2006 Liberty Lake Eurasian Watermilfoil Management Report

DESCRIPTION OF SITE

Liberty Lake is a 708-acre (1.1 square mile) soft-water mesotrophic lake situated 2.5 miles east of the City of Spokane Valley and 3 miles west of the Idaho border. The City of Liberty Lake rests ¼ mile north-northwest of the lake. Liberty Lake has a mean depth of 23 feet (7 meters) and a maximum depth of 30 feet (9 meters). The lake and incorporated area of Liberty Lake are known for their real estate and recreational value; they are heavily utilized by 80,000 to 100,000 visits per season (Funk *et. al.*, 1982). Recreational activities on the lake include fishing, swimming, boating, water-skiing, and jet skiing. A large percentage of the lake is privately owned with two public access points for recreation. These include a County Park swimming beach (situated in the southeast) and a Washington State Department of Fish and Wildlife boat launch (situated in the north).

MANAGEMENT HISTORY

A small infestation of Eurasian watermilfoil (*Myriophyllum spicatum*) was discovered in Liberty Lake in the fall of 1995 and was effectively controlled by hand harvesting until 1997. A private diving company utilized divers to pull the plants by hand, collect, and dispose of them. They were successful in the spring and early summer of 1997, however by late summer, many clear days and hot weather, combined with a large increase in boat traffic, caused fragments of milfoil to be scattered around the lake re-infesting many areas. After 1997, application of granular 2,4-D then became the primary milfoil management method in Liberty Lake, although hand harvesting also continued. Since that time, 2,4-D granular treatments have occurred in various sections of the lake. Each spring, diving and surface surveys are conducted by the Liberty Lake Sewer and Water District (LLSWD) to locate milfoil populations and determine treatment areas. The areas with numerous milfoil plants are treated with aquatic herbicide and the areas with smaller numbers of milfoil plants are hand harvested (Liberty Lake Aquatic Weed Management Plan, 2003).

2006 TREATMENT

Background

Previously, the milfoil infestation in Liberty Lake has been managed by the use of granular 2,4-D herbicide and diver hand harvests. Due to the past few years of the relatively ineffectiveness of the herbicide, the LLSWD decided to conduct a test in 2005 on the efficacy of three different aquatic herbicide products approved by the WA Department of Ecology. The three products selected were DMA*4IVM (2,4-D liquid), AquaKleen (2,4-D granular) and Renovate (Triclopyr). Given the results of the 2005 efficacy surveys, the LLSWD was pleased with the results of the DMA*4IVM product and favors its use for future management (Milfoil Management Report, 2005).

Initially it was decided by the LLSWD Lake Manager and the Board of Commissioners to apply herbicide to the entire shoreline of Liberty Lake in 2006 since the milfoil infestation intermittently covers the majority of the shoreline (Figures 1 and 3). This treatment was estimated to be approximately 55 to 60 acres. The plan was significantly altered when a cyanobacteria bloom of *Anabaena flosaqua* began early in the spring and persisted through July (Table 1). Despite many efforts to survey milfoil from both the surface and SCUBA diving, the surveys were relatively unsuccessful due to the lack of visibility. Consequently, the LLSWD did not feel it would be advantageous financially and/or effectively to perform a shoreline treatment this particular year. It was felt that the bloom was inhibiting growth of Eurasian milfoil and, if herbicides were applied at a large scale, that they may not be effective in reducing plant populations. However, it was planned to conduct some small spot treatments in areas that plants, and plant fragments, were found and in locations where historical problems persisted.

Figure 1. Fall 2005 milfoil survey results

Date	Anabaena flosaqua (cells/mL)	BioVolume (µm3)/mL	Secchi (m)
5/12/2006	48	15,730	3.00
5/25/2006	62	29,425	2.50
6/7/2006	98	9,967	2.00
6/22/2006	266	36,070	1.50
7/6/2006	814	110,378	1.80
7/20/2006	1,196	189,207	1.25
8/3/2006	2	226	3.50
8/15/2006	0	0	4.00

Table 1. 2006 Anabaena bloom in Liberty Lake

Herbicide Application and Sampling

Liberty Lake was treated by a licensed applicator using DMA*4IVM on August 2, 2006. 2,4-D was applied via boat at 10 gallons per acre via sub-surface injection. Depths varied and plant density could not be determined, so the applicator decided this to be the best rate for the project. In total, 36.5 gallons of 2,4-D was applied to a total of 3.8 acres. The largest treatment area was 2.1 acres.

