Griffy Lake
Aquatic Vegetation Management Plan
2017-2021
Monroe County, Indiana
February 21, 2017

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Executive Summary

Griffy Lake is a 109-acre reservoir located within the 1,180-acre Griffy Lake Nature Preserve in Monroe County. The lake lies approximately one mile north of Bloomington, Indiana. The maximum depth of Griffy Lake is 31 feet near the dam and the average depth is 14 feet. Public access, in the form of a boat ramp, is located in the southeast corner of the lake. This access site is managed by Bloomington Parks and Recreation. Boating is limited to electric motors only. The lake has been colonized by invasive Eurasian watermilfoil (*Myriophyllum spicatum*) and curly-leaf pondweed (*Potamogeton crispus*). Invasive Brazilian elodea (*Egeria densa*) was documented in past surveys, but was declared eradicated from the lake in 2009 following IDNR funded herbicide applications. These invasive plants are capable of producing dense mats that hinder recreational activities and may impact the ecology of the reservoir.

Plant management on Griffy Lake has consisted of a milfoil weevil stocking program in 2000-2002, a spot treatment with diquat herbicide for control of Brazilian elodea around the boat ramp in 2004, two whole lake fluridone treatments for eradication of Brazilian elodea in 2006 and 2007, and treatment of curly-leaf pondweed and Eurasian watermilfoil in 2008 and 2009. The reservoir was drawn down in 2012 and high use areas on the east end were dredged in 2013. Plant sampling and an aquatic vegetation management plan and updates were completed in 2005-2009. No targeted invasive plant management has occurred since 2009. Eurasian watermilfoil has spread throughout much of the littoral zone of the reservoir. Bloomington Parks officials were concerned over the potential impacts of invasive Eurasian watermilfoil, thus they applied for and received LARE funding for a new aquatic vegetation management plan.

An important component to an effective AVMP is the initial assessment of the plant community. This was completed with two plant surveys in 2016. The surveys consisted of mapping the invasive plant community and conducting point sampling (Tier 2 surveys) according to IDNR guidelines. Invasive mapping surveys conducted in 2016 found 22.6 acres of Eurasian watermilfoil and 2.6 acres of curly-leaf pondweed in the spring. The summer survey mapped 24.3 acres of Eurasian watermilfoil. Tier 2 surveys found plants at 65% of littoral sites in spring and 70% in summer. Eurasian watermilfoil was present at 18% of sample sites in spring and 22% of sites in summer. In addition, hydroacoustic surveying found that 49.4% of the lake's surface area contained vegetation during the summer survey. This information was presented to the public and city personnel at a public board meeting on October 25th. Options for controlling vegetation along with potential costs were discussed. The city wished to pursue a selective Eurasian watermilfoil treatment strategy using an EPA registered systemic herbicide.

For 2017, it is recommended that a spot treatment with 2,4-D granular based herbicide be completed in April or May for selective control of Eurasian watermilfoil. In addition, invasive plant sampling should be completed in spring to document Eurasian watermilfoil location. Another invasive survey should be completed in late summer along with a Tier 2 survey. This information will be used to update the AVMP. The estimated cost of the treatment is $19,500 and sampling and plan updates will cost approximately $3,500. If a grant is received the city will be responsible for covering 20% of these costs.

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1.0 WATERSHED & WATERBODY CHARACTERISTICS

Griffy Lake is a 109-acre reservoir located within the 1,180-acre Griffy Lake Nature Preserve in Monroe County. The lake lies approximately one mile north of Bloomington, Indiana. The maximum depth of Griffy Lake is 31 feet near the dam and the average depth is 14 feet. Griffy Lake was built in 1924 in order to provide additional water supply to the city of Bloomington. The dam was raised to its present height in 1943. The city of Bloomington no longer uses Griffy Lake as a water supply reservoir. Griffy Lake and a large part of the watershed is owned by the city of Bloomington and managed by Bloomington Parks and Recreation. Griffy Lake's drainage basin encompasses approximately 5,160 acres of land including the lake area (Figure 1) (JFNew 2009 & Jones et. al., 1984). The watershed is drained by Griffy Creek, which has three equally sized branches or forks. Presently, the North Fork watershed is fairly pristine, the Middle Fork is in the first stages of urbanization, and the South Fork is rapidly urbanizing (Commonwealth Biomonitoring, 2000).

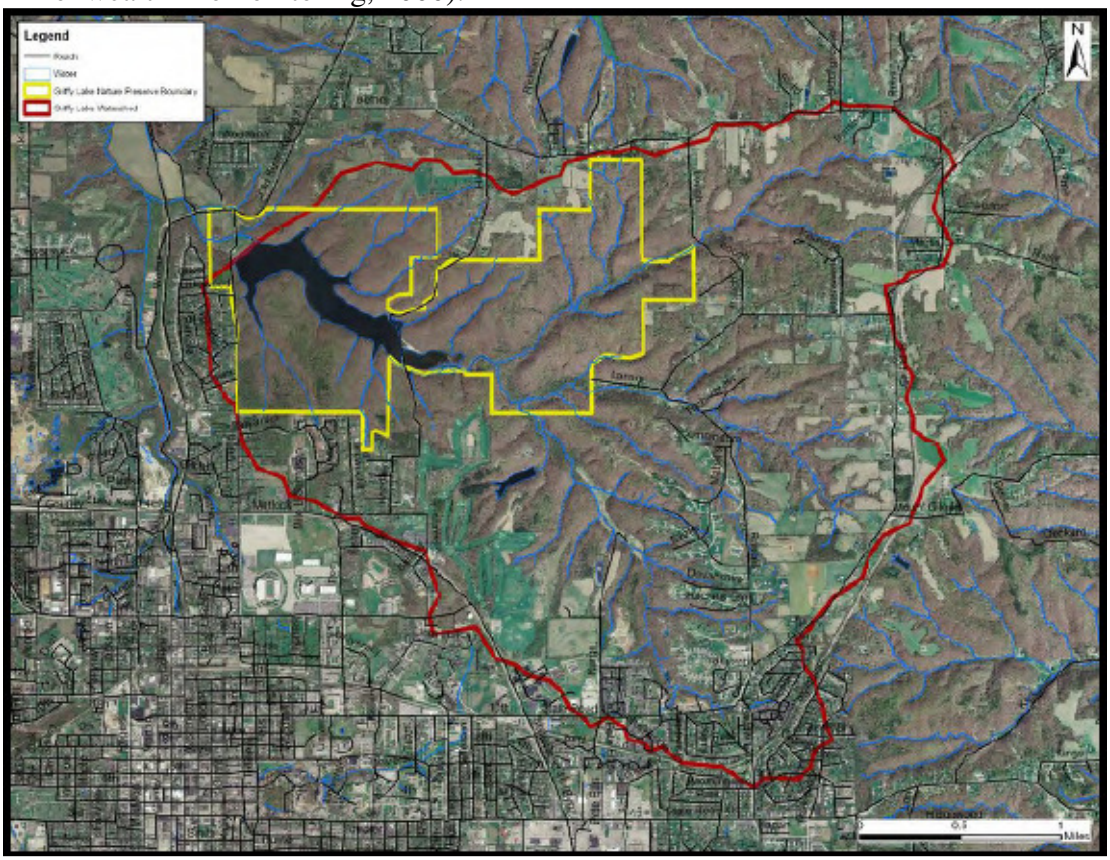


Figure 1. Griffy Lake watershed boundary (JFNew 2008).

2.0 PRESENT WATERBODY USES

Griffy Lake and the immediate surroundings are owned by the city of Bloomington and managed by the Bloomington Parks and Recreation department. There are no permanent dwellings on the shoreline of Griffy Lake. Griffy Lake attracts numerous visitors from the Bloomington area. It is a very popular place for boating, fishing, picnicking, hiking, and environmental education. Public access, in the form of a boat ramp, is located in the southeast corner or upper end of the lake (Figure 2). This access site is managed by

Bloomington Parks and Recreation. Boating is limited to electric motors only. Shoreline fishing occurs primarily along the north shore of the reservoir.

Figure 2. Griffy Lake usage map.

3.0 PROBLEM STATEMENT AND MANAGEMENT HISTORY

3.1 Problem Statement

In previous plans and updates, Brazilian elodea was the primary species of concern. However, since the eradication of Brazilian elodea, the primary species of concern is invasive Eurasian watermilfoil. Invasive curly-leaf pondweed is also present in Griffy Lake (Figure 3). Densely matted beds of these invasive species can create navigational problems, especially in a lake where electric motors are commonly used. In addition, there is the potential that these species could displace native plants and interfere with fishing and other recreational activities. Dense monocultures of invasive vegetation may also have impacts on the fish population and water quality.

Figure 3. Illustrations Eurasian watermilfoil (left), and curly-leaf pondweed (right) (Illustrations provided by Applied Biochemist).

The first documented effort to control invasive vegetation on Griffy Lake was a milfoil weevil stocking program which occurred from 2000-2002. The effort was met with little success as there was no conclusive evidence of any control from the weevils.(Scribalio & Alix 2003). IDNR treated the boat launch area with contact herbicides in 2004 for control of Brazilian elodea. This treatment temporarily reduced growth in the area thus lowering the risk of spread to other lakes in the region. IDNR then funded an eradication effort in 2007 and 2008 where the whole lake was treated with low rates of fluridone. These treatments eradicated invasive Brazilian elodea. Invasive curly-leaf pondweed and Eurasian watermilfoil colonized many of the areas once dominated by Brazilian elodea. The Parks Department received LARE funding and completed selective treatment of Eurasian watermilfoil and curly-leaf pondweed in 2008 and 2009. These treatments controlled the targeted species in the treatment year, but, due to the abundance of reproductive structures and the presence of Eurasian watermilfoil in the watershed, these species returned the following seasons. The reservoir was drawn down in 2012 and high use areas on the east end were dredged in 2013 thus providing some relief. Table 1 summarizes control activities over the last 17 years.

Table 1. Griffy Lake vegetation management history.

Year	Control Technique	Acres	Species Targeted
2000-2002	Milfoil weevils	na	Eurasian watermilfoil
2004	Diquat	2.0	Brazilian elodea
2006	Whole lake fluridone	109	Brazilian elodea
2007	Whole lake fluridone	109	Brazilian elodea
2008	Early spring endothal triclopyr	15.7 (clp) 2.9 (ewm)	Curly-leaf pondweed & Eurasian watermilfoil
2009	Early spring endothal & triclopyr	17.8 (clp) 25.2 (EWM)	Curly-leaf pondweed & Eurasian watermilfoil

4.0 AQUATIC PLANT COMMUNITY CHARACTERIZATION

Aquatic vegetation sampling must be completed in order to create an effective aquatic vegetation management plan. Sampling provides valuable data that allows managers to accomplish several tasks: locate areas of nuisance and beneficial vegetation; monitor changes in abundance of native and invasive species; monitor and react to changes in the overall plant community; monitor the effectiveness of management techniques; and compare the plant communities to other populations. In 2016, invasive species mapping survey and Tier II surveys were completed on May 30 and August 25.

4.1 Methods

The Tier II survey helps meet the following objectives:

1. To document the distribution and abundance of submersed and floating-leaved aquatic vegetation.
2. To compare present distribution and abundance with past distribution and abundance within select areas.

Sample sites are selected based on a stratified random methodology. Once a site is reached the boat was slowed to a stop. A depth measurement was taken by dropping a two-headed standard sampling rake that was attached to a rope marked off in 1-foot increments. An additional ten feet of rope was released and the boat was reversed at minimum operating speed for a distance of ten feet. Once the rake is retrieved the individual plant abundance on the rake is scored with either a 0 (no plants retrieved), 1 (1-20% of rake teeth filled), 3 (21-99% of rake teeth filled), or 5 (100% of rake teeth filled) (IDNR 2014). Fifty sample sites were surveyed on Griffy Lake (Figure 4).

