PIPE AND LUCERNE LAKES

HYDRILLA and AQUATIC PLANT COMMUNITY SURVEY – August 2012

PREPARED FOR
KING COUNTY

PREPARED BY

HERRERA ENVIRONMENTAL CONSULTANTS

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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. The 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, hydrilla, a 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 through 2009 to target hydrilla in the lakes, in accordance with the Pipe and Lucerne Lakes Integrated Aquatic Vegetation Management Plan. From 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 were conducted three times each summer by Herrera Environmental Consultants (previously known as EnviroVision) and the King County Lake Stewardship Program. No hydrilla has been found 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 the surveys. Because of the effectiveness of the herbicide treatment as indicated by 5 years without hydrilla, it was determined that for the 2012 monitoring year, one annual aquatic plant survey would sufficiently characterize the vegetation and presence of hydrilla.

This report presents the results from the August 2012 survey. The survey had two components: a hydrilla search, as part of the ongoing effort to assess the plant's eradication status, and a detailed assessment of the aquatic plant communities along eight reference transects. Results from these surveys are compared to a 2003 survey that characterized the plant communities along the same eight transects. Comparing these surveys will help to gauge the status of re-establishment of aquatic plant communities impacted by the fluridone treatments in Pipe and Lucerne lakes.

Methods

A survey team consisting of two scuba divers from Herrera and one snorkeler from King County, and two additional staff providing technical support, performed the hydrilla search and transect surveys on August 20, 2012, following the same survey technique used since 2003.

Hydrilla Search

Fourteen sections of the lakes (initially delineated in 2003) are used as reference locations to compare hydrilla and native plant growth by section. The sections are shown in Figure 1.

