCTURE 220 SETTLING BASIN 2 WHERE NEW RETAINING WALL AND FOOTING ADJOINS EXISTING WALLS. SEE DETAIL S385
3. RETAINING WALL IS TO STOP AT SOUTH EDGE OF TRENWA TRENCH SYSTEM. SEE CIVIL DRAWINGS FOR DETAILS.

RETAINING WALL DETAIL S210

NTS

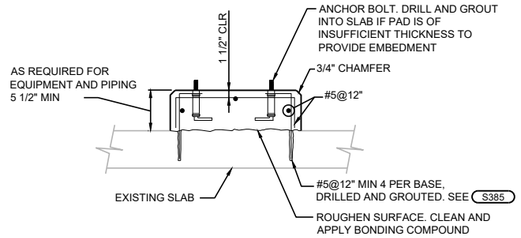


NOTES:

1. FOR EQUIPMENT PAD WITH ANCHOR BOLTS, SEE S343

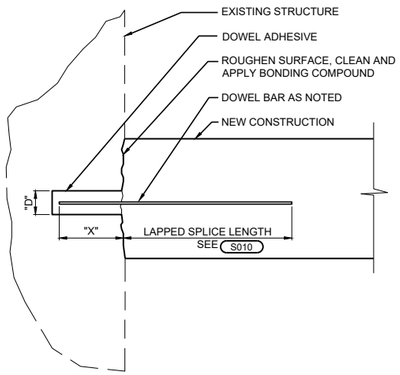
EQUIPMENT PAD DETAIL S341

NTS



EQUIPMENT PAD DETAIL S343

NTS

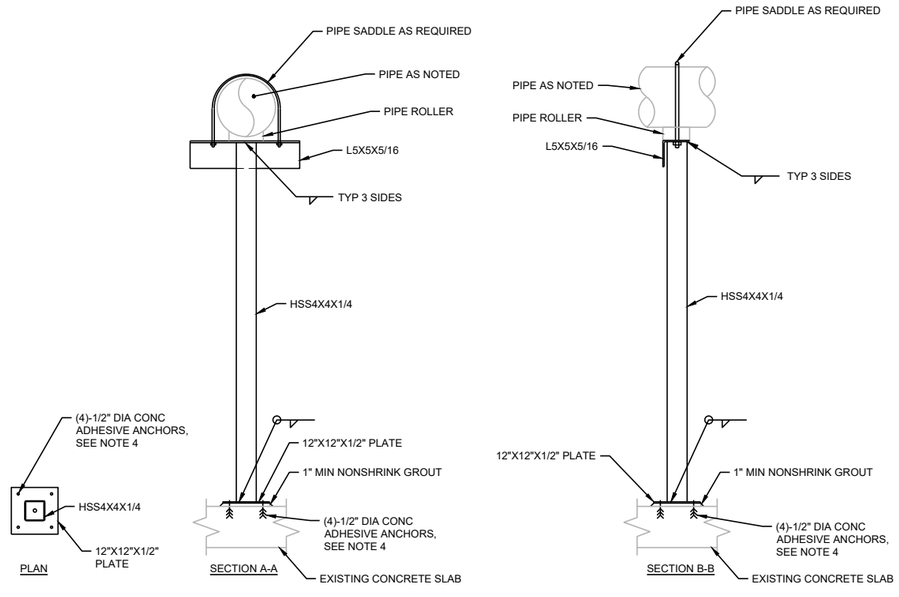


NOTES:

1. EMBEDMENT "X"=16 BAR DIAMETERS MIN.
2. HOLE DIAMETER "D"=PER ADHESIVE MFR.

DRILLED IN DOWEL DETAIL S385

NTS



NOTES:

1. ALL MATERIALS FOR PIPE SUPPORTS SHALL BE TYPE 316 STAINLESS STEEL.
2. CONTRACTOR TO FIELD VERIFY EXISTING CONDITIONS AND DIMENSIONS PRIOR TO FABRICATION.
3. CONTRACTOR TO COORDINATE SUPPORT LOCATIONS AND ELEVATIONS WITH PIPING.
4. CONTRACTOR TO PROVIDE ADDITIONAL COLUMNS AND FRAMING MEMBERS AS REQUIRED TO SUPPORT PIPING.
5. WHERE FLOOR SLAB IS 6" IN THICKNESS, CONCRETE ANCHORS SHALL HAVE AN EMBEDMENT DEPTH OF 4".
   WHERE FLOOR SLAB IS 12" IN THICKNESS OR GREATER, CONCRETE ANCHORS SHALL HAVE AN EMBEDMENT DEPTH OF 6".