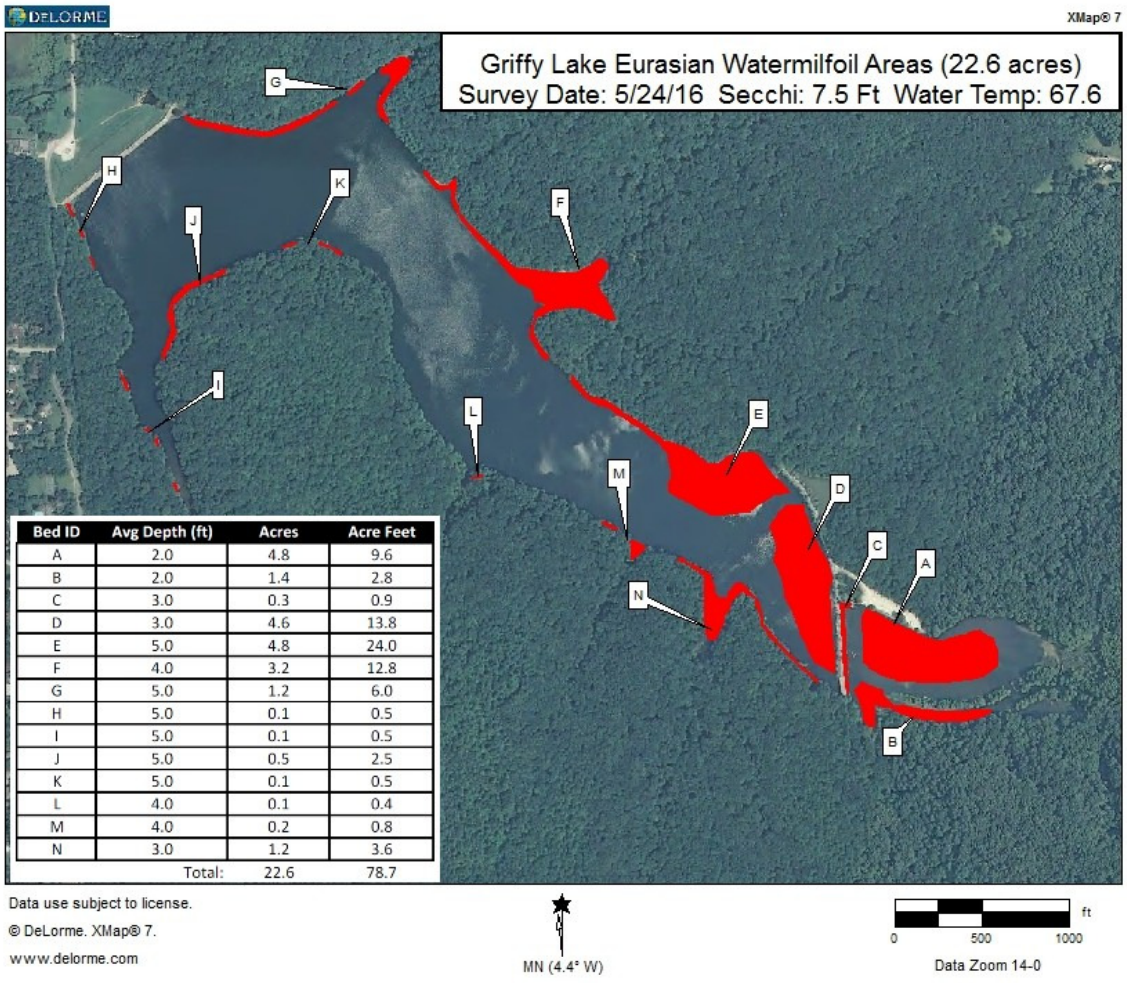
Figure 4. Tier II sample sites.

In addition to the Tier 2 survey, a mapping survey was also completed using hydroacoustic equipment and utilizing ciBioBase cloud based software to analyze the data. This data was collected passively during the summer Tier 2 survey by utilizing a Lowrance™ HDS7 sonar/gps unit. Hydroacoustic data was collected and stored on the unit and uploaded to ciBioBase cloud services where it was evaluated using custom acoustic algorithms, GIS tools, and mathematics to create interactive layered maps and standardized reports on depth and plant biovolume. This data allows one to objectively determine how a lakes plant coverage and depths change over time.

4.2 Sampling Results

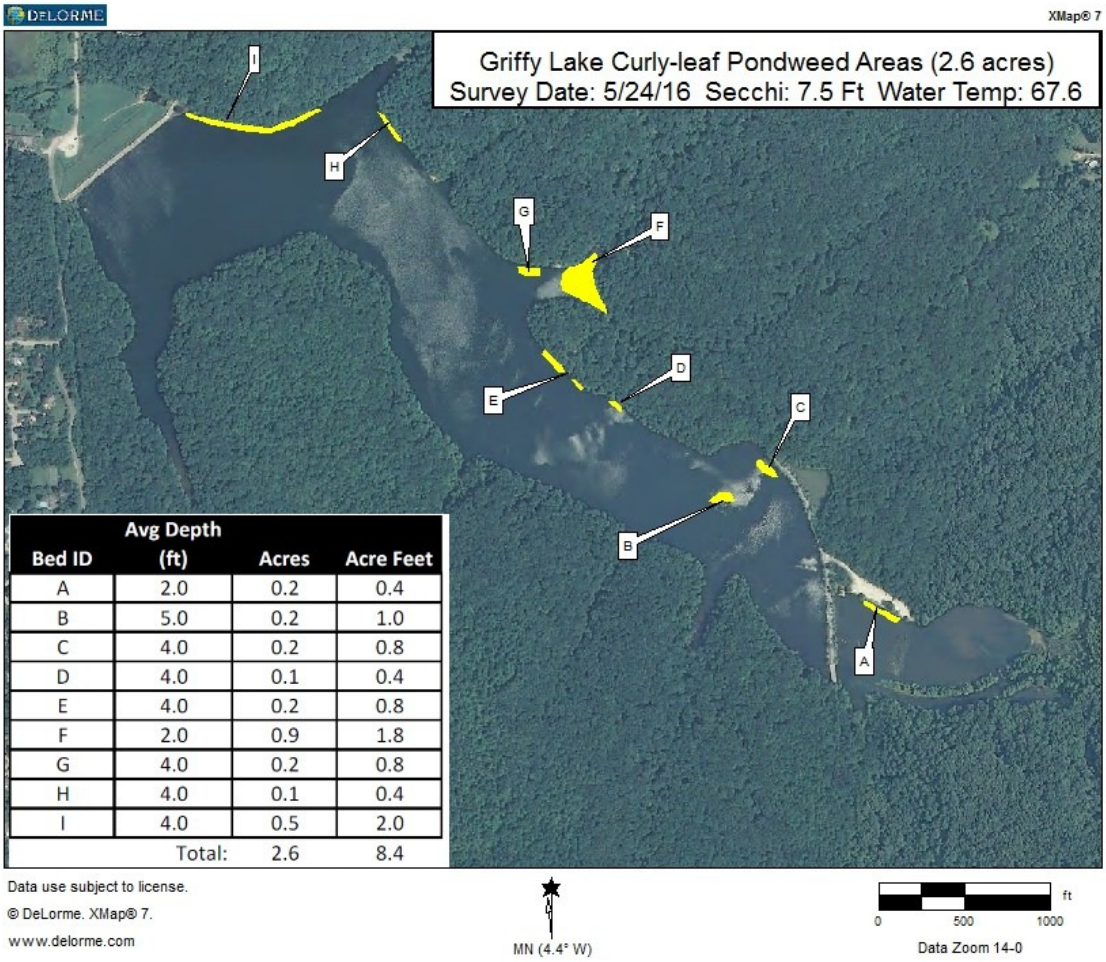
4.2.1 May 24, 2016 Survey

An invasive mapping survey was completed on May 24, 2016 and found 22.6 acres of Eurasian watermilfoil and 2.6 acres of curly-leaf pondweed in the spring (Figure 5 & 6)). Eurasian watermilfoil had reached the surface in many of these areas making navigation difficult. No other invasive aquatic plants were observed during the survey.



Bed ID	Avg Depth (ft)	Acres	Acre Feet
A	2.0	4.8	9.6
B	2.0	1.4	2.8
C	3.0	0.3	0.9
D	3.0	4.6	13.8
E	5.0	4.8	24.0
F	4.0	3.2	12.8
G	5.0	1.2	6.0
H	5.0	0.1	0.5
I	5.0	0.1	0.5
J	5.0	0.5	2.5
K	5.0	0.1	0.5
L	4.0	0.1	0.4
M	4.0	0.2	0.8
N	3.0	1.2	3.6
	Total:	22.6	78.7

Figure 5. Griffy Lake Eurasian watermilfoil areas, May 24, 2016.



Bed ID	Avg Depth (ft)	Acres	Acre Feet
A	2.0	0.2	0.4
B	5.0	0.2	1.0
C	4.0	0.2	0.8
D	4.0	0.1	0.4
E	4.0	0.2	0.8
F	2.0	0.9	1.8
G	4.0	0.2	0.8
H	4.0	0.1	0.4
I	4.0	0.5	2.0
	Total:	2.6	8.4

Figure 6. Griffy Lake curly-leaf pondweed areas, May 24, 2016.

A Tier 2 survey was also completed on May 24th. Fifty sample sites, down to a depth of 20 feet, were included in the survey. Seven species were collected to a maximum depth of 14 feet. Coontail was collected at the highest percentage of sample sites (40%), followed by Eurasian watermilfoil (18%) (Figure7). Curly-leaf pondweed was the only other invasive species collected and was found at only a single site (Figure 8). The results of the 2016 spring Tier II survey of Griffy Lake can be found in Table 2.

Table 2. Griffy Lake Tier 2 Survey Results, May 24, 2016.

Occurrence and Abundance of Submersed Aquatic Plants in Griffy Lake (all depths).								
County:	Kos	Total Sites:	50				Mean species/site:	0.88
Date:	5.24.16	Sites with plants:	26				SE Mean species/site:	0.17
Secchi (ft):	7.0	Sites with native plants:	24				Mean native species/site:	0.68
Max Plant Depth (ft):	14.0	Number of species:	7				SE Mean natives/site:	0.13
Trophic Status:	Meso	# of native species:	5				Species diversity:	0.72
Littoral Sites:	40	Maximum species/site:	6				Native species diversity:	0.61
All Depths		Frequency of Occurrence	Rake score frequency per sp				Plant Dominance	
Species			**0**	**1**	**3**	**5**		
Coontail		40.0	60.0	12.0	8.0	20.0	27.2	
Eurasian watermilfoil		18.0	82.0	14.0	2.0	2.0	6.0	
Sago pondweed		10.0	90.0	8.0	2.0	0.0	2.8	
Slender naiad		8.0	92.0	0.0	2.0	6.0	7.2	
Leafy pondweed		6.0	94.0	6.0	0.0	0.0	1.2	
Chara		4.0	96.0	0.0	4.0	0.0	2.4	
Curly-leaf pondweed		2.0	98.0	2.0	0.0	0.0	0.4	
Filamentous Algae		30.0						
Other species observed: Blue flag, iris, creeping water primrose,hibiscus, water willow, American pondweed, horned pondweed, and duckweed.								
Occurrence and Abundance of Submersed Aquatic Plants in Griffy Lake (0-5 ft).								
County:	Kos	Total Sites:	14				Mean species/site:	2.07
Date:	5.24.16	Sites with plants:	13				SE Mean species/site:	0.38
Secchi (ft):	7.0	Sites with native plants:	12				Mean native species/site:	1.43
Max Plant Depth (ft):	14.0	Number of species:	7				SE Mean natives/site:	0.29
Trophic Status:	Meso	# of native species:	5				Species diversity:	0.78
Littoral Sites:	14	Maximum species/site:	6				Native diversity:	0.70
Depth: 0 to 5 ft		Frequency of Occurrence	Rake score frequency per sp				Plant Dominance	
Species			**0**	**1**	**3**	**5**		
Coontail		64.3	35.7	14.3	14.3	35.7	47.1	
Eurasian watermilfoil		57.1	42.9	50.0	0.0	7.1	17.1	
Sago pondweed		35.7	64.3	28.6	7.1	0.0	10.0	
Leafy pondweed		21.4	78.6	21.4	0.0	0.0	4.3	
Chara		14.3	85.7	0.0	14.3	0.0	8.6	
Curly-leaf pondweed		7.1	92.9	7.1	0.0	0.0	1.4	
Slender naiad		7.1	92.9	0.0	7.1	0.0	4.3	
Filamentous Algae		28.6						
Occurrence and Abundance of Submersed Aquatic Plants in Griffy Lake (5-10 ft).								
County:	Kos	Total Sites:	14				Mean species/site:	0.79
Date:	5.24.16	Sites with plants:	9				SE Mean species/site:	0.19
Secchi (ft):	7.0	Sites with native plants:	8				Mean native species/site:	0.71
Max Plant Depth (ft):	14.0	Number of species:	3				SE Mean natives/site:	0.19
Trophic Status:	Meso	# of native species:	2				Species diversity:	0.51
Littoral Sites:	14	Maximum species/site:	2				Native diversity:	0.42
Depth: 5 to 10 ft		Frequency of Occurrence	Rake score frequency per sp				Plant Dominance	
Species			**0**	**1**	**3**	**5**		
Coontail		50.0	50.0	28.6	7.1	14.3	24.3	
Slender naiad		21.4	78.6	0.0	0.0	21.4	21.4	
Eurasian watermilfoil		7.1	92.9	0.0	7.1	0.0	4.3	
Filamentous Algae		14.3						