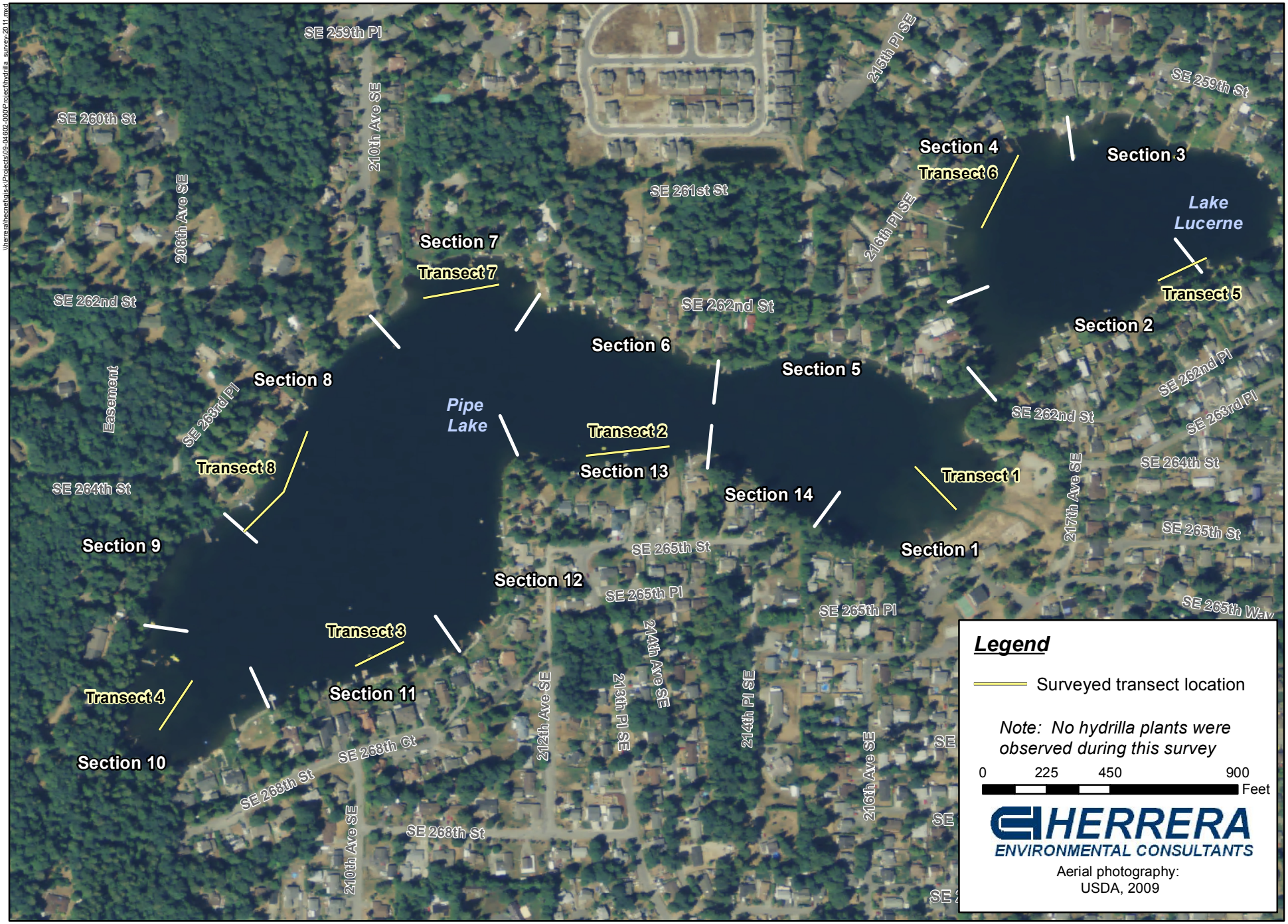

Figure 1. Pipe and Lucerne Lakes Hydrilla Survey Sections and Vegetation Survey Transects.

The snorkeler surveyed the shallow shoreline of the lake (i.e., from a depth of 0 to 4 feet). Figure 2 shows the survey patterns used by the divers and snorkelers. The divers surveyed from a depth of 4 feet out to the edge of the littoral zone, which in most cases was approximately 15 feet. Each of the scuba divers surveyed a specific depth zone (i.e., 3 to 8 feet and 8 to 15 feet) by swimming parallel to shore in a counterclockwise direction around the lakes. The staff in the boat monitored the position of the divers and snorkeler to ensure that they covered all areas of the littoral zone.

As in past years, there were three sections in which the survey methods were different than described above. In Section 1 (Figure 1), the snorkeler swam multiple parallel transects to ensure greater aerial coverage of the shallow embayment, while the dive team also swam multiple spoke-like transects from the shore to the littoral zone limit where the boat was stationed as a reference point. Pipe Lake, Section 10 (Figure 1), which is less than 5 feet in depth throughout its extent, was surveyed only by the snorkeler, who surveyed in spoke-like transects from the shore to a submerged stump marking the center of the section. Meanwhile, two parallel transects were surveyed by the divers between the western end of Section 9 and the western end of Section 11 to ensure adequate coverage out to the littoral zone limit of Section 10. Similarly, the divers swam along transects between in the western portion of Section 2 and Section 4 in Lucerne Lake to ensure adequate coverage.

The support boat staff remained near the diver/snorkeler team as a safety measure and to provide general diver support. If hydrilla plants had been found, the exact locations of the plants were to be recorded with a Trimble Geo XT GPS unit before removal by the divers for verification.

In addition to searching for hydrilla, the divers also made general observations about species diversity and density of the submerged plant community. Those observations were recorded by the boat staff and are documented in Appendix A.

Aquatic Plant Community Survey

Eight transects were established in 2003 and relocated in 2010 (Herrera 2010) to serve as reference points for the comparison of plant communities between years. The transect start, end, and path-lines were referenced in the field in order to replicate their locations again in 2011 and 2012. Surveyed transects are shown in Figure 1. Divers were shown the starting points of the transects by the technician in the boat. The end point of each transect was marked for the divers by holding the boat at that location. The technician recorded the start and end points of each transect surveyed using a Trimble Geo XT GPS unit. One intermediate point was recorded along Transect 8 to more accurately depict the transect line (Figure 1).

Transects 2, 3, and 5 through 8 run parallel to the shoreline. Transects 1 and 4, which are located in shallow bays, are perpendicular to the shoreline. The divers and snorkeler surveyed parallel transects (2, 3, and 5 through 8) by swimming parallel to each other and the shoreline, with divers surveying the deeper depths (approximately 4 to 15 feet deep) and the snorkeler surveying the 0 to 4 foot depth.

The divers took notes of the plant species observed as well as the relative abundance, and the overall vegetation density along each transect. Density was estimated 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 to

