



Flowering Rush in Forest Lake, July , 2016

Flowering Rush Delineation, Control, and Assessment for Forest Lake, Washington County, Minnesota, 2016

Delineation: July 14 and 15, 2016
Herbicide Treatments on 36 acres: August 3 and 31, 2016
Assessment: September 21, 2016

Prepared for:
Washington County and
Comfort Lake/Forest Lake
Watershed District



Prepared by:
Steve McComas
Blue Water Science

December 2016

Flowering Rush Delineation, Control, and Assessment for Forest Lake, Washington County, Minnesota, 2016

Summary

In 2016, Forest Lake flowering rush coverage was delineated at 83,189 square feet (1.9 acres) on July 14 and 15, 2016 (Table S1). After controlling flowering rush with herbicide treatments, flowering rush coverage was found to have decreased to 9,183 square feet (0.21 acres) on the assessment survey on September 21, 2016. This was a decrease of flowering rush coverage of 89%. Most of the area that decreased was from large flowering rush beds that were treated twice with a diquat herbicide.

Only 3 new sites, small in area, appeared from July to September in 2016.

The third year of the flowering rush program was 2016. At the end of 2016, a total of 243 sites of flowering rush had been observed from 2014 to 2016. On the September 21, 2016 assessment date, 81 sites of flowering rush were observed. The area of flowering rush decreased from October of 2014 to September of 2016 indicating the flowering rush control program was reducing the distribution and density of flowering rush. Although the estimated total area of flowering rush was around 0.21 acres in September of 2016, a typical flowering rush response is for regrowth from the rhizomes and some regrowth would be expected in 2017. Continuing to control areas of flowering rush should reduce abundant regrowth but it appears eradication will be a challenge.

The steps for controlling flowering rush in the next few years include the following three methods.

1. Continue treating large areas of flowering rush with diquat.
2. Cut or treat small patches 2 or 3 times/season.
3. Continue to remove flowerheads before seeds are produced which should help reduce areas of flowering rush colonization.

Table S1. Summary of flowering rush sites and areas for 2014, 2015, and 2016.

	1 st Lake		2 nd Lake		3 rd Lake		Total	
	Number of sites with plants	Area (sf)	Number of sites with plants	Area (sf)	Number of sites with plants	Area (sf)	Number of sites with plants	Area (sf)
July 22, 2014 (Delineation)	0	0	34	3,750	--	336,990 (estimated based on Oct 8 survey)	34+ (not including 3 rd lake)	340,740 (estimated)
2 nd Lake was treated with diquat on September 9, 2014								
October 8, 2014 (Assessment)	0	0	26	3,135	116	336,990	142	340,125
July 17, 2015 (Delineation)	0	0	22	2,360	85	230,939	107	233,299
2 nd and 3 rd Lakes were treated by cutting in July and August; 3 rd Lake treated with diquat twice in August, 2015								
September 28, 2015 (Assessment)	11	170	20	237	88	4,004	120	4,411
(new sites compared to 2014)	(11)	--	(13)	--	(25)	--	(49)	--
July 14 and 15, 2016 (Delineation)	4	100	46	33,000	132	50,000	182	83,189
2 nd and 3 rd Lakes were treated with diquat twice in August, 2016								
September 21, 2016 (Assessment)	0	0	21	305	60	8,818	81	9,183
(new sites compared to 2015)	(0)	--	(0)	--	(3)	--	3	--

Initial Flowering Rush Delineation - July 14-15, 2016

A flowering rush delineation was conducted on July 14-15, 2016. A total of 182 flowering rush sites with areas ranging from 5 square feet to greater than 1,000 square feet were found (Figure S1). A majority of the flowering rush sites were small and somewhat scattered in the nearshore area often in water depths of less than 3 feet. Although 3 areas of continuous flowering rush beds were delineated, many of the small patches could be considered to be continuous as well. A total area of 83,189 square feet of flowering rush was estimated in the July delineation.