PIPE SUPPORT DETAIL S500

NTS

TIMOTHY J BATES
REGISTERED
No. 11400728
STATE OF
INDIANA
PROFESSIONAL ENGINEER

01/06/2025

Revision Number	Revision Description	Drawn By	Checked By	Date

Designed By	CDP
Drawn By	CDP
Checked By	TJB
Approved By	TJB
Filename	999SD1.DWG
Project No.	14144
Project Date	JAN 2025

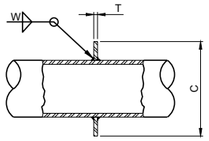
CITY OF BLOOMINGTON UTILITIES
MONROE WTP IMPROVEMENTS: CHEMICAL FEED LINE
REPLACEMENT AND BACKWASH SYSTEM PUMP ADDITION
AND TANK REHABILITATION - BLOOMINGTON, IN

GENERAL NOTES, SCHEDULES, AND STANDARDS DETAILS
STRUCTURAL

DONOHUE

Sheet No. 66

Drawing No. 999-S-2

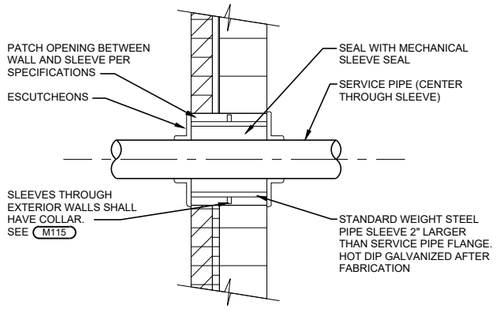


MINIMUM DIMENSIONS

NOMINAL PIPE DIA (INCHES)	T THICKNESS (INCHES)	C DIAMETER (INCHES)	W WELD SIZE (INCHES)
1	0.250	3.50	1/8
1 1/2	0.250	4.00	1/8
2	0.250	5.00	1/8
2 1/2	0.250	6.00	1/8
3	0.250	6.50	1/8
4	0.375	8.00	3/16
6	0.375	10.00	3/16
8	0.375	12.50	3/16
10	0.375	14.50	3/16
12	0.375	16.50	3/16
14	0.50	19.50	1/4
16	0.50	21.75	1/4
18	0.50	23.75	1/4
20	0.50	25.75	1/4
24	0.50	30.25	1/4
30	0.75	36.50	5/16
36	0.75	43.00	5/16
42	0.75	49.50	5/16
48	1.25	56.50	5/16
54	1.50	63.00	5/16

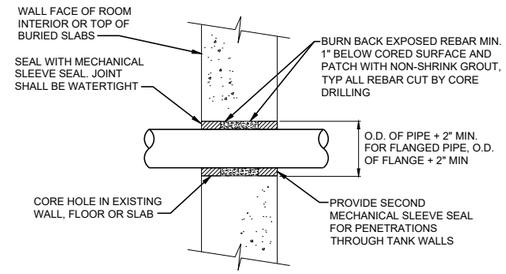
STEEL WALL AND FLOOR PIPE COLLAR DIMENSION DETAIL M115

NTS



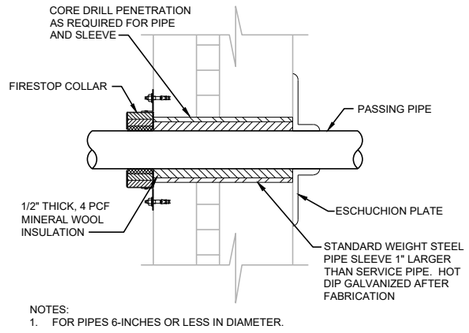
PIPE PENETRATION THROUGH MASONRY WALL DETAIL M122