Table 2 Continued

Occurrence and Abundance of Submersed Aquatic Plants in Griffy Lake (10-15 ft).								
County:	Kos	Total Sites:	12				Mean species/site:	0.33
Date:	5.24.16	Sites with plants:	4				SE Mean species/site:	0.14
Secchi (ft):	7.0	Sites with native plants:	4				Mean native species/site:	0.33
Max Plant Depth (ft):	14.0	Number of species:	1				SE Mean natives/site:	0.14
Trophic Status:	Meso	# of native species:	1				Species diversity:	0.00
Littoral Sites:	12	Maximum species/site:	1				Native diversity:	0.00
Depth: 10 to 15 ft		Frequency of Occurrence	Rake score frequency per sp				Plant Dominance	
Species			**0**	**1**	**3**	**5**		
Coontail		33.3	66.7	0.0	8.3	25.0	30.0	
Filamentous Algae		50.0						
Occurrence and Abundance of Submersed Aquatic Plants in Griffy Lake (15-20 ft).								
County:	Kos	Total Sites:	10				Mean species/site:	0.00
Date:	5.24.16	Sites with plants:	0				SE Mean species/site:	0.00
Secchi (ft):	7.0	Sites with native plants:	0				Mean native species/site:	0.00
Max Plant Depth (ft):	14.0	Number of species:	0				SE Mean natives/site:	0.00
Trophic Status:	Meso	# of native species:	0				Species diversity:	0.00
Littoral Sites:	0	Maximum species/site:	0				Native diversity:	0.00
Depth: 15 to 20 ft		Frequency of Occurrence	Rake score frequency per sp				Plant Dominance	
Species			**0**	**1**	**3**	**5**		
Filamentous Algae		30.0						

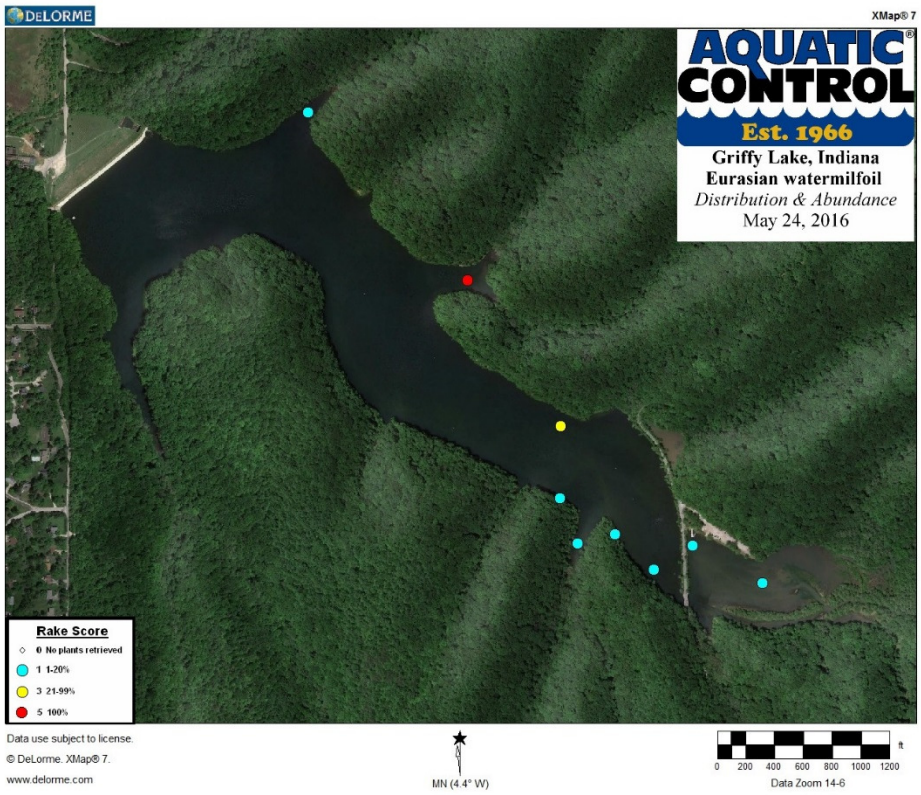


Figure 7. Tier 2 sample sites where Eurasian watermilfoil was collected, May 24, 2016.

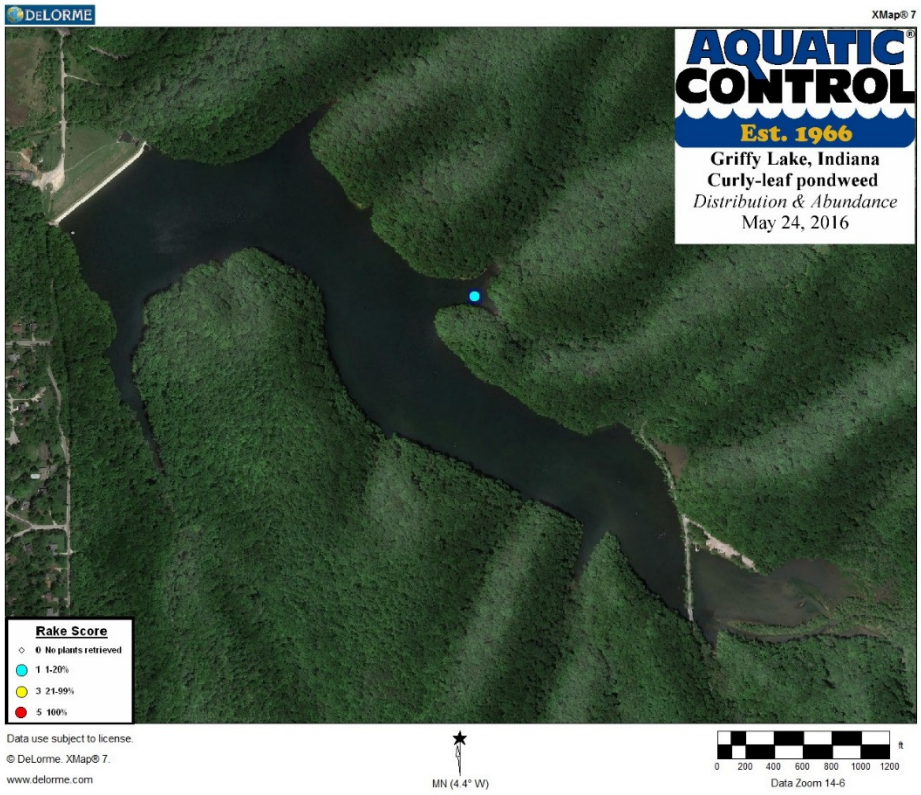
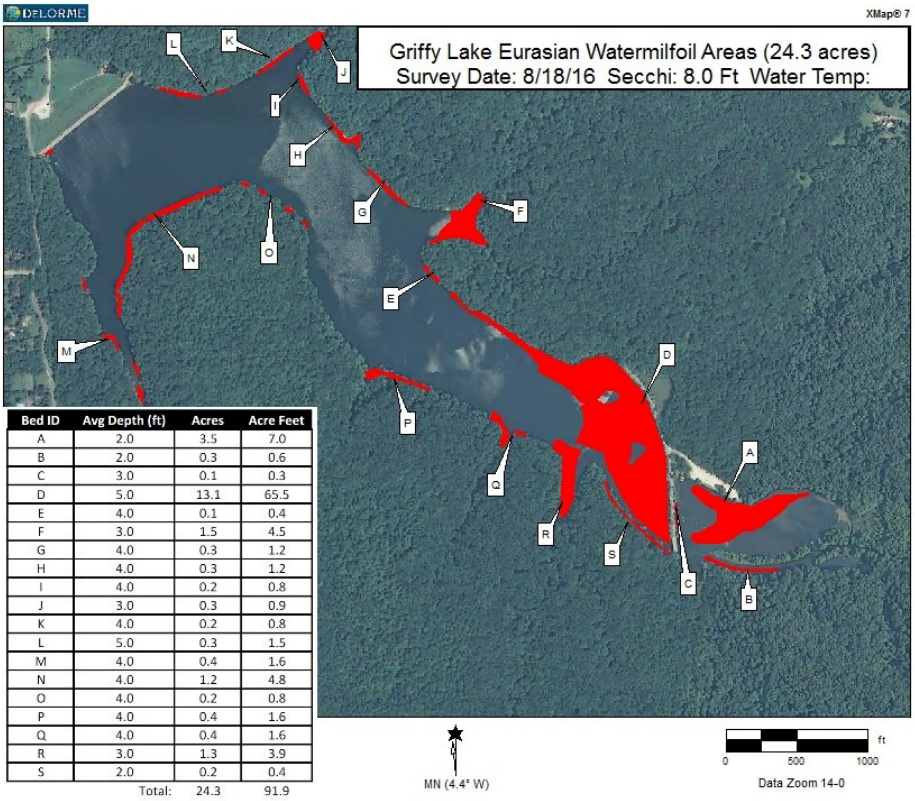


Figure 8. Tier 2 sample sites where curly-leaf pondweed was collected, May 24, 2016.

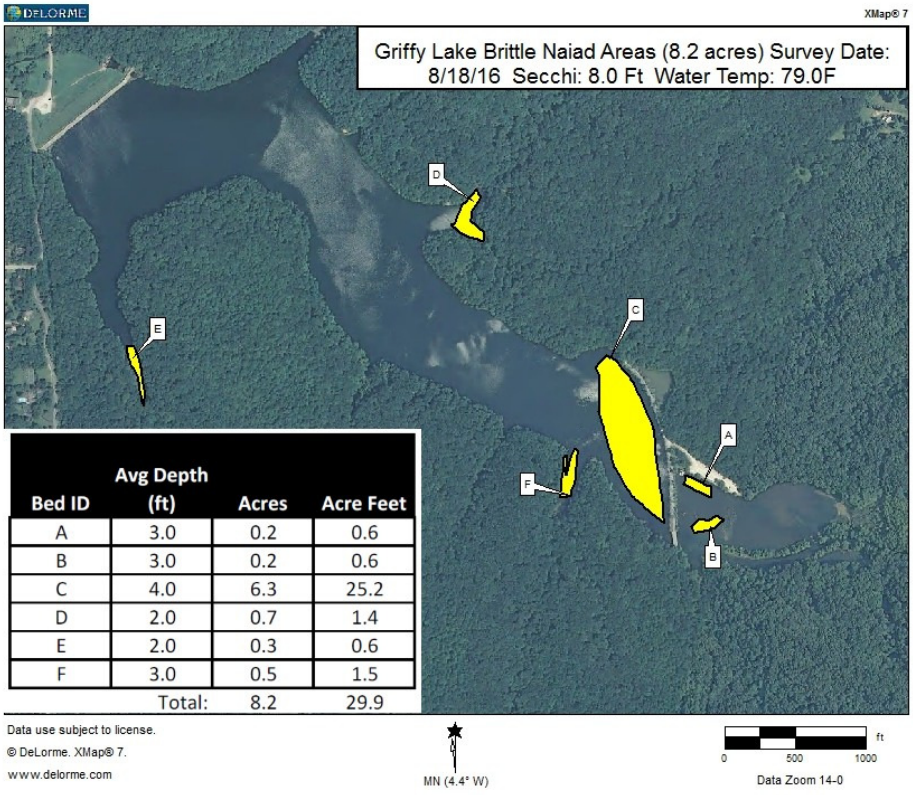
4.2.2 August 18, 2016 Survey

A second invasive mapping survey was completed on August 18, 2016 and found that Eurasian watermilfoil had increased and was now covering 24.3 acres (Figure 9). Curly-leaf pondweed was not detected in this survey, but non-native brittle naiad was found to be covering an area of approximately 8.2 acres (Figure 10).



Bed ID	Avg Depth (ft)	Acres	Acre Feet
A	2.0	3.5	7.0
B	2.0	0.3	0.6
C	3.0	0.1	0.3
D	5.0	13.1	65.5
E	4.0	0.1	0.4
F	3.0	1.5	4.5
G	4.0	0.3	1.2
H	4.0	0.3	1.2
I	4.0	0.2	0.8
J	3.0	0.3	0.9
K	4.0	0.2	0.8
L	5.0	0.3	1.5
M	4.0	0.4	1.6
N	4.0	1.2	4.8
O	4.0	0.2	0.8
P	4.0	0.4	1.6
Q	4.0	0.4	1.6
R	3.0	1.3	3.9
S	2.0	0.2	0.4
	Total:	24.3	91.9

Figure 9. Griffy Lake Eurasian watermilfoil areas, August 18, 2016.



Bed ID	Avg Depth (ft)	Acres	Acre Feet
A	3.0	0.2	0.6
B	3.0	0.2	0.6
C	4.0	6.3	25.2
D	2.0	0.7	1.4
E	2.0	0.3	0.6
F	3.0	0.5	1.5
	Total:	8.2	29.9

Figure 10. Griffy Lake brittle naiad areas, August 18, 2016.

A second Tier 2 survey was completed on August 18, 2016. The same fifty sample sites were included in the survey. Plants were present to a maximum depth of 14 feet. Only five species were collected and plants were present at 70% of littoral sites. Once again, coontail was collected at the highest frequency (50%) followed by Eurasian watermilfoil (22%) (Figure 11). Non-native brittle naiad, which was not present in the spring survey, was found at 18% of sites during the summer (Figure 12). The results of the August Tier II survey of Griffy Lake can be found in Table 3.