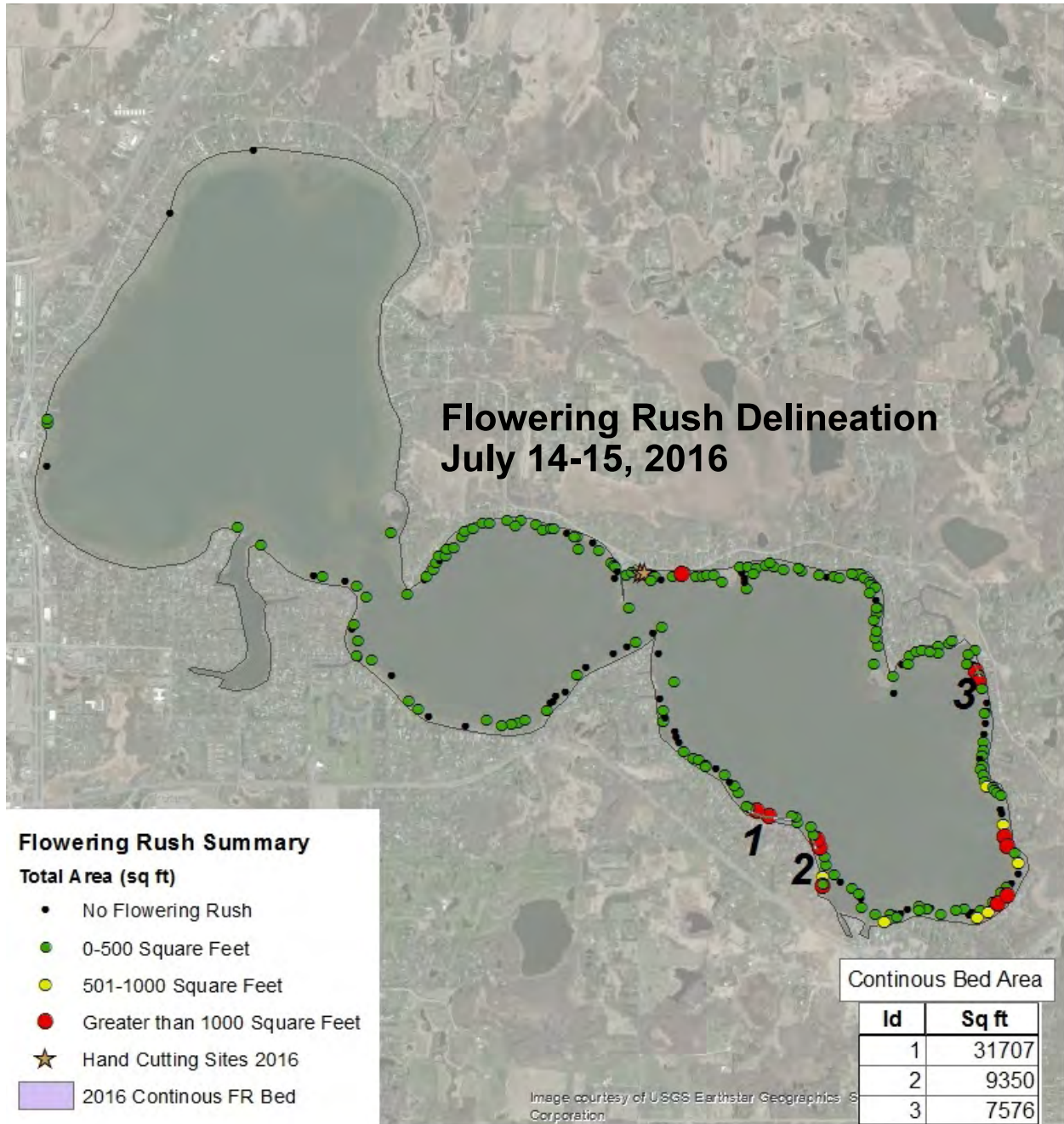
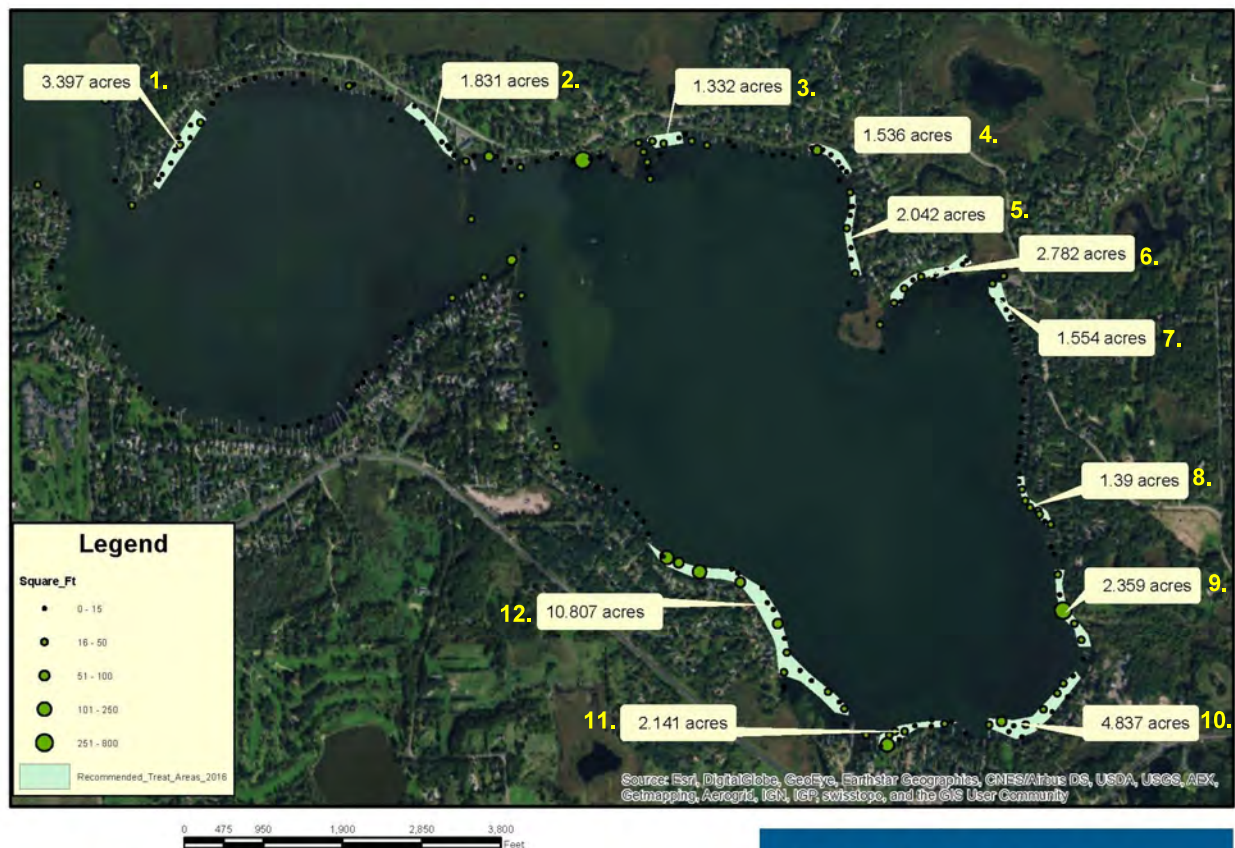


Figure S1. Flowering rush delineation on July 14-15, 2016.

Flowering Rush Treatment Map

A total of 36 acres of flowering rush in 12 treatment areas was treated with diquat on two occasions on August 3 and August 31, 2016. Although the area of flowering rush did not total 36 acres, previous treatment research in the Detroit Lakes area found treating large areas was more effective than treating small, individual patches. The applicator delineated the large areas to be treated. A number of small patches were treated as well.

Also an area of about 600 square feet by a public access on Lake 2 was handcut on several dates by CLFLWD staff as an experiment.



**2016 Flowering Rush Treatment
Forest Lake Lake, Washington County
Acres: 36**

PLM Lake & Land Management Corp.

PHONE: 218-270-3338 EMAIL: servicesmw@plmcorp.net
 FAX: 866-527-6399 WEBSITE: www.plmcorp.net

Figure S2. Flowering rush treatment areas for August 3, and 31, 2016.

Flowering Rush Assessment

About 3 weeks after the August 31 diquat application, flowering rush sites in Forest Lake were assessed. Except for 2 areas in 3rd Lake, flowering rush control was very good (Figure S3). Flowering rush was found at 81 sites, mostly in small patches of less than 100 square feet.

