PIPE AND LUCERNE LAKES

HYDRILLA and AQUATIC VEGETATION SURVEYS 2010: FINAL REPORT

PREPARED FOR
KING COUNTY

PREPARED BY

HERRERA ENVIRONMENTAL CONSULTANTS

Jan. 2011

Introduction

Pipe and Lucerne lakes in King County, Washington experienced the only known infestation of *Hydrilla verticillata* (hydrilla) in the state between 1995 and 2006. This infestation might have caused ecological damage and reduced recreational opportunities and aesthetics, potentially costing the state millions of dollars if it were allowed to spread to other waters. Therefore, this state-listed, highly invasive noxious weed was targeted for eradication by the Washington State Department of Ecology (Ecology) and King County (County).

The aquatic herbicide fluridone (trade name: Sonar PR) was applied every summer from 2003 to 2009 to target hydrilla in the lakes in accordance with the *Pipe and Lucerne Lakes Integrated Aquatic Vegetation Management Plan*. In 2003 through 2007, Sonar PR was applied to both lakes three times each summer to maintain the concentration of fluridone at a level toxic to hydrilla (i.e., 5 parts per billion (ppb)) throughout the growing season. Only Pipe Lake received herbicide treatments in 2008 and 2009.

Since herbicide treatments began in 2003, aquatic plant surveys have been conducted three times each summer by staff from Envirovision between 2003 and 2008, and Herrera Environmental Consultants (Herrera) beginning in 2010, and the King County Lake Stewardship Program. No hydrilla has been found during these surveys in either lake since August 2006. The focus of the surveys has shifted in recent years from treatment effectiveness monitoring to plant community characterization and evaluation; however, searching for hydrilla is still the primary goal of these surveys.

Three surveys were conducted during the summer of 2010. The three surveys replicated the surveys conducted in previous summers. These were broad scans of the entire littoral zone, primarily for the purpose of looking for hydrilla. For the August survey, an additional component was added. A detailed assessment of the aquatic plant communities along eight reference transects was conducted. Data from this transect survey is compared to a reference survey that was conducted in 2003, and will serve as a new reference point for future comparisons. These detailed surveys and comparisons help to gauge the status of reestablishment of the aquatic plant communities impacted by the fluridone treatments in Pipe and Lucerne lakes.

This report summarizes the aquatic plant survey activities that were undertaken in the summer of 2010. The results from these activities are discussed in the contexts of hydrilla eradication and plant community reestablishment.

Methods

Scuba divers from Herrera and Snorkelers from King County conducted three aquatic plant surveys in Pipe and Lucerne Lakes in 2010. All three surveys included thorough scans of the entire littoral zone, primarily for the purpose of looking for hydrilla. Additionally, detailed observations about the plant community, species composition and density were also recorded during these surveys. In addition to the

hydrilla search, the August survey included a detailed assessment of the aquatic plant community along eight reference transects. The subsections below briefly summarize the techniques that were used. More detailed descriptions of the methods used for each individual survey can be found in Herrera 2010a, 2010b, and 2010c.

Hydrilla Searches

Hydrilla searches were conducted on June 15, August 16, and October 6, 2010. Since 2003, the lakes have been surveyed for hydrilla three times each summer. Fourteen sections of the lakes (delineated in 2003) were used as reference locations to compare hydrilla plant growth by section (Figure 1). A two-person scuba dive team from Herrera led the survey efforts, and one snorkeler from King County assisted with the June survey and two snorkelers from King County assisted with the August survey. In most sections, divers swam in a 90 degree zigzag pattern from the shoreline to the end of the littoral zone. One diver surveyed the area from a depth of approximately 5 feet to a depth of 10 feet, while the other diver surveyed from a depth of 9 feet to 15 feet. The snorkeler(s) surveyed the shallower areas (less than 5 feet) by swimming parallel to the shore. In more expansive shallow areas of the lake, the divers or snorkeler(s) typically swam in spoke like transects out from shore. Typical search patterns used are illustrated in Figure 2.