Two locations were selected for the residual herbicide sampling and water quality analysis. The sample locations were identified as TA1-IN and TA1-OUT (Figure 2). Under the grant agreement between the WDOE and the LLSWD, residual sampling had to be conducted on the largest treatment area before the

treatment, at 1-Day, 5-Day, and 9-Day intervals for inside and outside the treatment area. Surface water grab samples for 2,4-D residue analysis were collected by the Lake Manager. All samples collected were stored on ice until delivery to the laboratory, and were analyzed by an Ecology accredited laboratory using method number EPA 8321A. In addition to the residual sampling, water quality parameters for temperature, dissolved oxygen, pH, and conductivity were collected for the background, 1-Day, 5-Day, and 9-Day intervals (Tables 3 and 4) .

Treatment Area	Sample Description	Sample Date	Analysis	Result (µg/l)(ppb)
TA1-IN-PT	Test area #1 Pre-Treatment; Inside treatment area	8/2/2006	2,4D Liquid	ND
TA1-OUT-PT	Test area #1 Pre-Treatment; 475' outside treatment area	8/2/2006	2,4D Liquid	ND
TA1-IN-24	Test area #1 1-Day; Inside treatment area	8/3/2006	2,4D Liquid	5.9
TA1-OUT-24	Test area #1 1-Day; 475' outside treatment area	8/3/2006	2,4D Liquid	5.4
TA1-IN-5D	Test area #1 5-Day; Inside treatment area	8/7/2006	2,4D Liquid	3.9
TA1-OUT-5D	Test area #1 5-Day; 475' outside treatment area	8/7/2006	2,4D Liquid	4.3
TA1-IN-9D	Test area #1 9-Day; Inside treatment area	8/11/2006	2,4D Liquid	4.3
TA1-OUT-9D	Test area #1 9-Day; 475' outside treatment area	8/11/2006	2,4D Liquid	4.2