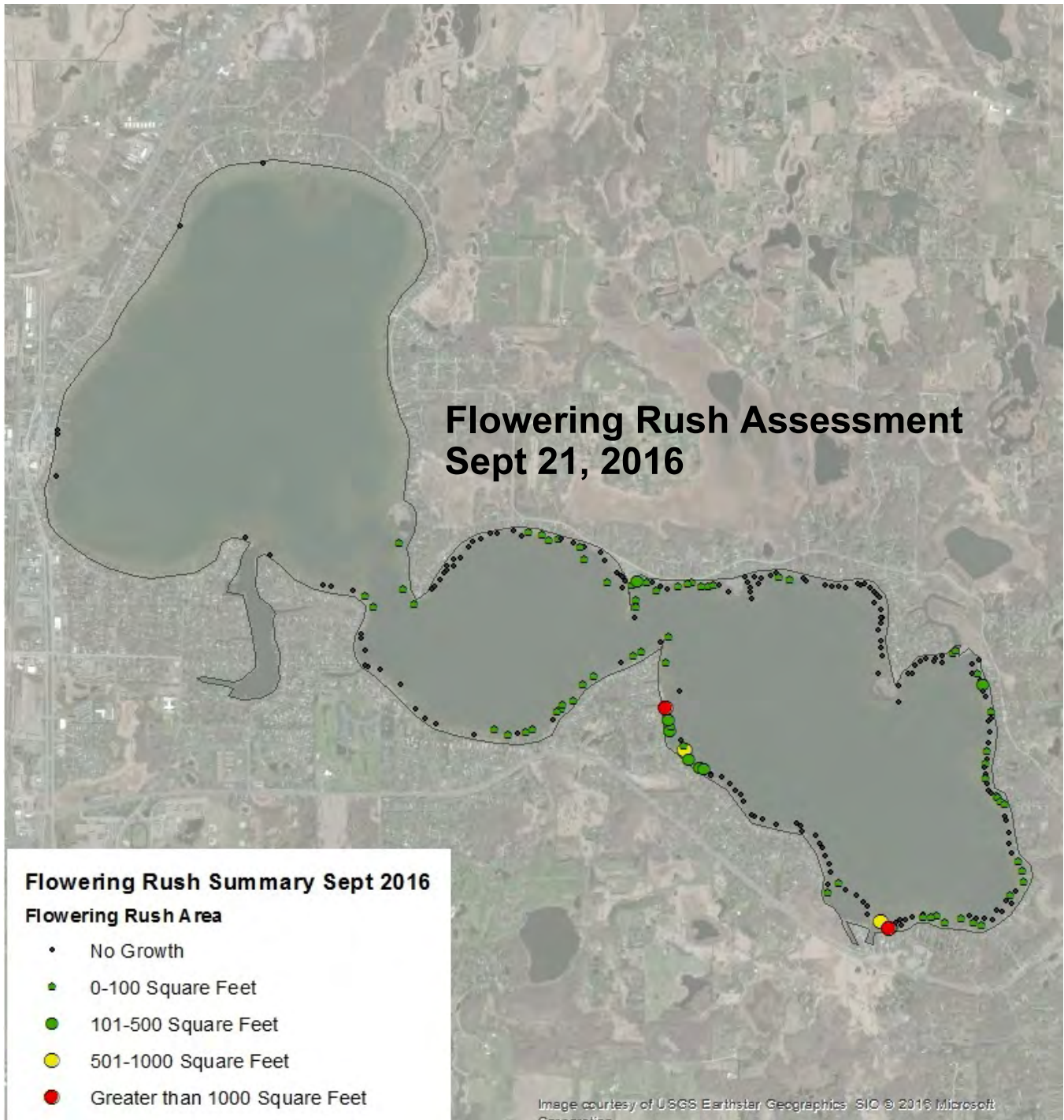


Figure S3. Flowering rush assessment on September 21, 2016.

Flowering Rush Delineation, Control, and Assessment for Forest Lake, Washington County, Minnesota, 2016

Introduction

Flowering rush (*Butomus umbellatus*) is an invasive species and is actively expanding in the United States. It has spread from a limited area around the Great Lakes and the St. Lawrence river to sporadic appearances in the northern U.S. and southern Canada. Populations in the eastern U.S. produce seeds. Only one Minnesota population (Forest Lake, Washington County) produces viable seeds. Otherwise, flowering rush reproduces by vegetative spread from its rootstock in the form of rhizome buds. Both seeds and rhizome buds are dispersed by water current.

Flowering rush competes with native shoreland vegetation and is on the DNR prohibited invasive species list in Minnesota.

A management and control program for flowering rush in Forest Lake was initiated in 2014 and was expanded in 2015 and 2016. In 2016, a delineation of all flowering rush in Forest Lake was conducted on July 14 and 15, 2016. Then an herbicide treatment using diquat was applied to all but one area where hand cutting was conducted. An assessment of the sites was conducted to evaluate the effectiveness of the control efforts. This was somewhat of an experimental approach to determine if flowering rush could be controlled with diquat and cutting.

Methods

Emergent flowering rush in 1st (Upper), 2nd (Middle), and 3rd (Lower) Lakes was delineated on July 14 and 15, 2016 and after herbicide treatments and cutting were completed, flowering rush was assessed on September 21, 2016. For the delineation and assessment, 2 observers in a boat traveled the entire lake nearshore area and searched for emergent flowering rush stems. At each site a waypoint was taken and an area of flowering rush was estimated. For flowering rush on 2nd and 3rd lakes occasional stem counts were recorded.

Table 1. Surveys and treatments in 2014, 2015, and 2016.

2014

Delineation of 1st and 2nd Lakes: July 22, 2014

Delineation of 3rd Lake: September 15, 2014

Herbicide Treatment in 2nd Lake: September 9, 2014

Assessment of 2nd Lake: September 28, 2014

2015

Delineation of 1st, 2nd, and 3rd Lakes: July 17, 2015

Cutting in 2nd and 3rd Lakes: July and August, 2015

Herbicide Treatments in 3rd Lake: August 4 and 26, 2015

Assessment of 1st, 2nd, and 3rd Lakes: September 28, 2015

2016

Delineation of 1st, 2nd, and 3rd Lakes: July 14 and 15, 2016

Herbicide Treatments in 3rd Lake: August 3 and 31, 2016

Assessment of 1st, 2nd, and 3rd Lakes: September 21, 2016

Flowering Rush Delineation on July 14 and 15, 2016

All flowering rush sites that were delineated in 2014 and 2015 were checked on July 14 and 15, 2016. Sites of flowering rush that were observed on July 14 and 15, 2016 are shown in Figure 1. Based on this delineation, control efforts were implemented with cutting flowering rush found in small patches and applying herbicides to the larger beds.

2016 Forest Lake Flowering Rush Delineation

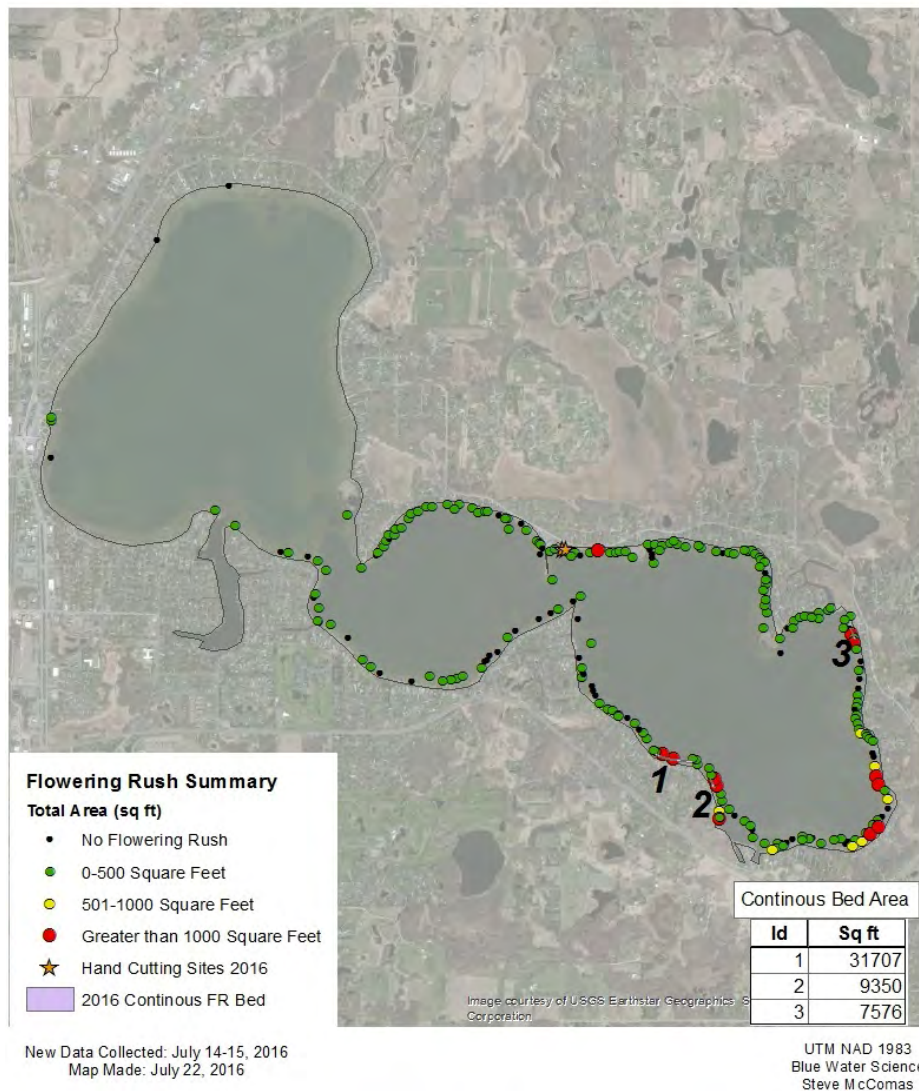


Figure 1. Flowering rush delineation on July 14 and 15, 2016. Flowering rush locations are shown with red dots or red lines which indicate continuous beds of flowering rush. Black dots indicate flowering rush was not observed in 2015 but was observed in 2014.