NTS



CORE HOLE PIPE PENETRATION DETAIL M123

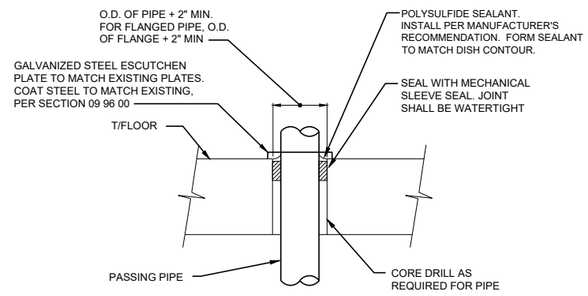
NTS



NOTES:
1. FOR PIPES 6-INCHES OR LESS IN DIAMETER.

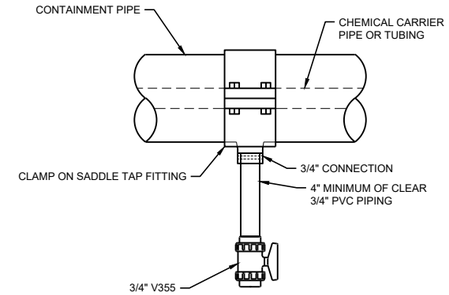
PLASTIC PIPE COLLAR THROUGH FIRE WALL DETAIL M174

NTS



FLOOR PENETRATION DETAIL M213

NTS



CHEMICAL CONTAINMENT PIPE DRAIN M575

NTS

Revision Number	Revision Description	Drawn By	Checked By	Date

Designed By	KAR
Drawn By	KAR
Checked By	SPG
Approved By	TMM
Filename	999MD1.DWG
Project No.	14144
Project Date	JAN 2025

CITY OF BLOOMINGTON UTILITIES
MONROE WTP IMPROVEMENTS: CHEMICAL FEED LINE REPLACEMENT AND BACKWASH SYSTEM PUMP ADDITION AND TANK REHABILITATION - BLOOMINGTON, IN

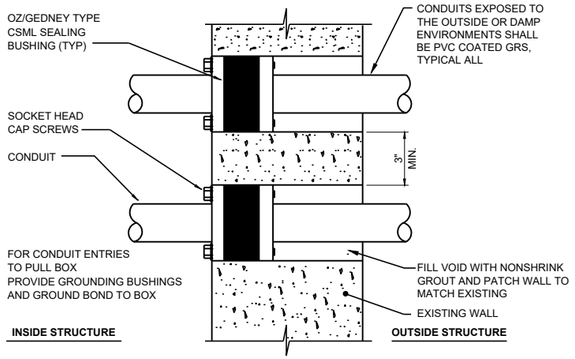
GENERAL NOTES, SCHEDULES, AND STANDARDS DETAILS
PROCESS-MECHANICAL

DONOHUE

Sheet No. 67

Drawing No. 999-M-1

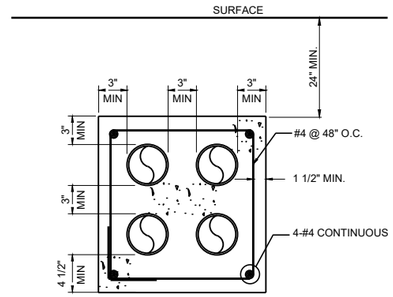
TRENT M. MONTEMAYOR REGISTERED No. PE11200215 STATE OF INDIANA PROFESSIONAL ENGINEER
01/06/2025



NOTE: CORE DRILL THE EXISTING WALL
TO INSTALL THIS SEALING.