General observations about the plant community were reported by the team in the water and recorded by the technician in the boat.`

Aquatic Plant Community Survey

Eight transects were established in 2003 (pre-treatment) to serve as reference points for comparing plant communities between years. These transects were surveyed on August 16, 2010. The location and orientation of the transects are shown in Figure 1. Scuba divers surveyed the littoral zone between a 6- and 15-foot depth while the snorkelers surveyed from the shoreline out to a depth of 6 feet. The team in the water took notes of the plant species observed as well as the relative abundance, and the overall vegetation density along each transect. Density was calculated by the average number of plants (independent of species) per square meter along the transect line. Low density growth was considered to be less than five plants growing per square meter. Medium density growth was considered to be 6-10 plants per square meter, and high density growth was greater than 10 plants per square meter. The divers and snorkelers surfaced at the end of each transect and reported their observations to the surface support crew. When the divers could not readily identify plant species, samples were collected and saved for later identification.

Results

Hydrilla Searches

No hydrilla was found in either lake during the three searches. The visibility was good to excellent during the surveys, which contributed to high quality surveys and greatly reduced the potential for missing hydrilla plants.

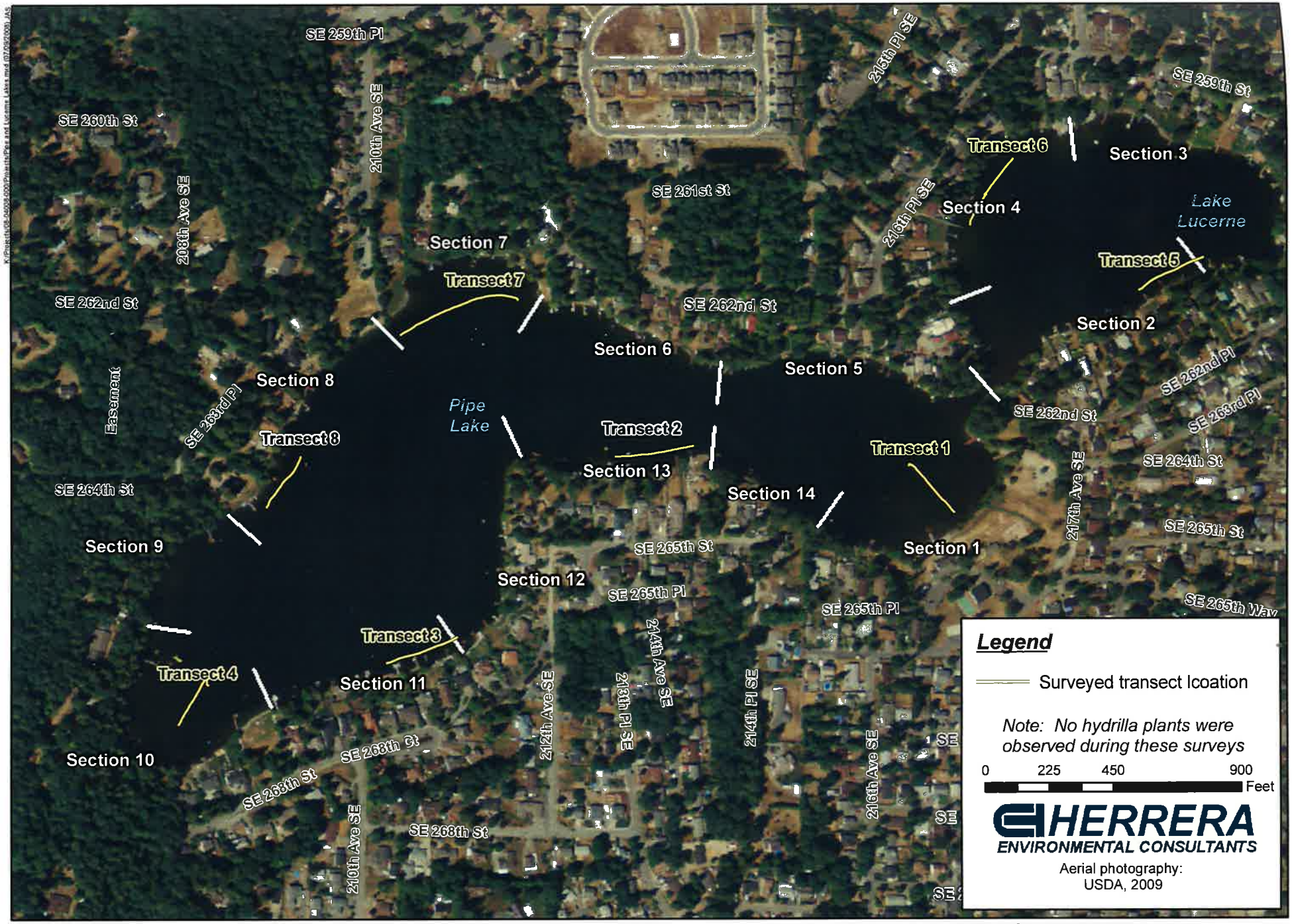

Figure 1. Pipe and Lucerne Lakes 2010 Aquatic Vegetation Survey Section and Transect Locations.