Table 3. Griffy Lake Tier 2 Survey Results, August 18, 2016.

Occurrence and Abundance of Submersed Aquatic Plants in Griffy Lake (all depths).								
County:	Monroe	Total Sites:	50				Mean species/site:	0.94
Date:	8.18.16	Sites with plants:	28				SE Mean species/site:	0.14
Secchi (ft):	8.0	Sites with native plants:	25				Mean native species/site:	0.54
Max Plant Depth (ft):	14.0	Number of species:	5				SE Mean natives/site:	0.08
Trophic Status:	Meso	# of native species:	3				Species diversity:	0.62
Littoral Sites:	40	Maximum species/site:	3				Native species diversity:	0.14
All Depths		Frequency of Occurrence	Rake score frequency per sp.				Plant Dominance	
Species			**0**	**1**	**3**	**5**		
Coontail		50.0	50.0	16.0	4.0	30.0	35.6	
Eurasian watermilfoil		22.0	78.0	12.0	8.0	2.0	9.2	
Brittle naiad		18.0	82.0	10.0	4.0	4.0	8.4	
Sago pondweed		2.0	98.0	2.0	0.0	0.0	0.4	
Slender naiad		2.0	98.0	0.0	2.0	0.0	1.2	
Other species observed: Sweet flag, arrowhead, creeping water primrose,swamp rose mallow/hibiscus, water willow, American pondweed, and water stargrass.								
Occurrence and Abundance of Submersed Aquatic Plants in Griffy Lake (0-5 ft).								
County:	Monroe	Total Sites:	14				Mean species/site:	2.00
Date:	8.18.16	Sites with plants:	14				SE Mean species/site:	0.18
Secchi (ft):	8.0	Sites with native plants:	12				Mean native species/site:	1.00
Max Plant Depth (ft):	14.0	Number of species:	5				SE Mean natives/site:	0.15
Trophic Status:	Meso	# of native species:	3				Species diversity:	0.69
Littoral Sites:	14	Maximum species/site:	3				Native diversity:	0.26
Depth: 0 to 5 ft		Frequency of Occurrence	Rake score frequency per sp.				Plant Dominance	
Species			**0**	**1**	**3**	**5**		
Coontail		85.7	14.3	28.6	7.1	50.0	60.0	
Eurasian watermilfoil		57.1	42.9	28.6	21.4	7.1	25.7	
Brittle naiad		42.9	57.1	21.4	14.3	7.1	20.0	
Sago pondweed		7.1	92.9	7.1	0.0	0.0	1.4	
Slender naiad		7.1	92.9	0.0	7.1	0.0	4.3	
Occurrence and Abundance of Submersed Aquatic Plants in Griffy Lake (5-10 ft).								
County:	Monroe	Total Sites:	14				Mean species/site:	0.93
Date:	8.18.16	Sites with plants:	9				SE Mean species/site:	0.25
Secchi (ft):	8.0	Sites with native plants:	9				Mean native species/site:	0.64
Max Plant Depth (ft):	14.0	Number of species:	3				SE Mean natives/site:	0.13
Trophic Status:	Meso	# of native species:	1				Species diversity:	0.47
Littoral Sites:	14	Maximum species/site:	3				Native diversity:	0.00
Depth: 5 to 10 ft		Frequency of Occurrence	Rake score frequency per sp.				Plant Dominance	
Species			**0**	**1**	**3**	**5**		
Coontail		64.3	35.7	14.3	7.1	42.9	50.0	
Brittle naiad		14.3	85.7	7.1	0.0	7.1	8.6	
Eurasian watermilfoil		14.3	85.7	7.1	7.1	0.0	5.7	

Table 3 Continued

Occurrence and Abundance of Submersed Aquatic Plants in Griffy Lake (10-15 ft).								
County:	Monroe	Total Sites:	12				Mean species/site:	0.50
Date:	8.18.16	Sites with plants:	5				SE Mean species/site:	0.19
Secchi (ft):	8.0	Sites with native plants:	4				Mean native species/site:	0.33
Max Plant Depth (ft):	14.0	Number of species:	3				SE Mean natives/site:	0.14
Trophic Status:	Meso	# of native species:	1				Species diversity:	0.50
Littoral Sites:	12	Maximum species/site:	2				Native diversity:	0.00
Depth: 10 to 15 ft		Frequency of Occurrence	Rake score frequency per sp.				Plant Dominance	
Species			**0**	**1**	**3**	**5**		
Coontail		33.3	66.7	16.7	0.0	16.7	20.0	
Brittle naiad		8.3	91.7	8.3	0.0	0.0	1.7	
Eurasian watermilfoil		8.3	91.7	8.3	0.0	0.0	1.7	

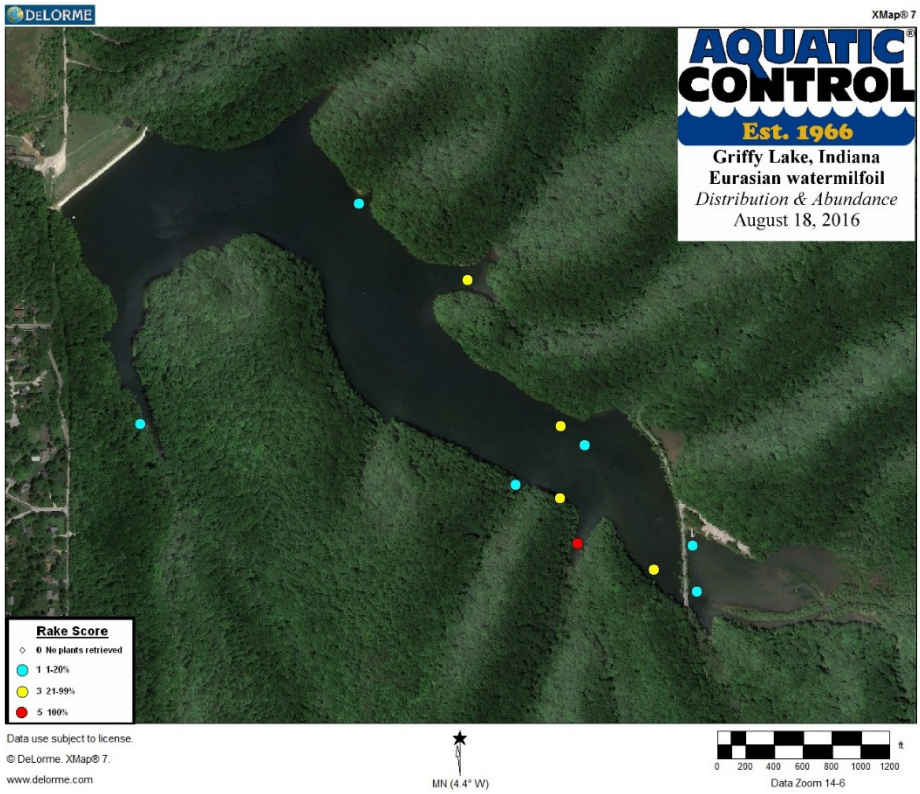


Figure 11. Tier 2 sample sites where Eurasian watermilfoil was collected, August 18, 2016.

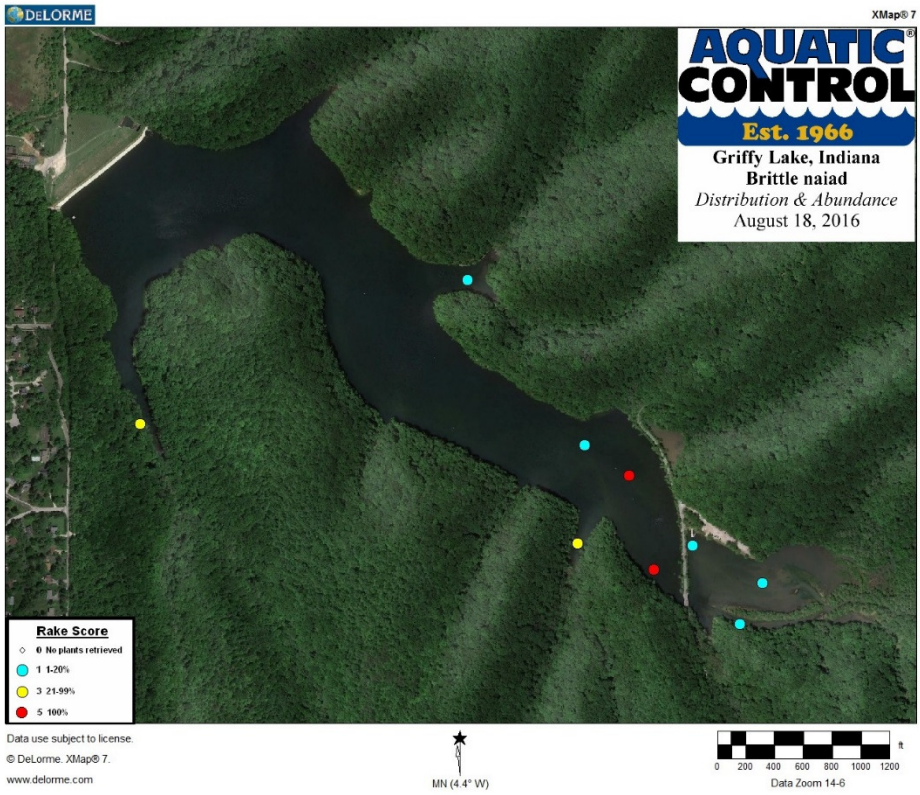


Figure 12. Tier 2 sample sites where brittle naiad was collected, August 18, 2016.

Hydroacoustic data was collected using a Lowrance HDS7 unit during the invasive and Tier 2 surveys. This data was uploaded to BioBase servers. BioBase programs use this data calculate the percent of the lake that was covered with vegetation, plant biovolume, and overall lake volume. According to the report, 49.4% of Griffy Lake was covered with vegetation and 40.6% of the lake's water volume was filled with aquatic plants. This is valuable baseline data that can be used in future comparisons. Figure 13 illustrates the plant coverage within Griffy Lake on August 18, 2016.

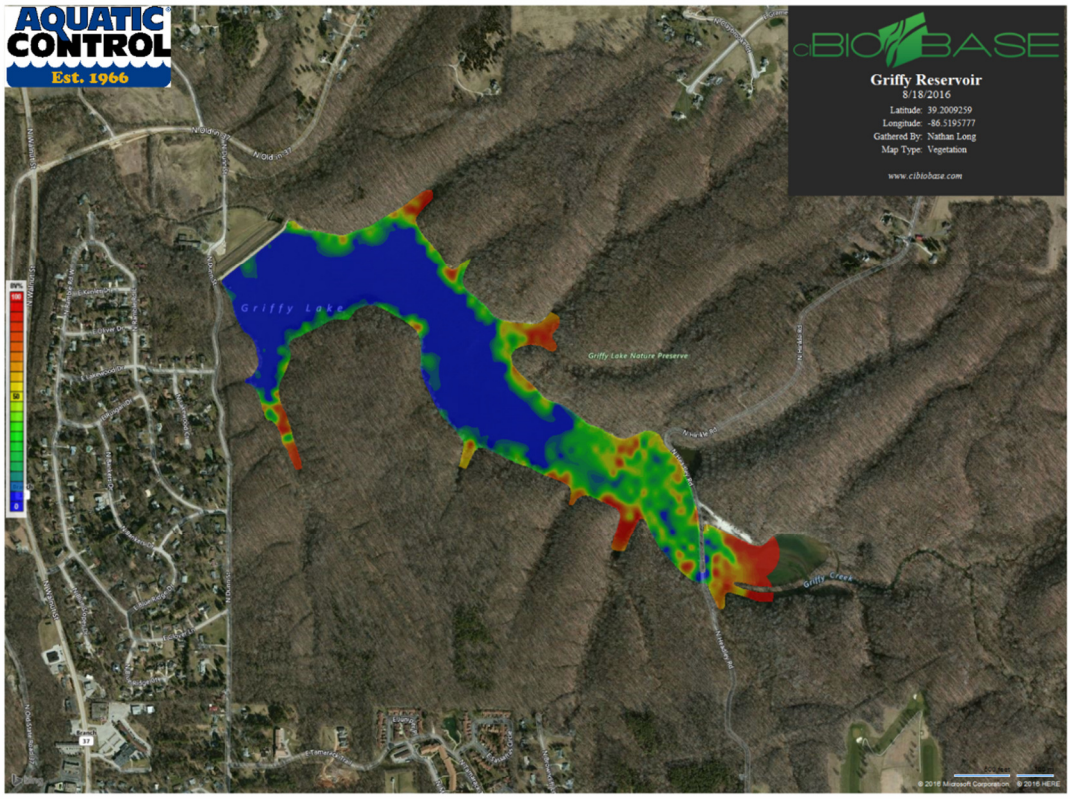


Figure 13. Griffy Lake plant biovolume, August 18, 2016.