Table 2. 2006 Residual herbicide sampling results

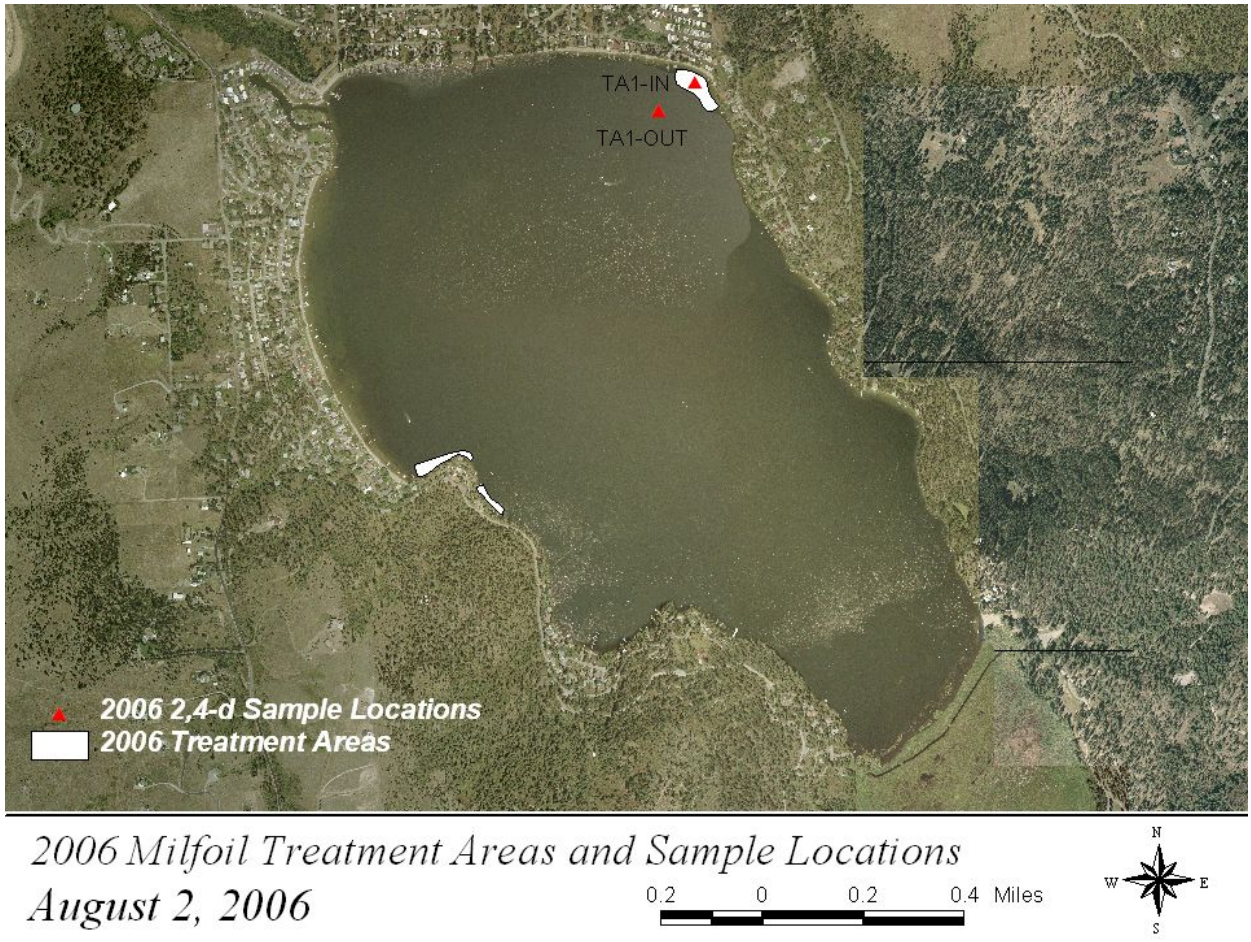

Figure 2. 2006 Herbicide treatment areas and residual sampling locations

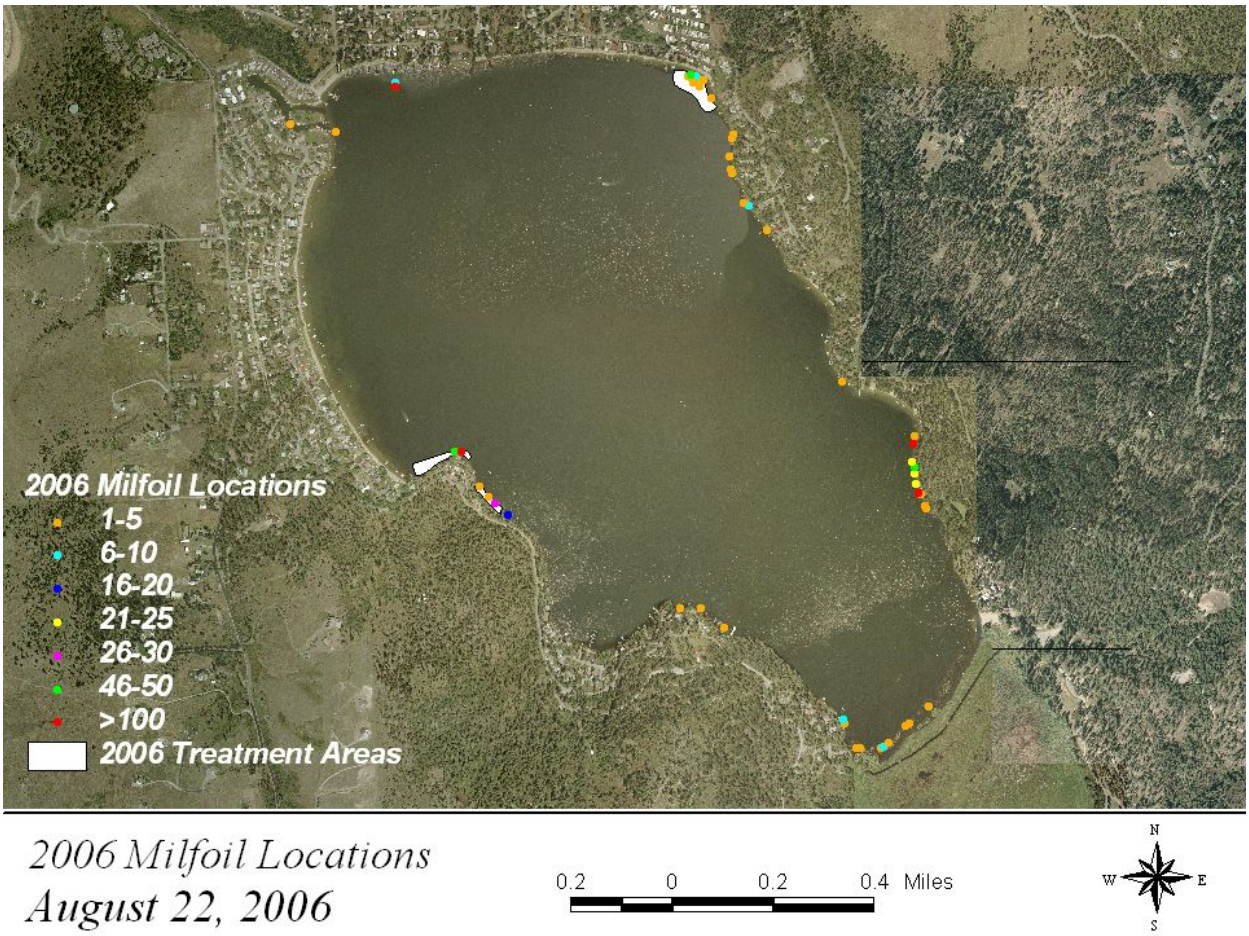

Figure 3. 2006 Herbicide treatment areas and milfoil locations

TA1- IN

Date	Time	Depth (m)	Temp (C)	DO (mg/l)	DO%	pH	SpCond (µs/cm)
8/2/2006	9:26:11	0.71	22.72	7.81	90	8.62	50.5
8/2/2006	9:26:56	1.01	22.7	7.75	89.3	8.65	50.4
8/2/2006	9:27:45	2	22.58	7.64	87.8	8.66	50.4
8/2/2006	9:28:44	3.01	22.42	7.75	88.8	8.7	50.3
8/2/2006	9:30:03	3.99	22.13	7.16	81.6	8.51	49.7
8/3/2006	9:08:43	0.62	22.65	8.63	99.3	8.53	49.5
8/3/2006	9:09:36	1	22.55	8.44	96.9	8.53	50.1
8/3/2006	9:10:41	1.99	22.57	8.4	96.5	8.55	50.2
8/3/2006	9:11:41	3	22.25	8.84	100.9	8.66	50
8/7/2006	9:10:45	0.59	22.76	8.4	97.4	8.33	49.3
8/7/2006	9:12:24	1.01	22.69	8.25	95.5	8.38	49.7
8/7/2006	9:13:39	2	22.63	8.24	95.2	8.41	50
8/7/2006	9:14:33	3.01	22.41	8.58	98.8	8.44	49.9
8/7/2006	9:15:35	3.5	22.22	8.33	95.6	8.57	49.6
8/11/2006	9:03:28	0.63	22.29	8.22	94.4	7.8	49.6
8/11/2006	9:04:10	1.01	22.31	8.03	92.3	7.78	49.4
8/11/2006	9:04:56	2	22.25	7.96	91.3	7.79	49.5
8/11/2006	9:05:29	2.97	22.04	8.07	92.2	7.89	49.5

Table 3. 2006 TA1-IN water quality sampling results

TA1- OUT

Date	Time	Depth (m)	Temp (C)	DO (mg/l)	DO%	pH	SpCond (µs/cm)
8/2/2006	9:35:48	0.68	22.75	7.61	87.8	8.59	50.1
8/2/2006	9:37:02	0.99	22.69	7.65	88.1	8.63	50.3
8/2/2006	9:38:35	2	22.55	7.57	86.9	8.63	50.3
8/2/2006	9:39:27	3.01	22.43	7.68	88	8.66	50.3