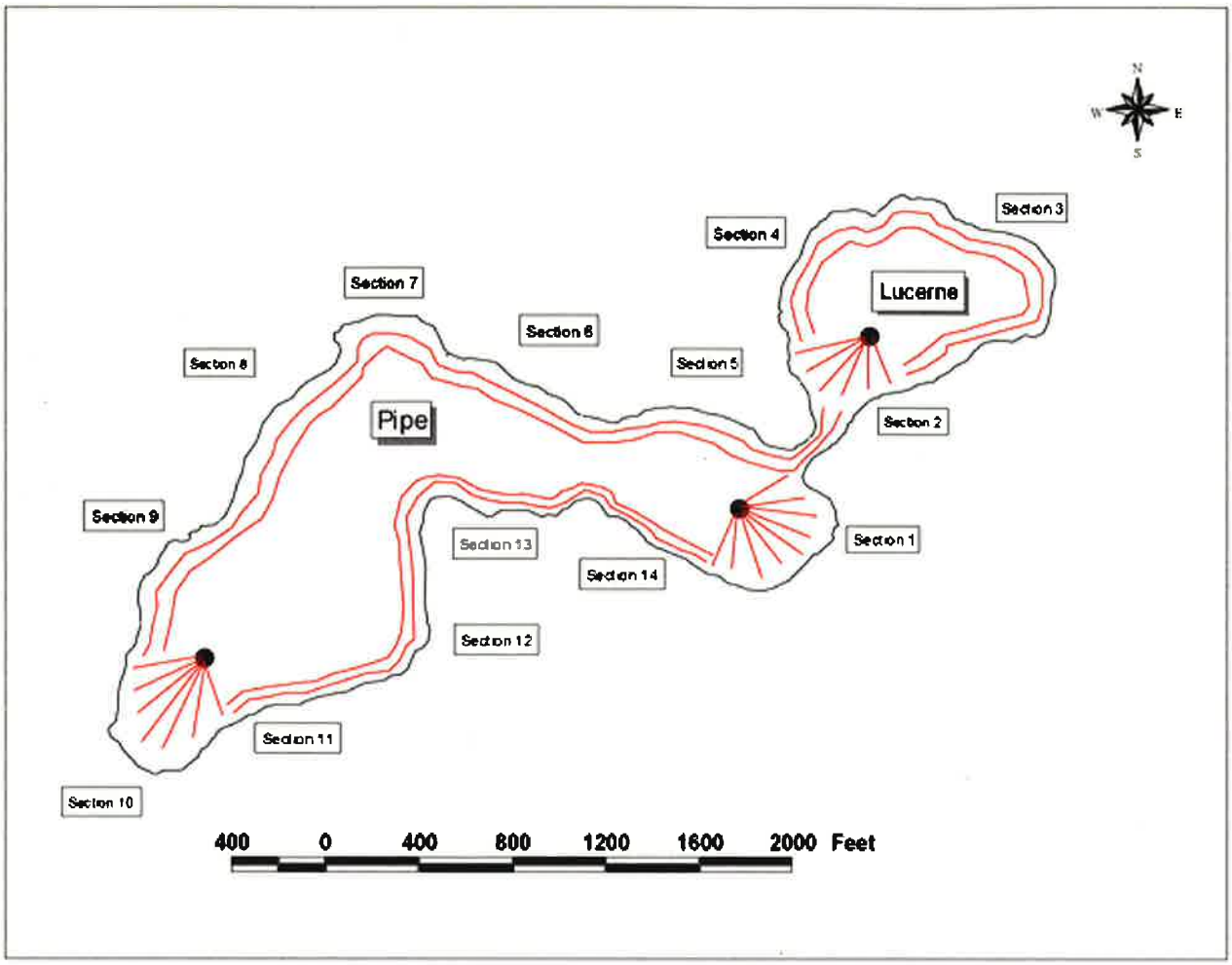

Figure 2. Typical diver survey patterns for hydrilla searches.

This year marks the fourth year in a row that hydrilla was not found in either lake. This is a strong indicator that hydrilla may be eradicated from both lakes. However, residual levels of fluridone were measured in both lakes in June 2010 at about four times below the prescribed treatment dose of 5 ppb. There is the potential that residual fluridone could have inhibited hydrilla growth even at low concentrations, and that hydrilla could return once the herbicide has degraded completely. However, prolific growth of other plant species throughout the growing season indicates that residual fluridone had little effect on plant growth.

Aquatic Plant Community

The comprehensive survey of the aquatic plant community indicates that a healthy native plant community is rapidly re-colonizing Pipe and Lucerne lakes. This was confirmed through the informal observations made by the divers during the hydrilla searches and transect surveys. Table 1 lists the aquatic plants that were observed during the survey activities