4.3 Plant Sampling Discussion

Table 4 compares Tier II surveys completed 2004-2009 and 2016. There has been some noticeable variation in the plant community over the past 12 years. A lot of this variability can likely be attributed to the Brazilian elodea eradication treatments that occurred in 2006 and 2007. The plant population predictably required a few years to recover from the eradication treatment. By the late summer of 2009 the population was almost back to pre-treatment levels. No surveys occurred for 6 years after 2009. Strangely, the plant population now appears less abundant and diverse then it did two years following the eradication efforts. Native diversity and the percentage of littoral sites with plants have both declined since 2009. The reason for the decline is not clear as there could be a wide variety of factors impacting the plant population.

Invasive species may have an impact on diversity of native vegetation. Eurasian watermilfoil was not detectable from the spring of 2006 until late summer of 2008. Treatments completed in 2009 reduced Eurasian watermilfoil to 1% occurrence by late summer. No treatments have occurred since 2009. In 2016, Eurasian watermilfoil was found covering 22-25 acres of the lake and was present at 22% of overall sampling sites and 57% of sites from 0-5 feet in the summer survey. Interestingly, brittle naiad, which was present at 40% of sample sites in the summer of 2009, was not collected in the spring of 2016 and was only at 18% of sites by late summer. Curly-leaf pondweed, which is typically abundant in the spring, was only found at 2% of sample sites in May of 2016. One native species that appears to have declined is Chara. Chara was routinely found at

10-20% of sites in 2008 and 2009, but was not collected in late summer of 2016. Slender and southern naiad also were found at lower levels in 2016.

Table 4. Griffy Lake Tier 2 survey comparison (additional data broken down by depth range can be found in Appendix)**.**

Griffy Lake												
Surveyor	AC	IDNR	AC	AC	AC	AC	AC	AC	AC	AC	AC	AC
Date	8/31/2004	7/11/2005	8/8/2006	8/21/2007	5/5/2008	7/8/2008	8/26/2008	5/7/2009	6/30/2009	8/18/2009	5/24/2016	8/18/2016
Total Sites	62	78	50	100	100	100	100	100	100	100	50	50
Littoral Sites	61	72	48	83	86	93	99	93	81	94	40	40
Sites with Plants	58	68	22	28	39	27	58	55	58	75	26	28
% Sites with plants	94%	87%	44%	28%	39%	27%	58%	55%	58%	75%	52%	56%
Sites with Native Plants	54	na	21	28	20	21	29	45	50	66	24	25
Percent Littoral Coverage	95%	94%	46%	34%	45%	29%	59%	59%	72%	80%	65%	70%
Maximum Plant Depth	20	18	18	13	12	15	15	13	14	14	14	14
Secchi (ft)	10	7.5	5.5	10	9	10	12	16	11	12	7	8
Number of Species	10	11	4	1	3	5	7	9	9	10	7	5
Number of Native Species	6	7	3	1	2	3	5	7	6	7	5	3
Species Diversity	0.75	0.81	0.57	0.00	0.57	0.68	0.77	0.83	0.78	0.74	0.72	0.62
Native Species Diversity	0.32	0.64	0.43	0.00	0.31	0.63	0.76	0.74	0.71	0.64	0.61	0.14
Mean Native Species/Site	0.98	1.32	0.50	0.28	0.21	0.27	0.95	0.55	0.78	1.01	0.68	0.54
FOO - Depth: 0 to 25 ft												
Eurasian Watermilfoil	54.8	69.9	0.0	0.0	0.0	2.0	1.0	16.0	2.0	1.0	18.0	22.0
Curly-leaf pondweed	3.2	16.4	0.0	0.0	23.0	0.0	0.0	12.0	1.0	1.0	2.0	0.0
Brittle naiad	21.0	17.8	0.0	0.0	0.0	10.0	54.0	0.0	35.0	40.0	0.0	18.0
Brazilian elodea	32.3	49.3	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Coontail	80.6	72.6	38.0	0.0	0.0	0.0	0.0	4.0	12.0	18.0	40.0	50.0
Sago pondweed	8.1	8.2	0.0	0.0	0.0	3.0	9.0	2.0	3.0	7.0	10.0	2.0
Chara sp.	3.2	2.7	10.0	28.0	17.0	15.0	10.0	23.0	19.0	8.0	4.0	0.0
Slender naiad	3.2	15.1	0.0	0.0	0.0	0.0	10.0	0.0	0.0	0.0	8.0	0.0
Southern naiad	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.0	35.0	56.0	0.0	0.0
Canada waterweed	0.0	0.0	0.0	0.0	0.0	1.0	0.0	4.0	6.0	5.0	0.0	0.0
Horned pondweed	0.0	0.0	2.0	0.0	4.0	3.0	1.0	4.0	3.0	0.0	0.0	0.0
Small pondweed	1.6	8.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	0.0	0.0
American pondweed	1.6	2.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Leafy pondweed	0.0	0.0	0.0	0.0	0.0	5.0	10.0	4.0	0.0	0.0	6.0	2.0
Flatstem pondweed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0
Filamentous algae	4.8	na	na	na	na	na	na	na	na	na	30.0	0.0

5.0 Public Involvement

The Bloomington Parks Department manages the boat ramp, boat rental, and the area surrounding Griffy Lake. The Parks Department has posted signage informing lake users of the importance of cleaning off boats when entering and exiting Griffy Lake. This was especially important when Brazilian elodea was present in the lake, but remains important today due to the presence of invasive plants in Griffy Lake and the presence of invasive plants and animals in nearby lakes. It is important to obtain input from these users and inform them of the plant survey results and potential actions designed to alleviate nuisance conditions. Information concerning the plan was presented at the Parks meeting on October 14, 2016. In order to gain input from the lake users a user survey was distributed. Approximately 20 individuals were in attendance and 11 filled out the survey. The results of the survey are found in Table 5. Less than half of respondents

believed Griffy Lake had nuisance levels of aquatic vegetation, but 94.7% were in favor of controlling vegetation. Several individuals expressed a desire to only control invasive plants (the only type of vegetation control LARE will support).

Table 5. Lake User Survey, October 14, 2016.

Griffy Lake 10/25/16		
How many years have you been using the lake?	2 or Less: 22.2%	5 to 10 0.0%
	2 to 5: 11.1%	Over 10: 66.7%
How do you use the lake (mark all that apply)	Swimming 0.0%	Camping 0.0%
	Boating 44.4%	Other 66.7%
	Fishing 68.4%	
Does Griffy Lake have aquatic plants in nuisance quantities?	Yes: 44.4%	No: 22.2%
Does aquatic vegetation interfere with your use or enjoyment of the lake?	Yes: 44.4%	No: 55.6%
Are you in favor of continuing efforts to control vegetation on the lake?	Yes: 94.7%	No: 0.0%
Mark any of these you think are problems on your lake:		
Too many boats access the lake	11.1%	
Too much fishing	0.0%	
Fish population problem	11.1%	
Dredging needed	33.3%	
Too many aquatic plants	33.3%	
Not enough aquatic plants	0.0%	
Poor water quality	11.1%	

Comments:
Water quality is poor sometimes.
Need to keep control of invasive water plants or loose recreation quality and potential!!
I support the removal/management of invasive aquatic plants in the lake.
Hard to fish from shore. Only invasives should be controlled.
Love the variety of rental boats available. Paddle boards have been a great addition.
Invasive species are a danger to native ecosystem.

It will be important to continue keeping lake users informed of plant management activities on this lake. Notifications concerning public meetings should be posted at the boat ramp and park entrance. In addition, once vegetation management commences

signage needs to be posted at the park entrance and public ramp. This signage should inform the public of what is being applied, what vegetation is being targeted, and any associated lake use restrictions.

6.0 Goals and Objectives

An effective aquatic vegetation management plan needs to have clearly defined goals and objectives. The vegetation management goals for Indiana public lakes, which were created by IDNR, are as follows:

- Develop or maintain a stable, diverse aquatic plant community.
- Direct efforts to preventing and/or controlling the negative impacts of aquatic invasive species.
- Provide reasonable public recreational access while minimizing the negative impact on plants, fish, and wildlife resources.

In order to achieve these goals and measure the success of the actions, the plan needs to define some clear, achievable, and measurable management objectives. The following objectives have been created based on lake user input, past sampling data, and aquatic plant management best management practices:

1. Reduce and maintain Eurasian watermilfoil to below 10% frequency of occurrence.
2. Maintain plant coverage at 50%.
3. Improve native plant diversity to 6 native species collected in summer Tier 2 surveys and a native plant diversity index of 0.75.
4. Maintain adequate navigational lanes from the boat ramp to the main lake.

7.0 Management Options

Now that there are clear objectives in place one must consider the various control techniques that can be implemented in order to meet these objectives. There are a variety of options available. The alternatives that will be explored include: no action; cultural control; environmental control; mechanical control; manual control; biological control; chemical control; and any combination of these methods.

A number of different techniques have been successfully used to control nuisance vegetation. These techniques vary in terms of their efficacy, rapidity, and selectivity, as well as the thoroughness and longevity of control they are capable of achieving. Each technique has advantages and disadvantages, depending on the circumstances. Selectivity is a particularly important characteristic of control techniques. Nearly all aquatic plant control techniques are at least somewhat selective, in that they affect some plant species more than others. Even techniques such as harvesting that have little selectivity within the areas to which they are applied can be used selectively, by choosing only certain areas in which to apply them. Selectivity can also occur after the fact, as when a technique controls all plants equally but some grow back more rapidly. One facet of selecting an appropriate aquatic plant control technique is matching the selectivity of the control technique with the goals of aquatic plant management. When controlling Eurasian watermilfoil, for example, it is typically desirable to use techniques that control Eurasian watermilfoil with minimal impact on most native species (Smith, 2002).

7.1 No Action

No plant management activity has taken place for the past several years and Eurasian watermilfoil is currently occupying a 20-30 acre area of a 60 acre littoral zone. Native plant diversity and abundance has declined since plant management activities ceased in 2009. Would this decline continue if no action is taken? If conditions were right Eurasian watermilfoil could spread into deeper water areas. This level of nuisance vegetation could lead to a decrease in lake use by the public and potential ecological problems within the lake.

7.2 Cultural Control-Prevention

Preventing an invasive species from entering a waterbody is the preferred control technique. This is a very difficult task when it comes to a plant like Eurasian watermilfoil which is established in many aquatic systems throughout the Midwest and spreads through fragmentation. It is obviously too late to prevent Eurasian watermilfoil from getting into Griffy Lake, but there are several other invasive species that can also be spread in the through fragmentation and introduction from boat trailers that have yet to find their way to Griffy Lake. Regular monitoring and education of lake users can help keep these other invasive plants from gaining a foothold. In addition, if Eurasian watermilfoil is controlled in Griffy Lake, it will be important to prevent any remaining plants from reaching current levels by finding these beds and controlling them as soon as possible. Regular plant monitoring should be included to find any new infestations of invasive species.

7.3 Environmental Control-Drawdown & Nutrient Reduction

Two environmental controls that should be considered for Griffy Lake are water level manipulation and nutrient reduction. Water level manipulation refers to the raising of water levels to control aquatic vegetation by drowning or lowering to control aquatic vegetation by exposing them to freezing, drying or heat. Use of water level manipulation for aquatic plant management is limited to lakes and reservoirs with adequate water control structures. Griffy Lake does have a control structure, but due to the fact that Eurasian watermilfoil is growing to a depth of 11 feet, this may not be a realistic option.

Plant growth can be limited if at least one nutrient, which is critical for growth, is in short supply. Nitrogen, phosphorus or carbon are usually the nutrients limiting plant growth in lakes. Therefore, if at least one of these nutrients can be limited sufficiently so that plants do not grow to a nuisance level, this nutrient limitation can be used as a method of aquatic plant management. Generally, however, plants in Indiana can obtain the majority of necessary nutrients from the soil. Reduction of nutrients can actually aggravate an existing problems by increasing light penetration leading to an expansion in plant growth (Hoyer & Canfield, 1997). However, in certain situations, nutrient reduction can be effective at reducing overabundant floating vegetation or microscopic algae blooms. Currently, Griffy Lake does not have excessive floating plants or algae, but with a reduction in plant cover this could change. Previous studies have pointed out areas of concern within the watershed. Parks officials should continue to work with these parties in an effort to maintain and improve Griffy Lake's water quality.

7.4 Mechanical Control

Mechanical control includes cutting and/or harvesting of aquatic vegetation or dredging the bottom sediments to eliminate aquatic plant growth. The main advantage to mechanical control is the immediate removal of the plant growth from control areas and the removal of organic matter and nutrients.