CONDUIT ENTRY THRU EXISTING WALL DETAIL **E011**

NTS



FOR ADDITIONAL REINFORCING
SEE DUCT SECTIONS

TYPICAL DUCT CONCRETE COVERING **E250**

NTS

FIXTURE SCHEDULE

TYPE	DESCRIPTION	LUMENS (LM)	MANUFACTURER	CATALOG NUMBER	REMARKS
L1	4' LED ENCLOSED VAPORTIGHT FIXTURE, 4000K, FROSTED ACRYLIC LENS, IP65, IP66 AND IP67 RATED	4000 LM	LITHONIA	FEM L48 4000LM LPAFL MD MVOLT GZ10 40K 80CRI	MATCH EXISTING: PENDANT MOUNTED, 12' ABOVE FINISHED FLOOR.
L1X	4' LED ENCLOSED VAPORTIGHT FIXTURE, 4000K, FROSTED ACRYLIC LENS, IP65, IP66 AND IP67 RATED, BATTERY BACK UP	4000 LM	LITHONIA	FEM L48 4000LM LPAFL MD MVOLT GZ10 40K 80CRI E10WMCP	MATCH EXISTING: PENDANT MOUNTED, 12' ABOVE FINISHED FLOOR.
L2	2'X4' RECESSED LED FIXTURE, 4000K, FROSTED ACRYLIC LENS	4000 LM	LITHONIA	2GTL 4 40L A12125 EZ1 LP840	MATCH EXISTING: RECESSED IN GRID CEILING
L2X	2'X4' RECESSED LED FIXTURE, 4000K, FROSTED ACRYLIC LENS, SELF DIAGNOSTIC BATTERY PACK	4000 LM	LITHONIA	2GTL 4 40L A12125 EZ1 LP840 E10WLCP	MATCH EXISTING: RECESSED IN GRID CEILING

CHASE E. BENTON
REGISTERED
No. 12300012
STATE OF
INDIANA
PROFESSIONAL ENGINEER
01/06/2025

Revision Number	Revision Description	Drawn By	Checked By	Date

Designed By	CEB
Drawn By	CEB
Checked By	JEF
Approved By	CEB
Filename	999ED1.DWG
Project No.	14144
Project Date	JAN 2025

CITY OF BLOOMINGTON UTILITIES
MONROE WTP IMPROVEMENTS: CHEMICAL FEED LINE REPLACEMENT AND BACKWASH SYSTEM PUMP ADDITION AND TANK REHABILITATION - BLOOMINGTON, IN