during 2010. Table 2 presents the results from the formal aquatic plant community survey, and provides a comparison to plant community density observed during the 2003 Survey.

Table 1. List of aquatic plants and macroalgae observed at Pipe/Lucerne Lakes in 2010.

Scientific Name	Common Name
EMERGENT PLANTS	
Iris pseudacorus	Yellow-flag iris
Juncus sp.	Rushes
Polygonum hydropiperoides	Waterpepper
Solanum dulcamara	Bittersweet, nightshade
Typha angustifolia	Narrowleaf cattail
Typha latifolia	Broadleaf cattail
FLOATING-LEAVED PLANTS	
Ludwigia palustris	Water purslane
Nymphaea odorata	Fragrant waterlily
SUBMERSED PLANTS	
Najas flexilis	Slender water-nymph
Potamogeton robbinsii	Fern-leaf pondweed
Potamogeton foliosus	Leafy pondweed
Potamogeton natans	Floating Pondweed
Potamogeton amplifolius	Big Leafed pondweed
Potamogeton strictifolius	Narrow Leafed pondweed
Utricularia spp.	Bladderworts
ALGAE	
Chara	Muskgrass, Stonewort
Nitella sp.	Nitella
Periphyton	Filamentous algae

Table 2. Submerged aquatic plants found in reference transects during SCUBA diver surveys at Pipe and Lucerne Lakes in August 2003 and August 2010.