One of the most common mechanical control techniques used on larger lakes in the Midwest is mechanical harvesting. Mechanical harvesting uses machines which cut plant stems and, in most cases, pick up the cut fragments for disposal. This type of mechanical control has little selectivity. Where a mix of Eurasian watermilfoil and native species exists, harvesting favors the plant species that grow back most rapidly following harvesting. In most cases, Eurasian watermilfoil recovers from harvesting much more rapidly than native plants. Thus, repeated harvesting hastens the replacement of native species by Eurasian watermilfoil and often leads to dense monocultures of Eurasian watermilfoil in frequently harvested areas. Harvesting also stirs up bottom sediments thus reducing water clarity, kills fish and many invertebrates, and hastens the spread of Eurasian watermilfoil via fragmentation.

Dredging has been used effectively in the upper end of Griffy Lake. The area from the boat slips leading out to the main lake was made significantly deeper when the lake was drawn down in 2013. Navigation in this area had historically been hampered by the shallow water and dense plant beds. Deepening of the area has reduced the amount of nuisance vegetation growth and has improved navigation. This control technique may need to be repeated every 7-10 years in order to maintain reasonable navigation.

7.5 Physical Control-Hand Pulling, Cutting, Raking

Removal of small amounts of vegetation by hand, which interfere with beach areas or boat docks, may have some limited benefits in small areas. Of course, hand removal is labor intensive and must be conducted on a routine basis. The frequency and practicality of continued hand removal will depend on availability of labor, regrowth or reintroduction potential of the vegetation, and the level of control desired (Hoyer & Canfield, 1997). Keep in mind that a plant like Eurasian watermilfoil can quickly return to a controlled area and the entire plant would need to be removed. In addition, plant fragments should be removed so they don't root in new areas. This technique may be employed in the dock area. City personnel are limited to clearing out a 625 square foot area without obtaining a permit.

7.6 Biological Control

Biological controls reduce aquatic vegetation using other organisms that consume aquatic plants or cause them to become diseased. The main biological controls for nuisance vegetation used in Indiana are the grass carp, milfoil weevil, and a variety of insects which prey upon purple loosestrife.

The grass carp (*Ctenopharyngodon idella)* is an herbivorous fish imported from Asia. Triploid grass carp, the sterile genetic derivative of the diploid grass carp, are legal for use in Indiana. Grass carp tend to produce all or nothing aquatic plant control. It is very difficult to achieve a stocking rate sufficient to selectively control nuisance species without eliminating all submersed vegetation. They are not particularly appropriate for Eurasian watermilfoil control because this species is low on their feeding preference list; thus, they eat most native plants before consuming Eurasian watermilfoil. Grass carp are also difficult to remove from a lake once they have been stocked and are also illegal to stock into Indiana natural lakes. Grass carp are not recommended for nuisance vegetation control in Griffy Lake.

The milfoil weevil, *Euhrychiopsis lecontei,* is a native North American insect that can feed on Eurasian and Northern watermilfoil. Numerous studies have been conducted to evaluate the utility of native insect herbivores as potential biocontrol agents of Eurasian watermilfoil, but none have proven to be predictable and effective to date. One of those studies was completed on Griffy Lake. Also, if native insects were able to effectively control introduced populations of Eurasian watermilfoil, new introductions of the weed would not result in population development and expansion to weedy proportions. Historical accounts of the introduction and spread of Eurasian watermilfoil suggest this has not occurred (Gettys et. al., 2014)

7.7 Chemical Control

Chemical control uses chemical herbicides to reduce or eliminate aquatic plant growth. Safety and potentially adverse environmental effects is often a concern when it comes to chemical control. Extensive testing is required of aquatic herbicides to ensure that the herbicides are low in toxicity to human and animal life and they are not overly persistent or bioaccumulated in fish or other organisms. It often takes several decades of testing by the Environmental Protection Agency (E.P.A.) before an herbicide is approved for aquatic use. After E.P.A approval and registration, the herbicide must go through the registration process in each state.

One disadvantage to the use of aquatic herbicides is water use restrictions. These restrictions must be posted prior to treatment on a public body of water. The most common restriction is irrigation. Another disadvantage to the use of herbicides is the release of nutrients that can occur if large areas of vegetation are controlled. This can be avoided by early application that controls vegetation before it reaches its maximum biomass. These perceived disadvantages are often times out-weighed by this technique's proven effectiveness, potential selectivity, and affordability.

There are two different types of aquatic herbicides, systemic and contact. Systemic herbicides are translocated throughout the plants and thereby kill the entire plants. Fluridone (trade name Sonar & Avast!) and 2,4-D (trade name Navigate, Sculpin, & DMA4 IVM), and triclopyr (trade name Renovate) are systemic herbicides that can effectively control Eurasian watermilfoil.

Whole-lake fluridone applications are one of the most effective means of controlling Eurasian watermilfoil. Successful fluridone treatments yield a dramatic reduction in the abundance of Eurasian watermilfoil, often reducing it to the point that Eurasian watermilfoil plants are difficult to detect following treatment. This was observed following the Brazilian elodea eradication treatments. Unfortunately, Eurasian watermilfoil was detected 1 year after the final fluridone treatment. Eurasian watermilfoil is known to exist upstream of Griffy Lake and that population likely led to the recolonization of the lake.

Triclopyr and 2,4-D are both effective systemic herbicides for control of Eurasian watermilfoil. These products can be used for treating isolated milfoil beds as opposed to whole lake treatments. Both herbicides are fairly selective to Eurasian watermilfoil. These products are a good alternative to fluridone when Eurasian watermilfoil is located in specific areas and when there are fluridone susceptible desirable plants within the population. It is difficult to completely eliminate Eurasian watermilfoil with these herbicides, but an aggressive treatment program would significantly reduce milfoil density and abundance to a more manageable and tolerable level. One drawback to using 2,4-D is the water use restrictions on irrigation.

Contact herbicides can also be effective for controlling submersed vegetation in the short term. The two primary contact herbicides used for control of submersed vegetation are diquat (trade name Reward) and copper based formulations (trade names Komeen, Nautique, and Clearigate). These products can be used to control Eurasian watermilfoil, but the longevity and selectivity is often limited.

8.0 Action Plan

We have established that Griffy Lake has an infestation of Eurasian watermilfoil which is producing dense mats that can hinder recreational activities. This is troublesome in a lake that is heavily used for shoreline fishing and is limited to electric motors for offshore fishing. Dense levels of Eurasian watermilfoil can also have impacts on the fish population and overall ecology of the lake. These concerns were expressed by lake users during the public meeting.

After reviewing available plant control options it is recommended that the City take an integrated approach to controlling this problem which includes a spot treatment of Eurasian watermilfoil with a selective systemic herbicide, monitoring of the plant population, periodic dredging of the high use boat ramp area, and continued education of the lake users. The herbicide treatment should be initiated in early spring 2017. Treatment should be completed with granular EPA registered 2,4-D herbicide (trade name: Navigate) at a rate of 2.0 ppm. Treatment areas should be mapped out in April or early May with an invasive survey. It is estimated that the cost of this treatment will be around $19,500.00. Up to 30 acres may require treatment. This treatment will require permitting from IDNR. IDNR has indicated that they will approve this application. A copy of the permit is located in the Appendix and will need to be signed and submitted along with a check for $5.00. This should be completed in January.

In addition to the herbicide treatment, it is also recommended that plant sampling be conducted in the spring and late summer to assess the treatment effectiveness. Sampling should include an invasive species survey in the spring of 2017 and an invasive and Tier 2 survey in late summer. This data can then be used to assess the treatment effectiveness and impacts on native vegetation and to update the vegetation management plan. Sampling and plan updates will cost approximately $3,500.00. LARE funding is available for sampling and plan updates. A grant application has been included in the Appendix of this plan that includes the plan update and treatment. This will need to be signed and submitted prior to January 31.

The public needs to be made aware of the treatment. Posting of signage informing lake users of the treatment will be required. In addition, lake users need to be encouraged to keep new invasive plants out of the lake. At a minimum signage should be maintained at the launch sites to inform boaters of the need to clean off their equipment before entering or leaving the lake. A public meeting should be held in late summer to inform lake users of the treatment and sampling results, best management practices, and future plans.

Navigation was greatly improved around the boat ramp area following the 2013 dredging. Hydroacoustic data showed that the channel leading from the ramp to the bridge still has 9-10 feet of water. Since the ramp is located on the upstream side of the main lake it will likely collect a lot of sediment following heavy rain events. Depth readings should be taken from this area every year in order to assess the need for future dredging.

This plan has focused on management of vegetation. Vegetation management and the overall water quality of Griffy Lake is impacted by what occurs in the watershed. It would benefit the longevity and health of Griffy Lake if Parks personnel continue their efforts to improve and maintain the reservoir's watershed.

The action plan is summarized below:

1. Complete treatment of invasive Eurasian watermilfoil with 2.0 ppm of EPA approved Navigate herbicide. Treatment should be completed following a spring invasive survey

2. Complete Tier 2 and invasive surveys in late summer to assess the effectiveness of the treatment and need for additional actions. In addition, survey can also be used to monitor the spread of other, less problematic, invasive species like curly-leaf pondweed and brittle naiad. This information should be used to update the vegetation management plan each season.

3. Annually monitor depths within the dredged channel leading to the main lake insuring there is adequate water depth for navigation. Consider budgeting for dredging this area every 10-15 years.

4. Educate lake users of the importance of cleaning boats when entering and leaving Griffy Lake with the use of signage and public meetings. Work with stakeholders upstream of Griffy Lake to reduce Eurasian watermilfoil abundance in watershed.

5. Continue to work to improve and maintain the Griffy Lake watershed.

Table 6. Estimated 5-Year vegetation management budget estimate for Griffy Lake

	2017	2018	2019	2020	2021
Invasive Species Treatment	$19,500	$9,000	$6,000	$4,000	$4,000
Vegetation Sampling and Plant Update	$3,500	$3,500	$3,500	$3,500	$3,500
Total Cost	$23,000	$12,500	$9,500	$7,500	$7,500
City's Share if LARE Grant Award (20%)	$4,600	$2,500	$1,900	$1,500	$1,500

In order to obtain and maintain funding for this project the City will have to complete a few tasks. We realize that this is a new endeavor, and in order to further streamline this process the following tasks are listed chronologically below:

- Submit a completed LARE grant application, located in the Appendix, by January 15, 2017.
- Submit a signed permit application, located in the Appendix, with a $5.00 check to IDNR by February 1, 2017.
- If selected to receive a grant, submit bid request forms (provided by IDNR) to a minimum of 3 contractors by March 1, 2017.
- Select a contractor by March 20, 2017.
- Submit contractor invoices to IDNR for 80% payment collection.

9.0 REFERENCES CITED

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10.0 APPENDICIES
10.1 Vegetation Control Permit Application

Page 1 of 3

APPLICATION FOR AQUATIC VEGETATION CONTROL PERMIT
State Form 26727 (R5 / 9-13)
Approved by State Board of Accounts, 2013

DEPARTMENT OF NATURAL RESOURCES
DIVISION OF FISH AND WILDLIFE
ATTN: COMMERCIAL LICENSE CLERK
402 W. Washington Street, Rm W273
Indianapolis, IN 46204
Telephone Number: (317) 232-4102
Fax Number: (317) 232-8150

FEE $5.00

Check type of permit: ☐ Whole Lake ☒ Multiple Treatment Areas

INSTRUCTIONS: 1. *Please print or type information.*
2. *Applicant must sign the application and is the only signature required. If applicant is also the certified chemical applicator that will be performing the treatment(s), he/she will also sign as the Certified Applicator.*

Applicant Name: Steve Cotter	Lake Association Name: City of Bloomington Parks & Recreation	
Street or Rural Route: 401 N Morton St Suite 250		Telephone Number: 812-349-3736
City and State: Bloomington, IN		ZIP Code: 47402
Certified Applicator Name	Company or Corporation Name	Certification Number
Street or Rural Route		Telephone Number
City and State		ZIP Code
Water Body Name (One application per water body): GriffyLake	Nearest Town: Bloomington	County: Monroe
Is the body of water a water supply or does it flow into a water supply?	☐ Yes	☒ No

Please complete one section for *EACH* treatment area. Attach lake map showing treatment area and denote location of any water supply intake.