Forest Lake Flowering Rush Herbicide Treatments, August 3 and 31, 2016

For flowering rush control on large beds, the herbicide diquat (Tribune) was applied by a contractor (PLM) to 36 acres on August 3, 2016 and again to the same 36 acres of flowering rush on August 31, 2016 (Figure 2). Although the area of flowering rush did not total 36 acres, previous treatment research in the Detroit Lakes area found treating large areas was more effective than treating small, individual patches. The applicator delineated the large areas to be treated.

A number of small patches were treated on August 10 using a total of 3 gallons of diquat (Tribune).

Also an area of about 600 square feet by a public access on Lake 2 was handcut on several dates by CLFLWD staff as an experiment.

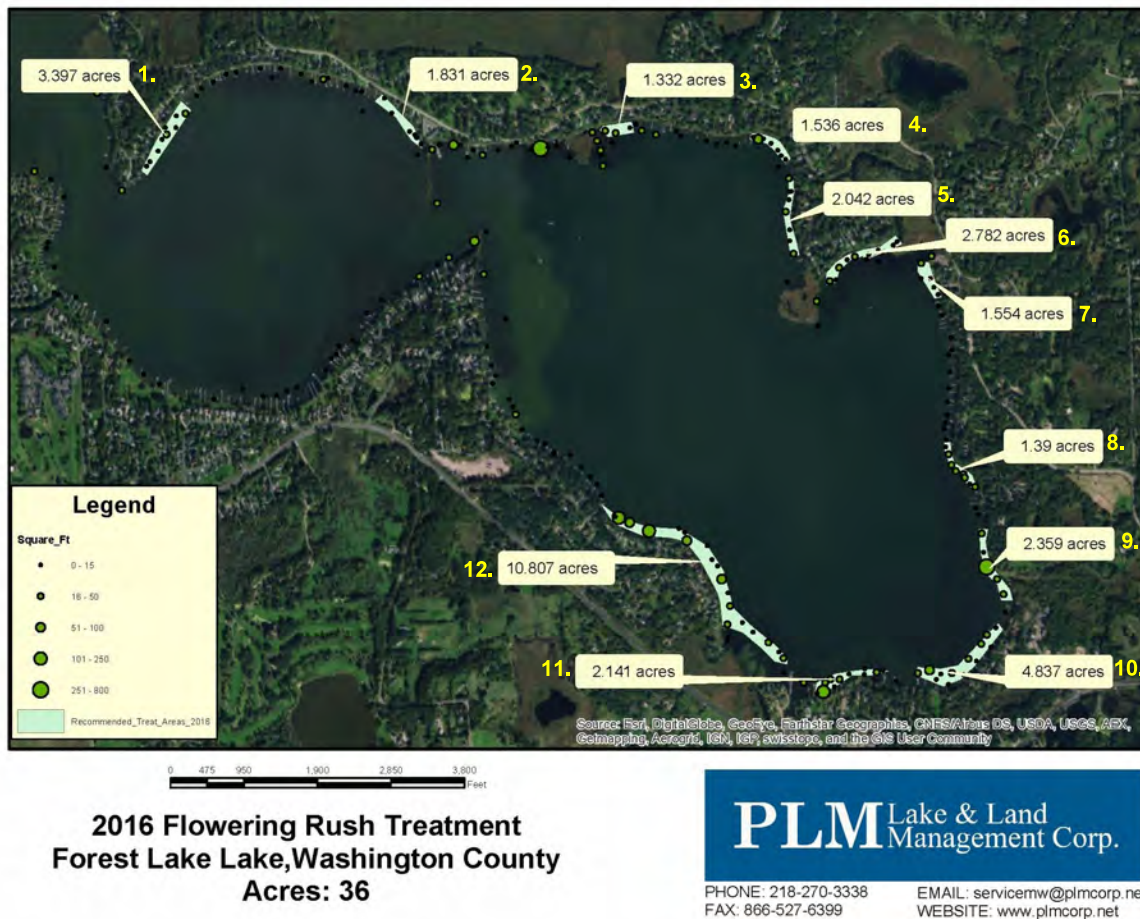


Figure 2. Flowering rush treatment areas for August 3, and 31, 2016 using diquat (Tribune). August 3, 2016 (11a to 2p). Ave depth 4 ft. Diquat: 2 gal/ac for 72.2 gal. August 31, 2016 (10:30a to 2:30p). Ave depth 1.5 ft. Diquat: 0.69 gal/ac for 25 gal. Littora: 3.0 quarts, Cidekick 11: 1.15 quarts).

Flowering Rush Assessment, September 21, 2016

At a number of sites where flowering rush was treated, there was very good control based on the assessment survey on September 21, 2016. Herbicide treatments were estimated to reduce flowering rush coverage by about 89% from July to September (83,189 sf to 9,183 sf). Most of the flowering rush that was observed consisted of small patches. It appears a couple of larger flowering rush patches in Treatment Areas 11 and 12 were not controlled with the diquat treatment (Figure 3 and Table 2).

2016 Forest Lake Flowering Rush Assessment
September 21, 2016

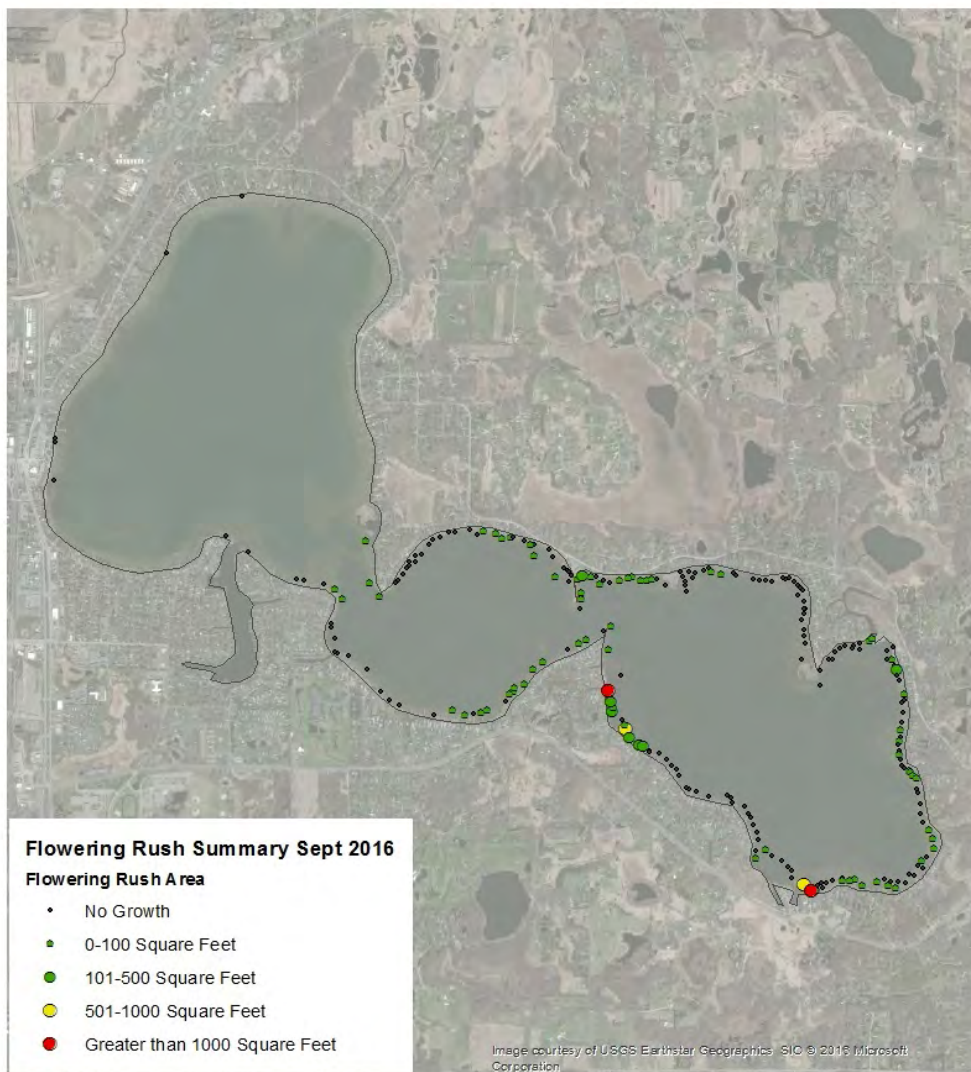


Figure 3. Flowering rush distribution on September 21, 2016 assessment.