Transect #	Depth (ft)	Submerged Plant Species Observed in 2003 Survey	Density [2]	Submerged Plant Species Observed in 2010 Survey [1]	Density [2]	Increase or Decrease in Density since 2003?
T1	0-3	FA, PZ, PR, C/N	L	PF, PR	L	Same
	3-6	FA	H	PF,PR	M	Decrease
	>6	FA, PZ, PR	L	PR,PF,C/N	M	Increase
T2	0-5	PZ, C/N	L	C/N	L	Same
	5-13	C/N	H	FA,C/N	L	Decrease
	13-16	PZ	L	C/N	M	Increase
T3	0-4	None - gravel bottom	-	C/N, PS	L	Increase
	4-8	PZ, C/N	L	PR, PF	L	Same
	8-13	PR, C/N, (HY)	M (L)	C/N	L	Decrease
T4	0-4	PZ, PR	L	PR,PF	L	Same
	4-6	PZ, PR, C/N	M	PR, PF	L	Decrease
T5	0-5	C/N	L	C/N, PF, PR	M	Increase
	5-10	PZ, C/N	L	C/N, PF	M	Increase
	10-15	C/N, UT	M	C/N, PF	L	Decrease
T6	0-5	PZ, PR, PA, C/N	L	C/N, PF, UT,PR, PG	L	Same
	5-8	PZ, C/N, FT	L	C/N, PF, UT,PR, PS	L	Same
T7	0-10	PZ, PR, C/N, (HY)	M (L)	C/N, PR	L	Same
	10-13	C/N	H	C/N, PR	H	Increase
T8	0-6	PZ, PR, C/N, (HY)	L (L)	PR, CN	L	Same
	6-10	PZ, PR, C/N, (HY)	L (L)	PR, C/N	M	Increase
	12-15	C/N	M	C/N, PR	M	Same

[1] FA = *filamentous algae*, PF = *Potamogeton foliosus*, PR = *Potamogeton robbinsii*, PA = *Potamogeton amplifolius*, PS = *Potamogeton strictifolius*, PG = *Potamogeton gramineus*, PZ = *Potamogeton zosteriformis* C/N = *Chara/Nitella*, UT = *Utricularia* spp., FT = *Fontinalis antipyretica*, HY = *Hydrilla verticillata* (density in parenthesis).

[2] L = 1-5 plants/m^2, M = 6-10 plants/m^2, H = >10 plants/m^2.

Transect Survey Results

A wide variety of plants were observed along the transects in both lakes (Table 2), although *Chara*, *Nitella*, *Potamogeton robbinsii,* and *Potamogeton foliosus* are dominant along most transects. All plants observed in the 2003 survey were observed in the 2010 survey except for *P. fontinalis* and *P. zosteriformis* (Table 2). Two species of Potamogeton (*P. strictifolius* and *P. foliosus*) were identified during the 2010 survey that were not found during the 2003 survey. However, there was some concern that *P. foliosus* may have been mistaken for *P. zosteriformis* in the 2003 survey. *P. foliosus* was positively distinguished this year from *P. zosteriformis*, based on the structure of the top (flowering) leaves (Ecology 2001, Brayshaw 1985).

While a greater number of species were identified throughout the lakes during the 2010 survey, some individual transects had a lower variety of species than in 2003. This is especially notable in transects 2, 7, and 8 of Pipe Lake. In the 2010 survey, only one vascular plant species was identified in these transects, but four (including hydrilla) were identified in 2003. Similarly, transect 2 had no vascular plants in the 2010 survey, whereas *P. zosteriformis* was identified in 2003.

Vegetation density ranged from low to high in 2010, depending on the transect. Similar variability in density among transects was also observed in 2003. Some individual transects, or depth zones of an individual transect, show a decreased density, while a greater number actually showed an increased density over the 2003 survey (Table 2). The divers observed very few plants and sparse growth in sections 10, 12, 13, and 14 of Pipe Lake (Figure 1), indicating that the plant community in these sections has not yet recovered from the herbicide treatments. Extensive patches of medium and high-density vegetation throughout both lakes indicate good progression towards recovery.