8/2/2006	9:40:37	4.01	22.31	7.59	86.8	8.64	50.3
8/2/2006	9:41:26	5.01	22.28	7.55	86.7	8.64	50.3
8/2/2006	9:42:25	5.98	17.51	0.69	7.1	6.81	49.4
8/2/2006	9:43:47	6.99	15.08	0.2	2	6.29	57.8
8/2/2006	9:45:08	8	13.75	0.2	1.9	6.41	84.2
8/3/2006	9:18:01	0.61	22.71	8.38	96.5	8.52	50
8/3/2006	9:19:03	1	22.71	8.17	94.1	8.53	50.3
8/3/2006	9:20:11	1.99	22.54	8.14	93.4	8.54	50.3
8/3/2006	9:20:52	3	22.48	8.12	93.2	8.56	50.3
8/3/2006	9:21:55	4.01	22.4	8.04	92.1	8.56	50
8/3/2006	9:22:53	5	22.34	8.04	91.9	8.57	50.3
8/3/2006	9:23:42	5.99	18.43	1.41	14.9	6.91	50.1
8/3/2006	9:24:38	6.99	15	0.36	3.5	6.32	58.9
8/3/2006	9:25:38	8.01	13.78	0.23	2.2	6.37	87.9
8/7/2006	9:21:05	0.64	22.77	8.49	97.4	8.39	49.9
8/7/2006	9:22:06	1.03	22.72	8.32	96.3	8.42	49.9
8/7/2006	9:23:07	2.01	22.65	8.18	94.6	8.41	49.8
8/7/2006	9:23:54	3	22.61	8.18	94.5	8.42	50.1
8/7/2006	9:25:16	4	22.55	8.17	94.3	8.41	50.1
8/7/2006	9:26:18	5	22.38	8.11	93.3	8.36	50.2
8/7/2006	9:27:40	6	19.41	1.16	12.6	6.55	50.9
8/7/2006	9:29:38	7	15.65	0.15	2	6.14	60.2
8/7/2006	9:30:51	8	13.65	0.08	0.7	6.47	97.6
8/11/2006	9:09:38	0.65	22.27	8.09	92.8	7.71	49.7
8/11/2006	9:10:25	1.03	22.36	7.8	89.6	7.73	49.6
8/11/2006	9:11:18	2	22.34	7.86	90.4	7.76	49.8
8/11/2006	9:11:55	2.99	22.36	7.87	90.5	7.77	49.6
8/11/2006	9:12:36	4.02	22.36	7.88	90.6	7.76	49.5
8/11/2006	9:13:43	5.03	22.36	7.77	89.3	7.74	49.6
8/11/2006	9:14:33	6.06	22.31	7.76	89.2	7.74	49.4
8/11/2006	9:15:17	7.01	16.16	1.06	10.8	6.53	57.8
8/11/2006	9:16:52	8.07	13.94	0.23	2.3	6.54	103