Table 2. Estimated flowering rush areas prior to treatment (July 14-15) and post treatment (Sept 21).

Treatment Areas	Sites 2016	July 14-15, 2015 Area (ft ²)	Sept 21, 2016 Area (ft ²)
	1	50	
	2	10	
	3	0	
	4	0	
	5	50	10
	6	40	5
1	7	0	
1	8	60	
1	9	30	
1	10	20	
1	11	0	
1	12	120	
1	13	30	
1	14	20	
1	15	200	
1	16	30	
	17	30	
	18	20	
	19	75	
	20	25	
	21	10	
	22	75	15
	23	60	50
	24	40	5
	25	20	20
	26	0	
2	27	10	
2	28	0	
2	29	40	
2	30	15	
2	31	50	
2	32	75	
2	33	0	
2	34	0	
	35	40	
	36	10	5
	37	30	200
	38	700	10
	39	600	
	40	5	
	41	0	
	42	20	5
	43	90	100
	44	120	5
	45	120	5
	46	40	10
	47	10	
3	48	50	
3	49	0	
3	50	0	
3	51	0	
3	52	80	
3	53	75	
3	54	60	
3	55	35	
3	56	60	5
	57	15	5
	58	20	
	59	0	
4	60	400	
4	61	5	
4	62	200	
4	63	500	
4	64	75	
4	65	30	
4	66	20	
4	67	15	
4	68	0	
4	69	100	
4	70	60	
5	71	10	
5	72	220	
5	73	0	
6	74	500	
6	75	0	
6	76	10	
6	77	50	
6	78	110	
6	79	0	
6	80	30	
6	81	10	30
6	82	20	15
6	83	100	

Treatment Areas	Sites 2016	July 14-15, 2015 Area (ft ²)	Sept 21, 2016 Area (ft ²)
7	84	250	
7	85		10
7	86		
7	87	7576	200
7	88	1000	
7	89	40	
7	90	0	10
	91	0	
	92	15	
	93	0	
	94	0	
	95	20	5
	96	15	
8	97	30	5
8	98	0	
8	99	60	
8	100	80	3
8	101	150	
8	102	20	
8	103	1000	
8	104	60	5
8	105	300	5
8	106	150	10
8	107	100	5
8	108	0	
8	109	0	
9	110	800	
9	111	2000	
9	112	2000	
9	113	208	10
9	114	1000	15
9	115	0	5
10	116	0	
10	117	60	5
10	118	30	
10	119	40	
10	120	20	
10	121	0	
10	122	0	5
10	123	100	
	124	80	5
	125	0	5
	126	150	10
	127	25	
11	128	0	
11	129	0	
11	130	0	
11	131	40	
11	132	200	50
11	133	100	600
11	134	0	
12	135	30	
12	136	0	
12	137	20	5
12	138	1000	
12	139	80	
12	140	60	
12	141		
12	142	9350	
12	143	20	
12	144	300	
12	145	300	
12	146	40	
12	147	30	
12	148	10	
12	149	0	
12	150	10	
12	151	0	
12	152	0	1000
	153	0	20
	154	0	
	155	400	300
	156	0	20
	157	10	400
	158	0	2000
	159	15	
	160	10	5
	161	0	5
	162	0	
	163	30	
12	164		
12	165		
12	166		

Treatment Areas	Sites 2016	July 14-15, 2015 Area (ft ²)	Sept 21, 2016 Area (ft ²)
12	167	31707	
	168	0	5
	169	0	
	170	30	5
	171	0	5
	172	0	
	173	0	10
	174	15	5
	175	0	10
	176	0	5
	177	0	5
	178	10	
	179	60	40
	180	25	
	181	70	10
	182	15	5
	183	0	
	184	0	
	185	10	
	186	0	
	187	15	
	188	0	
	189	200	40
	190	80	60
	191	0	
	192	15	
	193	0	
	194	15	
	195	25	
	196	0	
	197	3	
	198	10	
	199	100	
5	200	60	
5	201	30	
5	202	50	
	203	20	
	204	10	
	205	30	
	206	10	
	207	50	
	208	80	
	209	60	
	210	30	
	211	4000	20
	212	10	5
	213	10	5
	214	30	5
	215	40	
	216	15	
	217	10	
	218	30	
	219	60	
	220	80	50
	221	50	400
	222	300	200
	223	300	400
12	224	300	
12	225	150	
12	226	30	
12	227	2000	
12	228	10	5
	229	400	
11	230	40	
11	231	800	2600
11	232	200	
11	233	50	5
10	234	400	20
10	235	600	5
10	236	1000	
	237	2000	
	238	2000	
	239	100	
	240	55	10
	241		10
	242		10
	243		5

Comparison of 2014 - 2016 Flowering Rush Distribution and Abundance

At the end of September in 2016, the area of flowering rush was less compared to 2014, and the number of sites, usually less than 50 square feet per site declined slightly compared to 2014. Maps of flowering rush for 2014 - 2016 are shown in Figure 4.

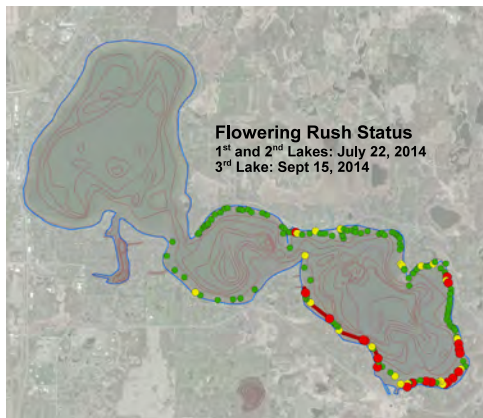


Figure 4a. Flowering rush sites and relative abundance in 2014. Green dots = 10-500 sf, yellow dots = 500-2,000 sf, and red dots = 3,000 to 50,000 sf. Estimated flowering rush area in September 2014: 340,125 square feet (sf).

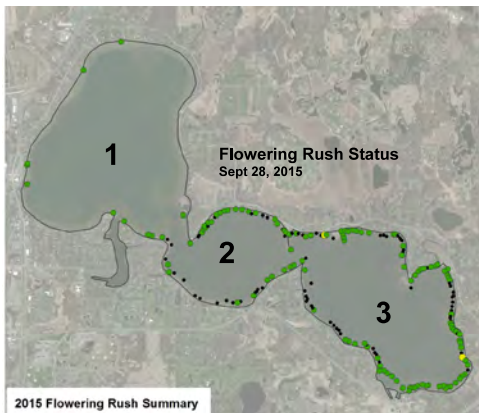


Figure 4b. Flowering rush sites and relative abundance in 2015. Black dots = no flowering rush, green dots = 10-500 sf, yellow dots = 500-2,000 sf, and red dots = 3,000 to 50,000 sf. Estimated flowering rush area in September 2015: 4,411 sf.