Treatment area number:	Latitude / Longitude or Universal Transverse Mercator (UTM):	Total acres to be controlled:	Proposed shoreline treatment length (ft):	Perpendicular distance from shoreline (ft):
1	Areas to be determined following spring survey	20-35	na	na

Maximum depth of treatment (ft):	Expected date(s) of treatment(s):	Treatment method:
8	spring	☒ Chemical ☐ Physical ☐ Biological Control ☐ Mechanical

Based on treatment method, describe chemical to be used, method of physical or mechanical control and disposal area, or the species and stocking rate for biological control. Granular 2,4-D for selective control of E. Milfoil following spring invasive survey

Plant survey method: ☐ Rake ☒ Visual ☐ Other (*specify*) _____

Aquatic Plant Name	Check if Target Species	% Relative Abundance of Community	Aquatic Plant Name	Check if Target Species	% Relative Abundance of Community
Eurasian watermilfoil	✓	25			
Coontail		35			
Chara		5			
Sago pondweed		15			
Brittle naiad		5			
Curlyleaf pondweed		5			
Slender naiad		5			
Leafy pondweed		5			

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Treatment area number:	Latitude / Longitude or Universal Transverse Mercator (UTM):	Total acres to be controlled:	Proposed shoreline treatment length (ft):	Perpendicular distance from shoreline (ft):

Maximum depth of treatment (ft):	Expected date(s) of treatment(s):	Treatment method: ☐ Chemical ☐ Physical ☐ Biological Control ☐ Mechanical

Based on treatment method, describe chemical to be used, method of physical or mechanical control and disposal area, or the species and stocking rate for biological control.

Plant survey method: ☐ Rake ☐ Visual ☐ Other (*specify*)

Aquatic Plant Name	Check if Target Species	% Relative Abundance of Community	Aquatic Plant Name	Check if Target Species	% Relative Abundance of Community
	☐			☐	
	☐			☐	
	☐			☐	
	☐			☐	
	☐			☐	

Treatment area number:	Latitude / Longitude or Universal Transverse Mercator (UTM):	Total acres to be controlled:	Proposed shoreline treatment length (ft):	Perpendicular distance from shoreline (ft):

Maximum depth of treatment (ft):	Expected date(s) of treatment(s):	Treatment method: ☐ Chemical ☐ Physical ☐ Biological Control ☐ Mechanical

Based on treatment method, describe chemical to be used, method of physical or mechanical control and disposal area, or the species and stocking rate for biological control.

Plant survey method: ☐ Rake ☐ Visual ☐ Other (*specify*)

Aquatic Plant Name	Check if Target Species	% Relative Abundance of Community	Aquatic Plant Name	Check if Target Species	% Relative Abundance of Community
	☐			☐	
	☐			☐	
	☐			☐	
	☐			☐	
	☐			☐	

AGREEMENT

I have read and understand the Indiana Aquatic Vegetation Control Permit Laws and agree to abide by them. Under the penalties of perjury (IC 35-44-2-1), I affirm the information supplied by me is true and correct to the best of my knowledge.

Signature of Applicant — Date (*month, day, year*)

Signature of Certified Applicator — Date (*month, day, year*)

Make check or money order payable to DNR - Division of Fish and Wildlife in the amount of $5.00
Return completed application with the $5.00 permit fee to the address shown on page 1.

OFFICE USE ONLY

Permit Number	Check Number	Other

☐ Denied ☐ Approved ☐ Approved w/Conditions	Fisheries Section Approval

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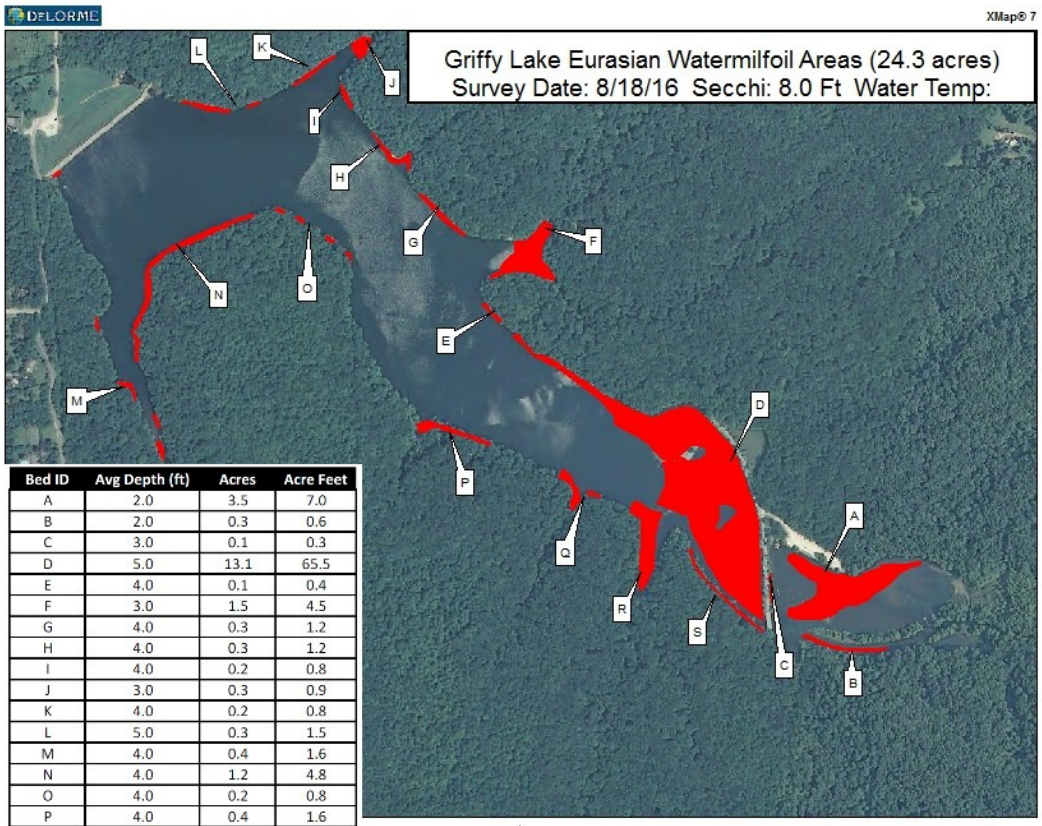

Bed ID	Avg Depth (ft)	Acres	Acre Feet
A	2.0	3.5	7.0
B	2.0	0.3	0.6
C	3.0	0.1	0.3
D	5.0	13.1	65.5
E	4.0	0.1	0.4
F	3.0	1.5	4.5
G	4.0	0.3	1.2
H	4.0	0.3	1.2
I	4.0	0.2	0.8
J	3.0	0.3	0.9
K	4.0	0.2	0.8
L	5.0	0.3	1.5
M	4.0	0.4	1.6
N	4.0	1.2	4.8
O	4.0	0.2	0.8
P	4.0	0.4	1.6
Q	4.0	0.4	1.6
R	3.0	1.3	3.9
S	2.0	0.2	0.4
	Total:	24.3	91.9

10.2 LARE Grant Application (Sponsor needs to sign and fill out sections A and B, Page 1 and top of page 2, electronic copy has been made available)

AQUATIC VEGETATION MANAGEMENT PROJECT APPLICATION
LAKE AND RIVER ENHANCEMENT (LARE) PROGRAM
State Form 54522 (R3 / 8-16)
INDIANA DEPARTMENT OF NATURAL RESOURCES, DIVISION OF FISH & WILDLIFE

Application deadline is January 31st of the year in which grant is awarded.

ACTIVITIES RELATED TO AQUATIC VEGETATION MANAGEMENT FOR LAKES
I. APPLICANT INFORMATION
A. Project sponsor *(applicant)*:
Name of Sponsor Organization: City of Bloomington Parks & Recreation
Address *(number and street)*: 401 N Morton St Suite 250
City, State, and ZIP Code: Bloomington, IN 47402
Telephone: 812-349-3736
E-mail address: cotters@bloomington.in.gov
Person completing application: Name: Steve Cotter
Title: Natural Resource Manager
Telephone *(if different)*:
E-mail address *(if different)*:
Is the project sponsor registered as a vendor with the state of Indiana? ☐ Yes ☐ No Is the project sponsor registered as a bidder with the state of Indiana? ☐ Yes ☐ No Project sponsor must be registered as both a vendor and a bidder to be eligible to receive LARE grants.
B. Daily contact for the project *(if different from person completing the application)* will be:
Name:
Title:
Telephone *(if different)*:
E-mail address *(if different)*:
C. Briefly describe the past and present activities of the sponsor organization.
D. Describe the legal status of the sponsor organization, i.e., indicate what the sponsor has done to acquire official standing. State when the organization was established. List current officers' / officials' names.
E. If the sponsor organization is a property owners or lake association, what percentage of the affected lake's residents are members of the group? na
F. Are there other organizations also representing residents of the affected lake? What relationship do those organizations have with the sponsor / applicant on matters related to this proposed project?

1

G. Briefly describe the financial resources available to the sponsor organization *(e.g. dues, contributions, fund drives, taxes, etc.).*

II. LAKE / WATERSHED INFORMATION

A. Lake(s) name(s):
Griffy Lake

B. County or Counties:
Monroe

C. Lake size(s) (acres):
109

D. Watershed (drainage basin) size (acres), *(if known):*
5037

E. 12 digit Hydrologic Unit Code (HUC)
051202020105

F. Describe how the general public can gain access to the lake(s) *(i.e., the number and types of access sites, their location, ownership, and any fees charged).*
Public access in souteast corner. Public property around lake.

III. PROJECT INFORMATION

A. For what specific purpose or need is funding being sought?
Treatment of Eurasian watermilfoil, plant sampling, and updating aquatic vegetation management plan.

Development of a new or updated Aquatic Vegetation Management Plan (AVMP)?
Yes, Update

Management (treatment) of aquatic vegetation?
Yes

Other? *(Explain.)*

B. Describe any studies or restoration measures that have been completed for the lake / watershed.
Design Report for the Griffy Lake Shoreline Stabilization Project 2011, Griffy Lake AVMP and Updates 2005, 2007-2010

C. Complete the table below as well as describe here or on an attached sheet the activities for which funding is requested *(include maps of treatment areas, include average depth of treatment areas, indicate whole-lake or spot treatment, indicate priority species if only one can be funded; as well as other support materials, as applicable).*

Species	Total Acreage Including Channels	Channel Only Acreage	Chemical Name	Treatment Cost
Eurasian watermilfoil	30		2,4-D Granular (Navigate) 2ppm	$19,500

D. What is the total estimated cost of the project? $ 23000

Itemized by specific expenses:

Planning and Surveys *(AVMP or update):* $ 3,500

Herbicide treatment costs: $ 19,500

Other *(revegetation, ecozones, etc):* $

Anticipated cost-share to be contributed by sponsor ($ or %): 20%

What was the basis for the estimate *(e.g., diagnostic or feasibility study, preliminary estimate by consultant, formal bidding, etc.)*? AVMP and consultation from contractor (Aquatic Control)
E. If a LARE grant were awarded for herbicide treatment, when would the effort realistically be expected to begin *(e.g., early-season treatment, prior to June 1st, etc.)*? April/May
F. Indicate how the sponsor will oversee the contractor's work and participate in the effort. Sponsor will help inform lake users of treatment date and restrictions. Sponsor will monitor treatment results and hold contractor accountable for work.
This application for Lake and River Enhancement program assistance is hereby submitted as authorized by the sponsoring organization.
Sponsor organization: City of Bloomington Parks & Recreation
Printed name of representative:
Signature of representative: ***(Note: Please insert the initials of the representative in this box to constitute the electronic signature on your organization's application.)***
Date *(month, day, year)*:

INSTRUCTIONS: This application should be completed electronically.
To submit, choose "save as", assign a file name with your organization's name, and then choose "save."
E-mail the resulting file to: lare@dnr.IN.gov

If you have questions contact:
Lake and River Enhancement Program
Division of Fish and Wildlife
Indiana Department of Natural Resources
402 W. Washington Street, Room W273
Indianapolis, IN 46204

Telephone: 317-233-1484
Fax: 317-232-8150

Application deadline is January 31st of the year grant is awarded.