Table 4. 2006 TA1-OUT water quality sampling results

Summary of 2,4-D Residues from Liberty Lake

All of the residual herbicide samples collected were well below the EPA standard of 70 ppb following the treatment. It is not clearly understood why the sampling results display abnormally low values following the treatment. At the affirmed labeled rate of 10 gallons/acre, it would be expected to observe values of 30+ times greater than the values reported. Contact was made with the laboratory and the applicator to clarify the results. Representatives from each party were confident in their responsibilities, and the low concentration values were never explained. Table 2 outlines the sampling results of the herbicides applied to Liberty Lake. In addition to Table 2, refer to Figure 2 for the treatment area residual sample locations.

Herbicide Application Efficacy

Liberty Lake was visually surveyed after the treatment by the Lake Manager. No adverse impacts such as algae blooms or fish kills were observed following the treatment. However, Anabaena was observed in the lake five days prior to the treatment and the milfoil plants observed did not display actively growing green growth. Secchi disk readings in Liberty Lake during the application period were improving (3.5m; compared to 1.25m two weeks prior), and the water quality parameters collected did not show any anomalies to report (Tables 3 and 4).

Efficacy surveys were conducted at weekly intervals up to 7-weeks following the treatment. Plant observations were recorded in a field book. Below is a summary of the weekly efficacy surveys:

- Week 1 (8/10/06): Plants observed in the treatment areas displayed green tips, but no curling of the tips were observed. Many plants, both inside and outside the treatment areas, were covered in periphyton growth and appeared toppled at varying degrees.
- Week 2 (8/17/06): All the plants in the treatment areas displayed brown stalks with abundant periphyton growth. Plants still appeared to be toppled; now nearly horizontal. Green tips were still observed, but becoming increasingly covered with periphyton.
- Week 3 (8/24/06): All the plants in the treatment areas are toppled and covered with periphyton growth. Large fragments 2.5 to 3 feet in length were found at TA1. A dive survey was also conducted. The dive survey showed that the root mass of the plants sampled appeared intact and healthy.
- Week 4 (8/31/06): No apparent differences were observed between Week 3 and Week 4.
- Week 5 (9/6/06): No observable change since Week 3. All milfoil plants found in the lake are covered in periphyton and are toppled nearly horizontal (forming a 90º). The leaflets are still attached and healthy. Green stalks were observed from the fragments removed from the plants.
- Week 7 (9/22/06): Still no observable change in plant characteristics between treatment area plants and plants outside the treatment areas. However, a few less plants are observed within the treatment areas compared to pre-treatment populations. Secchi levels have influenced the surveys with visibility to 2.5m.

Conclusion

Overall, the efficacy of the 2006 herbicide application in Liberty Lake was meager. It is not clearly understood the reasoning for the relatively poor efficacy of the treatment and the low residual sampling results, but it is certain that the spring Anabaena bloom influenced the normal growth rate of the milfoil plants in the lake and may have attributed to the shortcomings of the herbicide treatment. However, given the relatively ineffectiveness of the 2006 herbicide treatment, the LLSWD still favors the use of DMA*4IVM based on the results obtained from the 2005 herbicide test. Plans for treatment in 2007 still include an entire shoreline treatment if spring algae blooms are minimal.