Figure 4c Flowering rush sites and relative abundance in 2016. Black dots = no flowering rush, green dots = 10-500 sf, yellow dots = 500-2,000 sf, and red dots = 3,000 to 50,000 sf. Estimated flowering rush area in September 2016: 9,183 sf.

Impact of Flowering Rush Control on Native Plants

Impacts of flowering rush control methods on native plants was closely observed in 2014, 2015, and 2016. Listed below are notes and observations.

- Overall impact of flowering rush control on native plants was minimal.
- At a majority of the sites flowering rush covered less than 100 square feet or a 10 foot x 10 foot area. In almost all cases chara was the most common plant present within an area. Chara was not adversely impacted by cutting or with herbicide treatments.
- When flowering rush was in water 4 feet or deeper, the patches were small and submerged native aquatic plants such as claspingleaf were absent.
- At the time of the flowering rush assessment on September 28, 2015 the peak abundance of native plants had passed. However, they were still present but not a peak biomass.
- The areas where the herbicide diquat was applied totaled 13 acres. Flowering rush and native plants were not found in continuous beds, rather growth was patchy for both flowering rush and native plants.
- Live native plants were found in treated areas. Species included chara, elodea, coontail, and claspingleaf.
- Bulrush beds as well as other emergent and floatingleaf species were not impacted (Figure 5).

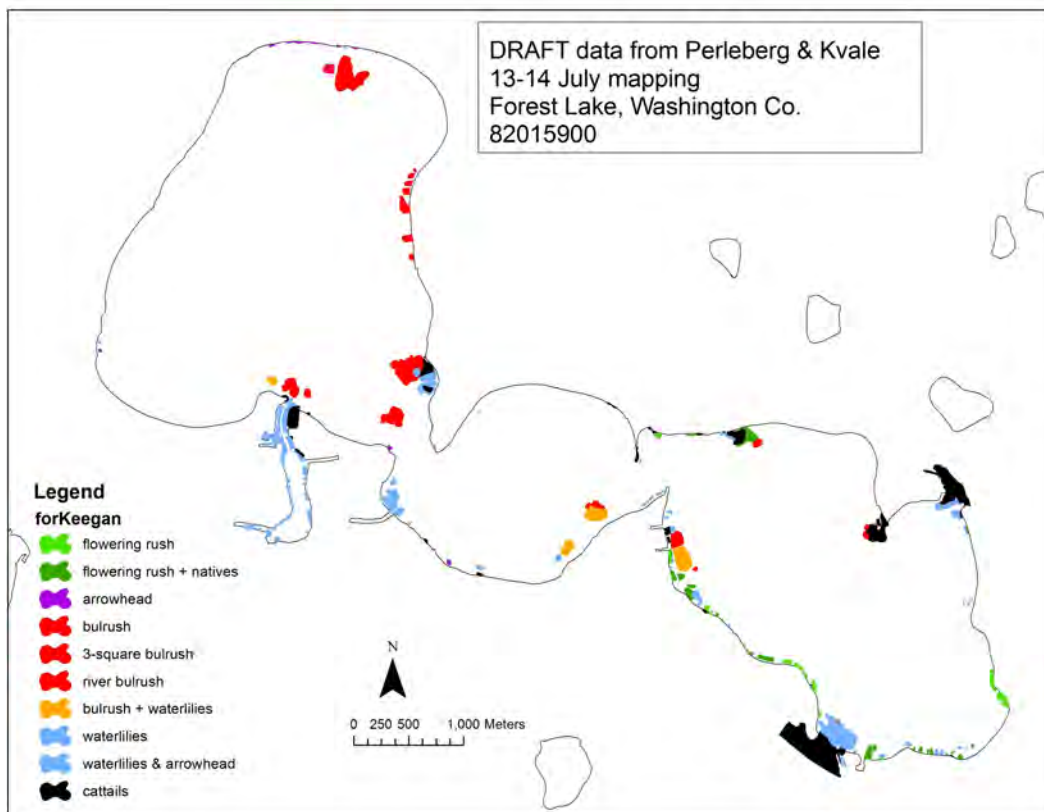


Figure 5. Delineation of flowering rush, arrowhead, bulrush, waterlilies, and cattails by the MnDNR on July 13 and 14, 2015 (source: MnDNR).

Conclusions and Recommendations

In 2016, Forest Lake flowering rush coverage was delineated at 83,189 square feet (1.9 acres) on July 14 and 15, 2016 (Table 3). After controlling flowering rush with herbicide treatments, flowering rush coverage was found to have decreased to 9,183 square feet (0.21 acres) on the assessment survey on September 21, 2016. This was a decrease of flowering rush coverage of 89%. Most of the area that decreased was from large flowering rush beds that were treated twice with a diquat herbicide.

Only 3 new sites, small in area, appeared from July to September in 2016.

The third year of the flowering rush program was 2016. At the end of 2016, a total of 243 sites of flowering rush had been observed from 2014 to 2016. On the September 21, 2016 assessment date, 81 sites of flowering rush were observed. The area of flowering rush decreased from October of 2014 to September of 2016 indicating the flowering rush control program was reducing the distribution and density of flowering rush. Although the estimated total area of flowering rush was around 0.21 acres in September of 2016, a typical flowering rush response is for regrowth from the rhizomes and some regrowth would be expected in 2017. Continuing to control areas of flowering rush should reduce abundant regrowth but it appears eradication will be a challenge.

The steps for controlling flowering rush in the next few years include the following three methods.

1. Continue treating large areas of flowering rush with diquat.
2. Cut or treat small patches 2 or 3 times/season.
3. Continue to remove flowerheads before seeds are produced which should help reduce areas of flowering rush colonization.

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2 nd and 3 rd Lakes were treated with diquat twice in August, 2016								
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(new sites compared to 2015)	(0)	--	(0)	--	(3)	--	3	--

APPENDIX

(Prepared by the CLFLWD)



2015 Forest Lake Flowering Rush Treatment

Funded by
Comfort Lake—Forest Lake Watershed District
Washington County
Forest Lake Lake Association
City of Forest Lake

Purpose: Flowering rush is a harmful aquatic invasive species (AIS) that can have negative ecological, recreational and economic impacts on waterbodies. The purpose of this treatment process is to reduce these effects and prevent it from spreading to other waterbodies.

Photo right: Flowering rush growing in large dense patches on the south side of Forest Lake east basin (3rd Lake). Photo was taken in April 2014.



Photo left: Patch of flowering rush on 3rd Lake after herbicide treatment. Photo was taken in August 2015.



Photo top: Flowering rush 2 days after herbicide treatment, some portions starting to turn brown and die.

Photo bottom: Flowering rush 10 days after herbicide treatment. Entire patch is brown, withering and dying or already dead.



Recap

1st round of treatment (late July/early August): Mechanical cutting and spot herbicide spraying of small patches of flowering rush near the shoreline performed by Minnesota Conservation Corps crews (MCC). Herbicide treatment of large patches performed by PLM Lake and Land Management Inc.

2nd round of treatment (late August): Mechanical cutting and spot spraying of small patches near shoreline again. Herbicide treatment expanded to larger areas to obtain more effective control.