10.3 LARE Tier 2 Data Comparison by Depth Range

Griffy Lake												
Surveyor	AC	IDNR	AC	AC	AC	AC	AC	AC	AC	AC	AC	AC
Date	8/31/2004	7/11/2005	8/8/2006	8/21/2007	5/5/2008	7/8/2008	8/26/2008	5/7/2009	6/30/2009	8/18/2009	5/24/2016	8/18/2016
Total Sites	62	78	50	100	100	100	100	100	100	100	50	50
Littoral Sites	61	72	48	83	86	93	99	93	81	94	40	40
Sites with Plants	58	68	22	28	39	27	58	55	58	75	26	28
% Sites with plants	94%	87%	44%	28%	39%	27%	58%	55%	58%	75%	52%	56%
Sites with Native Plants	54	na	21	28	20	21	29	45	50	66	24	25
Percent Littoral Coverage	95%	94%	46%	34%	45%	29%	59%	59%	72%	80%	65%	70%
Maximum Plant Depth	20	18	18	13	12	15	15	13	14	14	14	14
Secchi (ft)	10	7.5	5.5	10	9	10	12	16	11	12	7	8
Number of Species	10	11	4	1	3	5	7	9	9	10	7	5
Number of Native Species	6	7	3	1	2	3	5	7	6	7	5	3
Species Diversity	0.75	0.81	0.57	0.00	0.57	0.68	0.77	0.83	0.78	0.74	0.72	0.62
Native Species Diversity	0.32	0.64	0.43	0.00	0.31	0.63	0.76	0.74	0.71	0.64	0.61	0.14
Mean Native Species/Site	0.98	1.32	0.50	0.28	0.21	0.27	0.95	0.55	0.78	1.01	0.68	0.54
FOO - Depth: 0 to 25 ft												
Eurasian Watermilfoil	54.8	69.9	0.0	0.0	0.0	2.0	1.0	16.0	2.0	1.0	18.0	22.0
Curly-leaf pondweed	3.2	16.4	0.0	0.0	23.0	0.0	0.0	12.0	1.0	1.0	2.0	0.0
Brittle naiad	21.0	17.8	0.0	0.0	0.0	10.0	54.0	0.0	35.0	40.0	0.0	18.0
Brazilian elodea	32.3	49.3	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Coontail	80.6	72.6	38.0	0.0	0.0	0.0	0.0	4.0	12.0	18.0	40.0	50.0
Sago pondweed	8.1	8.2	0.0	0.0	0.0	3.0	9.0	2.0	3.0	7.0	10.0	2.0
Chara sp.	3.2	2.7	10.0	28.0	17.0	15.0	10.0	23.0	19.0	8.0	4.0	0.0
Slender naiad	3.2	15.1	0.0	0.0	0.0	0.0	10.0	0.0	0.0	0.0	8.0	0.0
Southern naiad	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.0	35.0	56.0	0.0	0.0
Canada waterweed	0.0	0.0	0.0	0.0	0.0	1.0	0.0	4.0	6.0	5.0	0.0	0.0
Horned pondweed	0.0	0.0	2.0	0.0	4.0	3.0	1.0	4.0	3.0	0.0	0.0	0.0
Small pondweed	1.6	8.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	0.0	0.0
American pondweed	1.6	2.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Leafy pondweed	0.0	0.0	0.0	0.0	0.0	5.0	10.0	4.0	0.0	0.0	6.0	2.0
Flatstem pondweed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0
Filamentous algae	4.8	na	na	na	na	na	na	na	na	na	30.0	0.0
FOO - Depth: 0 to 5 ft												
Eurasian Watermilfoil	86.4	na	0.0	0.0	0.0	0.0	0.0	21.4	0.0	0.0	57.1	57.1
Curly-leaf pondweed	4.5	na	0.0	0.0	13.3	0.0	0.0	14.3	0.0	4.0	7.1	0.0
Brittle naiad	36.4	na	0.0	0.0	0.0	17.6	82.9	0.0	61.1	64.0	0.0	42.9
Brazilian elodea	36.4	na	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Coontail	68.2	na	21.4	0.0	0.0	0.0	0.0	0.0	5.6	16.0	64.3	85.7
Sago pondweed	9.1	na	0.0	0.0	0.0	5.9	11.4	3.6	5.6	12.0	35.7	7.1
Chara sp.	9.1	na	28.6	56.0	20.0	26.5	25.7	25.0	27.8	4.0	4.0	0.0
Slender naiad	4.5	na	0.0	0.0	0.0	0.0	11.4	0.0	0.0	0.0	7.1	7.1
Southern naiad	0.0	na	0.0	0.0	0.0	0.0	0.0	14.3	66.7	76.0	0.0	0.0
Canada waterweed	0.0	na	0.0	0.0	0.0	2.9	0.0	14.7	27.8	20.0	0.0	0.0
Horned pondweed	0.0	na	0.0	0.0	13.3	8.8	2.9	14.3	16.7	0.0	0.0	0.0
Water stargrass	0.0	na	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Small pondweed	0.0	na	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0	0.0	0.0
American pondweed	4.5	na	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Illinois pondweed	0.0	na	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Leafy pondweed	0.0	na	0.0	0.0	0.0	14.7	17.1	10.7	0.0	0.0	21.4	0.0
Flatstem pondweed	0.0	na	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0	0.0	0.0
Filamentous algae	13.6	na	na	na	na	na	na	na	na	na	28.6	0.0

Species Frequency of Occurrence - Depth: 5 to 10 ft												
Eurasian Watermilfoil	56.5	na	0.0	0.0	0.0	2.5	2.5	19.2	5.4	2.2	7.1	14.3
Curly-leaf pondweed	4.3	na	0.0	0.0	30.6	0.0	0.0	13.5	2.7	0.0	0.0	0.0
Brittle naiad	21.7	na	0.0	0.0	0.0	10.0	52.5	0.0	64.9	45.7	0.0	14.3
Brazilian elodea	43.5	na	21.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Coontail	91.3	na	57.1	0.0	0.0	0.0	0.0	5.8	24.3	13.0	50.0	64.3
Sago pondweed	13.0	na	0.0	0.0	0.0	2.5	10.0	1.9	5.4	8.7	0.0	0.0
Chara sp.	0.0	na	0.0	37.1	22.4	15.0	0.0	23.1	21.6	13.0	0.0	0.0
Slender naiad	4.3	na	0.0	0.0	0.0	0.0	12.5	0.0	0.0	0.0	21.4	0.0
Southern naiad	0.0	na	0.0	0.0	0.0	0.0	0.0	19.2	51.4	67.4	0.0	0.0
Canada waterweed	0.0	na	0.0	0.0	0.0	0.0	0.0	1.9	2.7	0.0	0.0	0.0
Horned pondweed	0.0	na	7.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Water stargrass	0.0	na	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Small pondweed	4.3	na	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.7	0.0	0.0
Illinois pondweed	0.0	na	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Leafy pondweed	0.0	na	0.0	0.0	0.0	0.0	10.0	1.9	0.0	0.0	0.0	0.0
Flatstem pondweed	0.0	na	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.2	0.0	0.0
Filamentous algae	0.0	na	na	na	na	na	na	na	na	na	14.3	0.0
Species Frequency of Occurrence - Depth: 10 to 15 ft												
Eurasian Watermilfoil	20.0	na	0.0	0.0	0.0	5.0	0.0	0.0	0.0	0.0	0.0	8.3
Curly-leaf pondweed	0.0	na	0.0	0.0	26.7	0.0	0.0	6.3	0.0	0.0	0.0	0.0
Brittle naiad	0.0	na	0.0	0.0	0.0	0.0	17.4	0.0	0.0	12.0	0.0	8.3
Brazilian elodea	20.0	na	16.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Coontail	80.0	na	50.0	0.0	0.0	0.0	0.0	6.3	5.3	32.0	33.3	33.3
Sago pondweed	0.0	na	0.0	0.0	0.0	0.0	4.3	0.0	0.0	0.0	0.0	0.0
Chara sp.	0.0	na	8.3	3.2	0.0	0.0	4.3	25.0	15.8	4.0	0.0	0.0
Slender naiad	0.0	na	0.0	0.0	0.0	0.0	4.3	0.0	0.0	0.0	0.0	0.0
Southern naiad	0.0	na	0.0	0.0	0.0	0.0	0.0	0.0	10.5	24.0	0.0	0.0
Species Frequency of Occurrence - Depth: 15 to 20 ft												
Coontail	100.0	na	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Filamentous algae	0.0	na	na	na	na	na	na	na	na	na	30.0	0.0

May 24, 2016 Tier 2 Survey Raw Data

WPT	Lat	Long	Depth	Eurasian watermilfoil	Curly-leaf pondweed	Fil. Algae	Coontail	Chara	Leafy pondweed	Slender naiad	Sago pondweed
1	39.19714	-86.5113	3	1							
2	39.19698	-86.5129	3			P	3				1
3	39.1974	-86.5139	3	1		P	1		1		3
4	39.1984	-86.5137	7				5				
5	39.19919	-86.5145	6			P	1			5	
6	39.20008	-86.5149	6				3			5	
7	39.19976	-86.5156	7							5	
8	39.20013	-86.5162	9	3							
9	39.20066	-86.5177	13			P					
10	39.20137	-86.5187	14			P					
11	39.20195	-86.5195	16			P					
12	39.20258	-86.5196	12			P	5				
13	39.20292	-86.5185	2	5	1		5	3	1	3	
14	39.20307	-86.5197	12			P					
15	39.2038	-86.5208	16			P					
16	39.20438	-86.5212	11				5				
17	39.2051	-86.522	14				3				
18	39.20611	-86.5224	5	1							1
19	39.20588	-86.5233	14			P					
20	39.20543	-86.5243	18								
21	39.2054	-86.5257	17			P					
22	39.20553	-86.5265	17								
23	39.20499	-86.5275	14								
24	39.20445	-86.5283	18								
25	39.20381	-86.5285	13								
26	39.20295	-86.5277	18								
27	39.2024	-86.5274	16								
28	39.20157	-86.5275	14								
29	39.20016	-86.5266	2			P			1		
30	39.20113	-86.5271	9								
31	39.20238	-86.5268	11				5				
32	39.20321	-86.5262	16								
33	39.20367	-86.5249	19								
34	39.20378	-86.5237	9			P	1				
35	39.20327	-86.5225	8				1				
36	39.20243	-86.5223	9								
37	39.20161	-86.5221	9								
38	39.20112	-86.5217	6								
39	39.20092	-86.5215	9								
40	39.20029	-86.5206	3				1	3			
41	39.19987	-86.5191	8				1				
42	39.19945	-86.5181	5								
43	39.19901	-86.5173	4				5				
44	39.19917	-86.5159	9				5				
45	39.19876	-86.5162	5	1			3				
46	39.19789	-86.5158	3	1		P	5				
47	39.19843	-86.5154	4				5				1
48	39.19807	-86.5149	5	1			5				
49	39.19785	-86.513	3	1							1
50	39.19636	-86.5118	11			P					

August 18, 2016 Tier 2 Survey Raw Data

WPT	Lat	Long	Depth	Eurasian watermilfoil	Brittle naiad	Fil. Algae	Coontail	Slender naiad	Sago pondweed
1	39.19714	-86.5113	3.0		1		5		1
2	39.19698	-86.5129	3.0	1			5		
3	39.1974	-86.5139	3.0	3	5				
4	39.1984	-86.5137	7.0				5		
5	39.19919	-86.5145	6.0		5		5		
6	39.20008	-86.5149	6.0				5		
7	39.19976	-86.5156	7.0	1	1		5		
8	39.20013	-86.5162	9.0	3			5		
9	39.20066	-86.5177	13.0						
10	39.20137	-86.5187	14.0			P			
11	39.20195	-86.5195	16.0						
12	39.20258	-86.5196	12.0				5		
13	39.20292	-86.5185	2.0	3`	1		5		
14	39.20307	-86.5197	12.0						
15	39.2038	-86.5208	16.0						
16	39.20438	-86.5212	11.0	1			5		
17	39.2051	-86.522	14.0						
18	39.20611	-86.5224	5.0				5		1
19	39.20588	-86.5233	14.0						
20	39.20543	-86.5243	18.0						
21	39.2054	-86.5257	17.0						
22	39.20553	-86.5265	17.0						
23	39.20499	-86.5275	14.0						
24	39.20445	-86.5283	18.0						
25	39.20381	-86.5285	13.0						
26	39.20295	-86.5277	18.0						
27	39.2024	-86.5274	16.0						
28	39.20157	-86.5275	14.0				1		
29	39.20016	-86.5266	2.0	1	3		1		
30	39.20113	-86.5271	9.0				5		
31	39.20238	-86.5268	11.0				1		
32	39.20321	-86.5262	16.0						
33	39.20367	-86.5249	19.0						
34	39.20378	-86.5237	9.0						
35	39.20327	-86.5225	8.0				3		
36	39.20243	-86.5223	9.0						
37	39.20161	-86.5221	9.0						
38	39.20112	-86.5217	6.0						
39	39.20092	-86.5215	9.0						
40	39.20029	-86.5206	3.0				3		
41	39.19987	-86.5191	8.0				1		
42	39.19945	-86.5181	5.0				1		
43	39.19901	-86.5173	4.0	1			5		
44	39.19917	-86.5159	5.0				1		
45	39.19876	-86.5162	9.0	3			5		
46	39.19789	-86.5158	3.0	5	3		5		
47	39.19843	-86.5154	4.0				1	3	
48	39.19807	-86.5149	5.0				1		
49	39.19785	-86.513	3.0	1	1				
50	39.19636	-86.5118	11.0		1				

10.4 Aquatic Plant List

Scientific Name	***Common Name***
Ceratophyllum demersum	coontail
Chara sp.	chara
Egeria densa	Brazilian elodea
Elodea canadensis	Canada waterwead
Heteranthera dubia	water stargrass
Myriophyllum spicatum	Eurasian watermilfoil
Najas flexillis	slender naiad
Najas guadalupensis	southern naiad
Najas minor	brittle naiad
Potamogeton crispus	curly-leaf pondweed
Potamogeton foliosus	leafy pondweed
Potamogeton nodosis	American pondweed
Potamogeton pusillus	small pondweed
Potamogeton zosteriformis	flat-stemmed pondweed
Stuckenia pectinata	sago pondweed
Zannichellia palustris	horned pondweed