GENERAL NOTES, SCHEDULES, AND STANDARDS DETAILS
ELECTRICAL

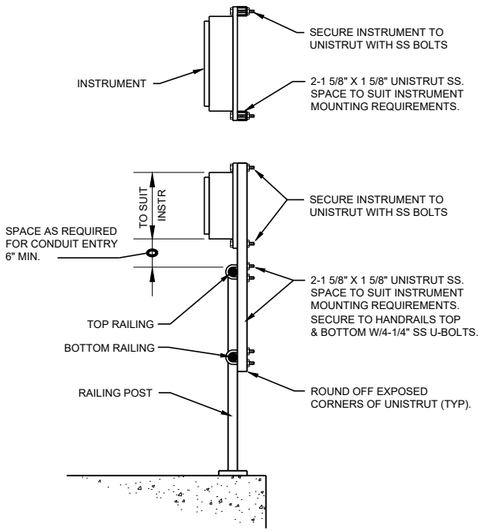
DONOHUE

Sheet No. 68

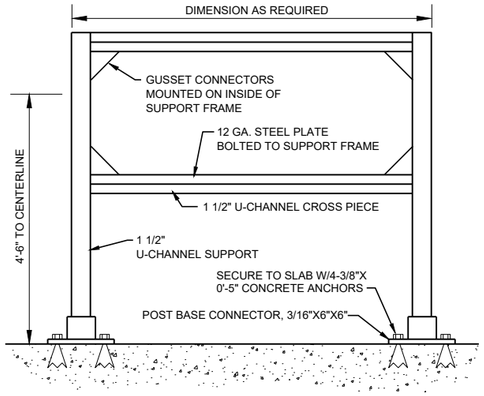
Drawing No. 999-E-1

INSTRUMENTATION AND CONTROLS GENERAL NOTES

1. DRAWINGS SHOW CONTROL, SIGNAL, AND ASSOCIATED SINGLE PHASE POWER WIRING REQUIREMENTS.
2. CONTRACTOR SHALL BE RESPONSIBLE FOR ALL WIRING, WHETHER SHOWN OR NOT, NECESSARY FOR A COMPLETE AND OPERABLE SYSTEM.
3. DRAWINGS SHOW APPROXIMATE LOCATIONS OF DEVICES AND PANELS. FIELD VERIFY DIMENSIONS AND ELEVATIONS.
4. SHIELDED AND UNSHIELDED CONDUCTORS SHALL BE RUN IN CONDUIT. SHIELDED CONDUCTORS SHALL NOT BE COMBINED WITH UNSHIELDED CONDUCTORS IN ANY CONDUIT. NEITHER SHIELDED NOR UNSHIELDED CONDUCTORS SHALL BE INCLUDED IN THE SAME CONDUIT AS POWER WIRING. INTRINSICALLY SAFE CIRCUITS SHALL BE RUN IN SEPARATE CONDUITS FROM NON-INTRINSICALLY SAFE CIRCUITS.
5. SHIELDED AND UNSHIELDED CONDUCTORS SHALL HAVE A MINIMUM OF 6" SEPARATION BETWEEN CONDUIT ON PARALLEL RUNS.
6. SHIELDED AND UNSHIELDED CONDUCTORS SHALL BE SEPARATED BY STEEL BARRIERS IN ALL COMBINED SIGNAL JUNCTION BOXES AND INSTRUMENT TERMINATION CABINETS.
7. CONDUITS SHALL BE SIZED TO ACCOMMODATE REQUIRED CONDUCTORS AND SPARES.
8. DRAWINGS DO NOT SHOW CONDUIT SYSTEMS. PROVIDE, AS A MINIMUM, PULL BOXES AS RECOMMENDED BY CONDUCTOR MANUFACTURER. CONDULETS SHALL NOT BE USED AS PULL BOXES.
9. PROVIDE EXPLOSION-PROOF SEAL-OFF FITTINGS ON ALL CONDUIT EXITING CLASSIFIED OR RATED LOCATIONS AS REQUIRED PER THE NEC.
10. CONDUCTORS SHALL NOT BE SPLICED EXCEPT AT TERMINALS OR AS DESIGNATED BY ENGINEER.
11. FOR EACH CONDUIT, PROVIDE A MINIMUM OF TWO CONDUCTORS OR 10% OF TOTAL CONDUCTORS IN CONDUIT, WHICHEVER IS GREATER AS SPARES. TAG BOTH ENDS OF EACH SPARE. TERMINATE EACH END OF SPARE CONDUCTORS AT TERMINALS WHENEVER POSSIBLE.
12. SPARE AND GROUND CONDUCTORS ARE GENERALLY NOT SHOWN IN WIRING TABLES.
13. INSTRUMENTATION TRANSMITTERS, DISPLAYS, AND OTHER INDICATORS SHALL BE ORIENTATED SUCH THAT THEY ARE EASILY READABLE AND ACCESSIBLE FROM OPERATING LOCATIONS.

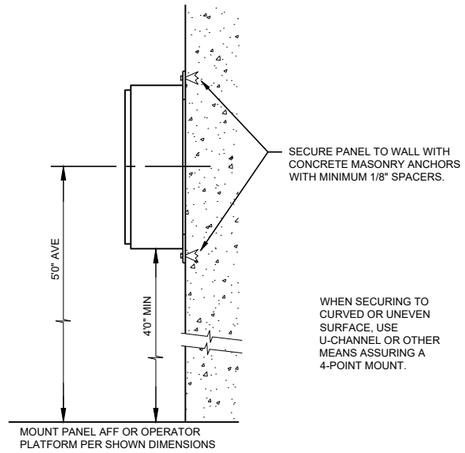


RAILING MOUNT SMALL CASE INSTRUMENTATION N141
NTS

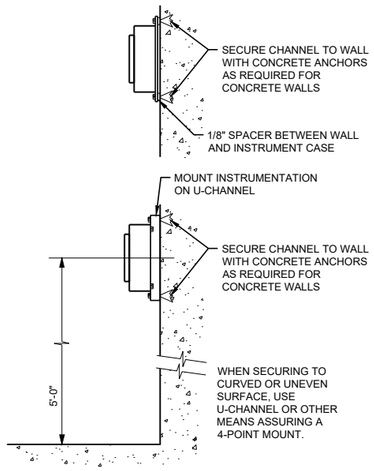


NOTE: FABRICATE RACKS IDENTICALLY FOR LIKE PROCESSES. PRIME AND PAINT TO MATCH ASSOCIATED PROCESS EQUIPMENT.