Photo right: MCC crew spraying small patches along the shoreline using backpack sprayers.

Photo bottom: MCC crew member using mechanical cutting device to manually cut flowering rush stems. Cutting the stems just below the water line cuts off the plant's access to oxygen, eventually causing it to die.



Photo right: Herbicide treatment of large patches. The herbicide that was used is called Tribune and the active ingredient is Diquat. During the first round, large patches were treated with herbicide. During the second round, entire shorelines on 3rd Lake were treated. This change was recommended by the herbicide applicator based on his recent experiences treating other lakes.



For more information contact:

Comfort Lake—Forest Lake Watershed District
44 Lake Street South, Suite A, Forest Lake, MN 55025
651-395-5850 info@clfiwd.org www.clfiwd.org



Forest Lake Lake Association
P.O. Box 61, Forest Lake, MN 55025
www.ourforestlake.com

Flowering Rush Control Effectiveness Using Cutting and Diquat Techniques in 2015

Flowering rush control of small patches by employing cutting emergent stems below the waterline in July and again in August had mixed results. The primary cutting tool was a brush cutter where the cutting head could be submerged and the motor was out of the water. On calm days in water depth of 1 to 2 feet, cutting was satisfactory. In shallow water, a backpack sprayer applied herbicide to flowering rush patches. In deeper water, cutting was not very effective from a boat. Also, windy days hampered cutting efficiency as well. A total of 875 staff cutting hours were used in July and August. The Conservation Corps of Minnesota (CCM) crews were not able to cut all the flowering rush in the time that was allocated. Also regrowth of flowering rush was observed in the September 2015 assessment. Possibly using 3 cuttings in a season could be more effective.

The herbicide treatments using diquat were effective. In the September 2015 assessment only scattered small patches, usually less than 10 square feet, were observed in the areas where herbicide was applied.



[top-left] A hand held brush cutter was the primary cutting tool.

[top-right] A boat mounted aquatic plant cutter was also used in water 3 feet and deeper.

[bottom-left] The second herbicide treatment areas on August 26, 2015 covered 13.17 acres.

[bottom-right] Herbicide treatment was effective with small scattered patches of flowering rush remaining after the treatments. Approximately 98% of the flowering rush was controlled.

List of Flowering Rush Sites and Estimated Areas

Flowering rush for 1st Lake. In the delineation, green shading represents areas for hand removal by cutting and red shading indicates areas designated for herbicide treatments. In the assessment, green shading is present when flowering rush was present. An “N” after a way point indicates a new flowering rush observation. Way point locations are shown in Figure 8.

1 st Lake Flowering Rush in 2014 and 2015						
Way Point	2014		2015		2016	
	July 22, 2014 Delineation Area of Emergent Flowering Rush (square feet)	October 8, 2014 Assessment Area of Emergent Flowering Rush (square feet)	July 17, 2015 Delineation Area of Emergent Flowering Rush (square feet)	Sept 28, 2015 Assessment Area of Emergent Flowering Rush (square feet)	July 14/15, 2016 Delineation Area of Emergent Flowering Rush (square feet)	Sept 21, 2016 Assessment Area of Emergent Flowering Rush (square feet)
1N				20 (2 patches)		
2N				10		
3N				4		
4N				20		
43N				25		
44N				25		
45N				40		
46N				4		
47N				4		
48N				9		
49N				9		
Total Area	0	0	0	170		
Green area	0	0	0	170		
Red area	0	0	0	0		
Number of sites with plants	0	0	0	11 (11 new)		

Flowering rush for 2nd Lake. In the delineation, green shading represents areas for hand removal by cutting and red shading indicates areas designated for herbicide treatments. In the assessment, green shading is present when flowering rush was present. An “N” after a way point indicates a new flowering rush observation. Way point locations are shown in Figure 8.

2 nd Lake Flowering Rush in 2014 - 2016						
Way Point	2014		2015		2016	
	July 22, 2014 Delineation Area of Emergent Flowering Rush (square feet)	October 8, 2014 Assessment Area of Emergent Flowering Rush (square feet)	July 17, 2015 Delineation Area of Emergent Flowering Rush (square feet)	Sept 28, 2015 Assessment Area of Emergent Flowering Rush (square feet)	July 14/15, 2016 Delineation Area of Emergent Flowering Rush (square feet)	Sept 21, 2016 Assessment Area of Emergent Flowering Rush (square feet)
1			50			
2			80			
3						
4	100					
5 and 6	50	10	100			
7	10	10				
8	10	10		4		
9	200	160	100			
10	50	50	50			
11	100	100	20			
12	50		100			
13	200	200	300	50		
14	20	20				
15	50	20		6		
16	20	10		4		
17	50		10	10		
18	30					
19	100	50				
20	20					
21	100	100	300	4		
22	60	60	200			
23	60	60	100			
24	30					
25	30	30	200			
26	30	30	100	9		
27	200	200	50	7		
28	60	20	50			
29						
30			100			
31						
32	50	50				
33	400	400	100			
34	40		100			
35	60					
36	60	60				
37	1,000	1,000				
38	30	5				
39	50	50				
40	30	30	25			
41	400	400	25			
81			200			
5N				24		
6N				4		
7N				4		
8N				2		
9N				10		
10N				6		
11N				4		
12N				25		
13N				6		
14N				4		
15N				4		
19N				50		
20N						
Total Area	3,750	3,135	2,360	237		
Green and Yellow areas	3,750	3,135	2,360	237		
Red area	0	0	0	0		
Number of sites with plants	34	26	22	20 (13 new)		

Flowering rush for 3rd Lake. In the delineation, green shading represents areas for hand removal by cutting and red shading indicates areas designated for herbicide treatments. In the assessment, green shading is present when flowering rush was present. An “N” after a way point indicates a new flowering rush observation. Way points locations are shown in Figure 8.

3rd Lake Flowering Rush in 2014 - 2016					
Way Point	Sept 15, 2014 Delineation Area of Emergent Flowering Rush (square feet)	July 17, 2015 Delineation Area of Emergent Flowering Rush (square feet)	Sept 28, 2015 Assessment Area of Emergent Flowering Rush (square feet)	July 14/15, 2016 Delineation Area of Emergent Flowering Rush (square feet)	Sept 21, 2016 Assessment Area of Emergent Flowering Rush (square feet)
1	10		15, 25		
2	20	20	25		
3	200	100	9		
4	200	500	9		
5	3,000	2,000	9		
6	1,000	100			
7	3,200	1,000			
8	20	20			
9	10				
10	50	25			
11	20				
12	30				
13	10	10			
14	20	10	4		
15	20				
16	50	10			
17	30	10			
18	50	10	9		
19	100	125	25		
20	50	25	25		
21	400	40	50		
22	200	10	25		
23	300	2,100	25		
24	20	75			
25	200	125	9		
26	2,000	1,000	9		
27	30,000	10,000	25		
29	22,000	4,500	800		
30	300	3,000	4, 25		
31	200	200			
32	500	100	4		
33	8,500	500	25		
34-35	46,700	50,000	4, 25, 30, 9, 4		
36-38	5,000	20,000	10, 1		
39	750	500	50, 25		
40	1,000		9, 15		
41	100	25	15		
42	6,000	25			
43	12,000	500	4		
44	300	50	10		
45	90	10	6		
46	4,800	25	25		
47	150	25	25		
48	750	25	25		
49	6,000	3,000	250		
50	80	100	36		
51-53	2,700	1,300	25, 9, 25		
54	30,000	5,000	25		
55	75	2,400	25		