General Observations

Plant coverage and density was higher in Lucerne Lake than Pipe Lake. This result is not unexpected, because the last fluridone treatment in Lucerne Lake was in 2008, and the last treatment in Pipe Lake was in 2009. The extra year of plant community recovery time in Lucerne Lake likely resulted in the higher observed plant density.

The native aquatic plant community substantially increased in density and areal extent as the summer progressed. There was no difference in the number of species identified, even in individual sections among the three surveys. However, the divers remarked that many open patches had filled in since the previous surveys. This was especially notable for *P. robbinsii* in sections 8 through 10 of Pipe Lake. Several areas that were characterized by intermittent, moderately dense patches in the June survey have grown into very large, continuous patches with 90 to 100 percent density. Increases in the density and coverage of other plant species also occurred in other areas of the lake but were less pronounced.

Conclusions

The last hydrilla plant in Lucerne Lake was found over 6 years ago (June 2004), and it has been 3 years since herbicide was applied to this lake. This indicates that hydrilla may be eradicated from Lucerne

Lake. Hydrilla has not been found in Pipe Lake for 4 years. The last herbicide treatment in Pipe Lake occurred in July 2009, so its eradication status is still unclear; however, the continued absence of hydrilla is encouraging. Very low concentrations of fluridone herbicide (less than 1.3 ppb) were detectable in both lakes in the spring of 2010. Although concentrations were below the prescribed treatment doses, it may have limited hydrilla growth and slowed the return of the native plant community early in the summer. The prolific growth of the native plant community between June and October suggests that fluridone concentration has subsided to a level where it is not affecting plant growth.

The overall plant community is recovering well since fluridone treatments were stopped in 2009. The diversity, as measured by number of aquatic plant species in the lakes, is actually greater now than it was in 2003. Areas of the lakes still show some impacts of herbicide treatment as evidenced by sparse plant growth. The plant community density is expected to increase annually until all available aquatic habitat is fully utilized.

Future Considerations

Even though hydrilla appears to be eradicated from the lakes, the searches scheduled over the next two summers are necessary to confirm the eradication. As the native plant community increases in coverage and density, the hydrilla searches will become more challenging. Past surveys have been aided by the sparse plant growth resulting from the ongoing fluridone applications. Had they been present, hydrilla plants would have been easy to see on the exposed sediments. It will be more difficult to spot hydrilla plants growing among a dense, native plant community.

It is important to acknowledge that future hydrilla search surveys serve two purposes. While the primary goal is to locate hydrilla plants, the greater value of these surveys may be in providing a qualitative assessment of the aquatic plant community regeneration. The detailed observations the divers reported for each section of the lake regarding plant species presence, relative abundance, and overall community density were useful tools in tracking changes throughout the summer of 2010. The general results from these surveys will also prove useful for comparing the aquatic plant community between years. This type of assessment will provide better understanding of the changes in the plant community over the next few years and enhance the conclusions from the more detailed transect surveys.

References

Brayshaw, T.C. 1985. Pondweeds and Bur-reeds, and Their Relatives, of British Columbia. British Columbia Provincial Museum. No. 26. Occasional Papers.

Ecology. 2001. An Aquatic Plant Identification Manual for Washington's Freshwater Plants. Publication #01-10-032. Washington Department of Ecology.

Herrera. 2010a. Pipe and Lucerne Lakes Hydrilla Survey - June 2010. Prepared for King County by Herrera Environmental Consultants, Inc., Olympia, Washington.

Herrera. 2010b. Pipe and Lucerne Lakes Hydrilla and Aquatic Vegetation Survey - August 2010. Prepared for King County by Herrera Environmental Consultants, Inc., Olympia, Washington.

Herrera. 2010c. Pipe and Lucerne Lakes Hydrilla Survey - October 2010. Prepared for King County by Herrera Environmental Consultants, Inc., Olympia, Washington.