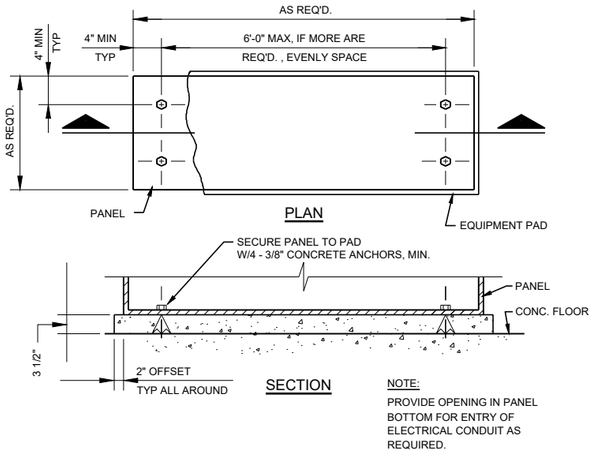
RACK MOUNTED INSTRUMENTATION N150
NTS



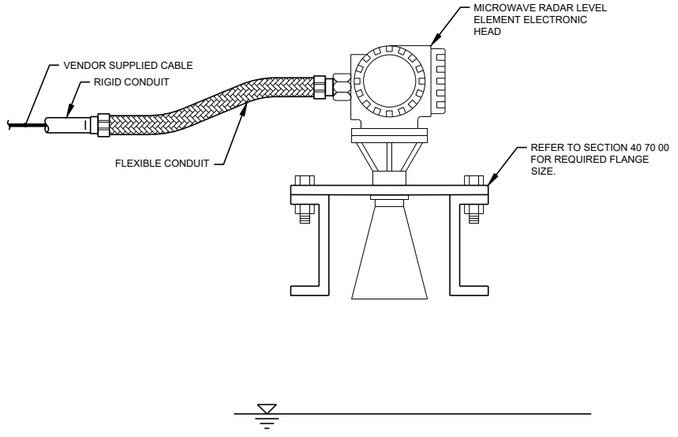
WALL MOUNT CONTROL PANEL N170
NTS



WALL MOUNT SMALL CASE INSTRUMENTATION N171
NTS



FREE STANDING CONTROL PANEL N180
NTS



MICROWAVE RADAR LEVEL SENSOR FLANGE MOUNTED N230
NTS

Revision Number	Revision Description	Drawn By	Checked By	Date

Designed By	JCE
Drawn By	JCE
Checked By	AHB
Approved By	AHB
Filename	999ND1.DWG
Project No.	14144
Project Date	JAN 2025

CITY OF BLOOMINGTON UTILITIES
MONROE WTP IMPROVEMENTS: CHEMICAL FEED LINE REPLACEMENT AND BACKWASH SYSTEM PUMP ADDITION AND TANK REHABILITATION - BLOOMINGTON, IN