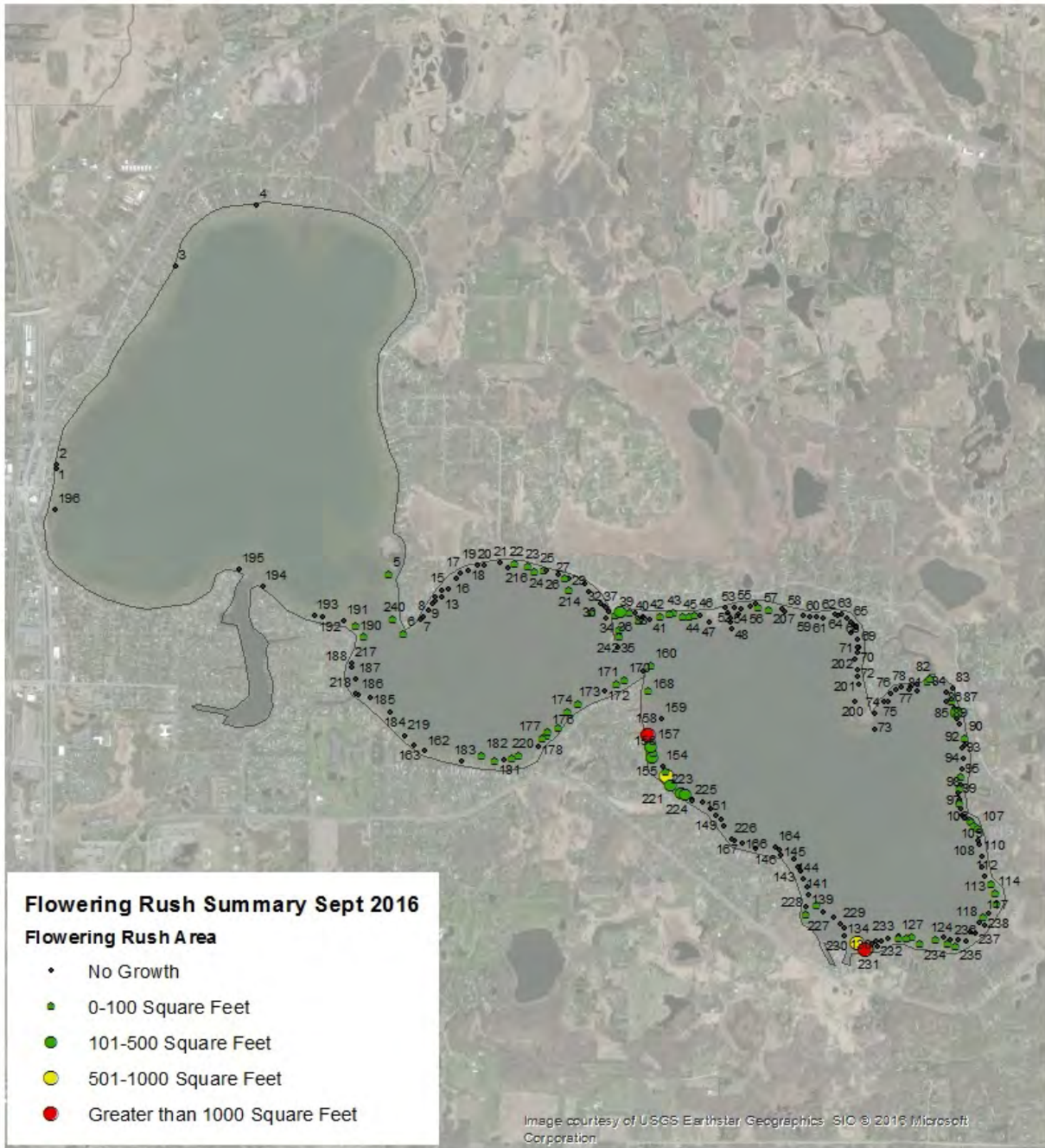
Flowering rush for 3rd Lake. In the delineation, green shading represents areas for hand removal by cutting and red shading indicates areas designated for herbicide treatments. In the assessment, green shading is present when flowering rush was present. An “N” after a way point indicates a new flowering rush observation. Way points locations are shown in Figure 8.

3rd Lake Flowering Rush in 2014 - 2016					
Way Point	Sept 15, 2014 Delineation Area of Emergent Flowering Rush (square feet)	July 17, 2015 Delineation Area of Emergent Flowering Rush (square feet)	Sept 28, 2015 Assessment Area of Emergent Flowering Rush (square feet)	July 14/15, 2016 Delineation Area of Emergent Flowering Rush (square feet)	Sept 21, 2016 Assessment Area of Emergent Flowering Rush (square feet)
56-57	14,400	20,000			
58	100	4			
59	2,000	6,000			
61-62	4,000	4,400			
63-64	47,500	30,000	9		
65	500	500			
66	100				
67	200	225			
68	250	600			
69-70	50,000	45,000			
71	500	600			
72	400				
73	200				
74	400	25			
75-76	10,000	8,000			
77	150				
78	300	100	4		
79	850	2,000			
80	200	100	25		
81	80	50	16		
82	300	75			
83	3,100	400	80		
84	1,000	100			
85	80	25			
86	200	1,000	6		
87	1,500	300			
88	180	50			
89	100	25	700		
90	100	100	6		
91	100				
92	80	100	32		
93	80	50	15		
94	450	10	20		
95	1,000	100	25		
96	300	75	25		
97	300	750	25		
98	80	100			
99	30		20		
100	60		25		
101	30				
102	15		4		
103	15	100			
104	50				
105	60				
106	380	400	80		
107	320	100	4		
108	100	50			
109	140				
110	100	25			
111	300				

Flowering rush for 3rd Lake. In the delineation, green shading represents areas for hand removal by cutting and red shading indicates areas designated for herbicide treatments. In the assessment, green shading is present when flowering rush was present. An “N” after a way point indicates a new flowering rush observation. Way points locations are shown in Figure 8.

3rd Lake Flowering Rush in 2014 - 2016					
Way Point	Sept 15, 2014 Delineation Area of Emergent Flowering Rush (square feet)	July 17, 2015 Delineation Area of Emergent Flowering Rush (square feet)	Sept 28, 2015 Assessment Area of Emergent Flowering Rush (square feet)	July 14/15, 2016 Delineation Area of Emergent Flowering Rush (square feet)	Sept 21, 2016 Assessment Area of Emergent Flowering Rush (square feet)
112	240	50	25		
113	200	50			
114	200				
115	1,500				
116	600				
117	200				
118	80				
119	15				
120	60		20		
121	60		25		
122	150		25		
123	30	100	6		
124	1,000	200	25		
125	60				
126	90		4		
127	600	400	4		
128	20		4		
130			4		
16N					
17N			20		
18N			4		
21N			25		
22N			25		
23N			25		
24N			25		
25N			9		
26N			100		
27N			100		
28N			200		
29N			100		
30N			200		
31N			50		
32N			9		
33N			100		
34N			24		
35N			15		
36N			25		
37N			9		
38N			9		
39N			4		
40N			4		
41N			4		
42N			9		
Total Area	336,990	230,939	4,004		
Green and Yellow areas	28,090	17,539	4,004		
Red area	308,700	213,400	0		
Number of sites with plants	116	85	88 (25 new)		

2016 Forest Lake Flowering Rush Assessment September 21, 2016



New Data Collected: Sept. 21, 2016

UTM NAD 1983
Blue Water Science
Steve McComas