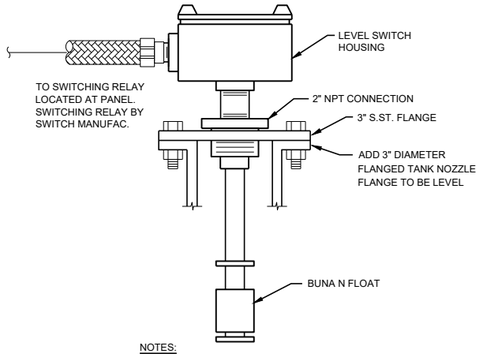
GENERAL NOTES, SCHEDULES, AND STANDARDS DETAILS
INSTRUMENTATION AND CONTROL

DONOHUE

Sheet No. 69

Drawing No. 999-N-1

ARC REGISTRATION REGISTERED No. PE11706C52 STATE OF ARIZONA PROFESSIONAL ENGINEER
1-6-25

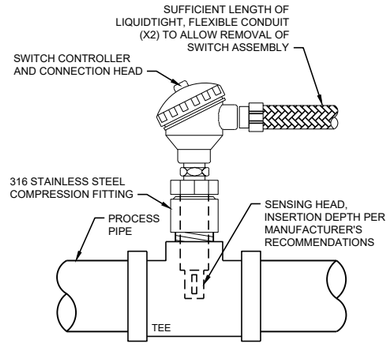


NOTES:

1. TANK NOZZLE TO BE MOUNTED VERTICALLY ON TANK.
2. SWITCH TO BE ADJUSTED TO ACTUATION LEVEL SPECIFIED.

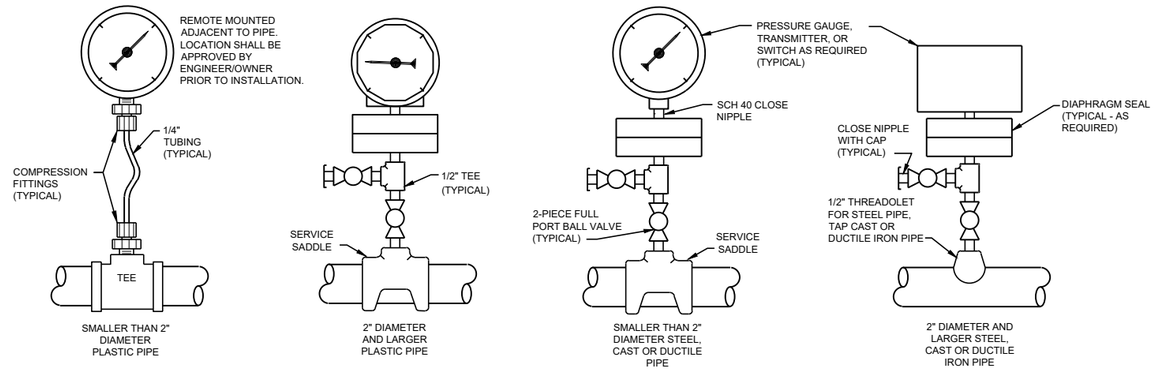
VERTICAL FLOAT LEVEL SWITCH NOZZEL MOUNTED N274

NTS



THERMAL DISPERSION FLOW SWITCH N370

NTS



NOTES:

1. ALL MATERIALS ARE TO BE AS NOTED UNLESS NOTED MATERIAL IS NOT COMPATIBLE WITH PROCESS STREAM. IF NOTED MATERIALS NOT COMPATIBLE WITH PROCESS STREAM PROVIDE MATERIALS THAT ARE COMPATIBLE.
2. 1/2" PIPE SHALL NOT BE REDUCED PRIOR TO FLUSHING TEE OR ISOLATION VALVE
3. INSTRUMENTATION TRANSMITTERS, DISPLAYS, AND OTHER INDICATORS SHALL BE ORIENTATED SUCH THAT THEY ARE EASILY READABLE AND ACCESSIBLE FROM OPERATING LOCATIONS.

PRESSURE ELEMENTS PIPE MOUNTED - W OR WO DIAPHRAGM SEAL N590

NTS

Revision Number	Revision Description	Drawn By	Checked By	Date

Designed By	JCE
Drawn By	JCE
Checked By	AHB
Approved By	AHB
Filename	999ND1.DWG
Project No.	14144
Project Date	JAN 2025

CITY OF BLOOMINGTON UTILITIES
MONROE WTP IMPROVEMENTS: CHEMICAL FEED LINE REPLACEMENT AND BACKWASH SYSTEM PUMP ADDITION AND TANK REHABILITATION - BLOOMINGTON, IN

GENERAL NOTES, SCHEDULES, AND STANDARDS DETAILS
INSTRUMENTATION AND CONTROL

DONOHUE

Sheet No.	70
Drawing No.	999-N-2