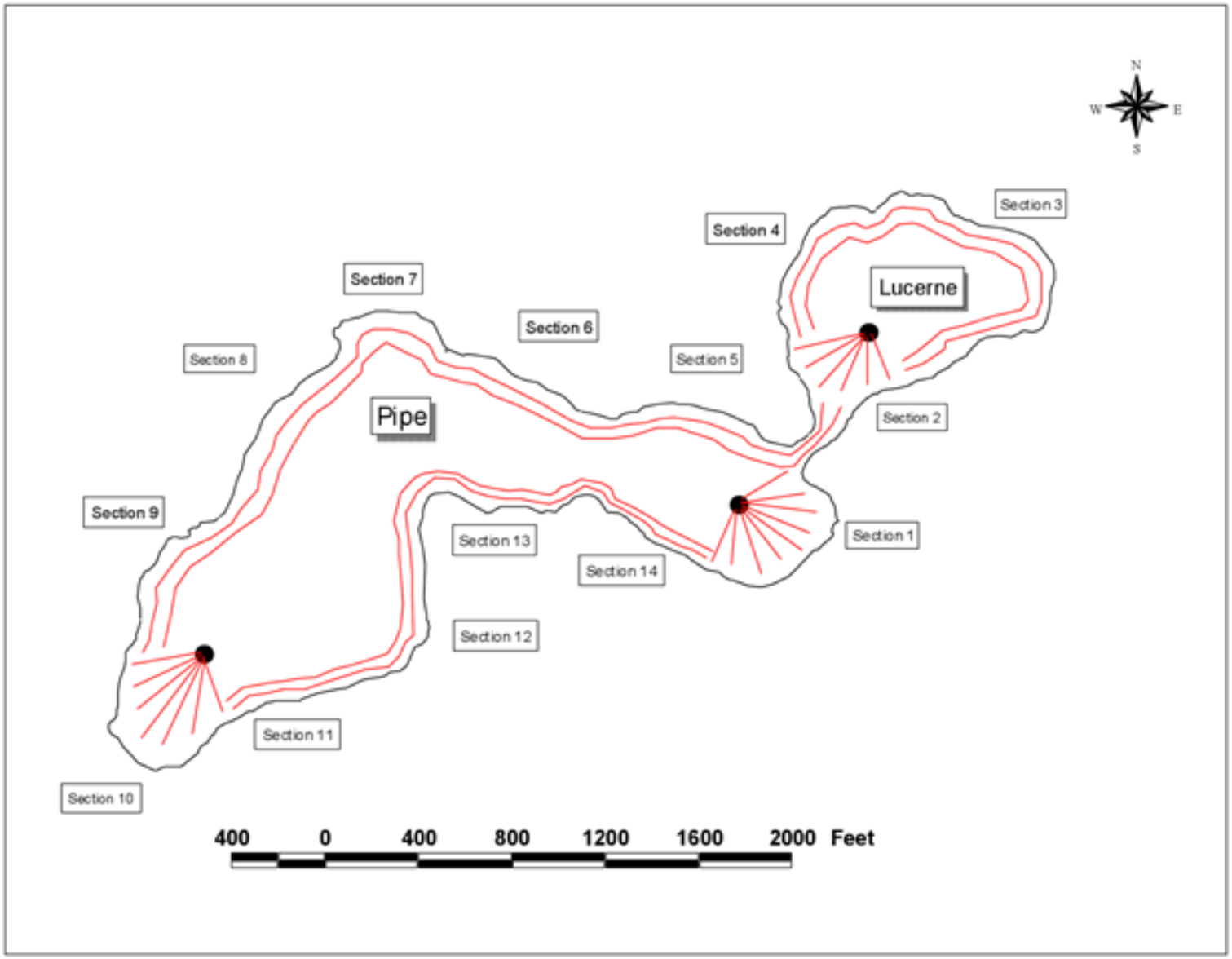

Figure 2. Typical diver survey patterns for hydrilla searches.

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 boat crew. When the divers could not readily identify plant species, samples were collected and saved for later identification.

Results

Hydrilla Search

Hydrilla was not observed in either lake during the hydrilla search and aquatic plant community surveys; a continuation of the results over the past 7 years (2005 through 2011), where no hydrilla plants have been observed. The visibility was good during the survey which contributed to a high quality survey and greatly reduced the potential for missing hydrilla plants.

Aquatic Plant Community Survey

The presence of submersed aquatic plants remains somewhat low in both lakes, though coverage and density are increasing. Plant coverage and density was higher in Lucerne Lake than Pipe Lake. This result is not unexpected because Pipe Lake was treated with fluridone 1 year after the fluridone treatments were ended in Lucerne Lake, and therefore had one less year to recover. Survey results are summarized as follows:

- **Table 1** lists the aquatic plants and macroalgae observed during both the hydrilla search and aquatic plant community surveys performed in August 2012.
- **Table 2** presents only the results from the 2012 aquatic plant community survey, and provides a comparison in plant community density to the 2003 Survey.
- **Appendix A** presents informal observations and notes reported by the divers describing the species and relative abundance of plants present in sections 1 through 14 (Figure 1) that were observed during the hydrilla search.
- **Appendix B** provides additional information and notes from the divers pertaining to the plant communities along the eight survey transects.

A wide variety of plants were observed in both lakes (Table 2 and Appendix A) though *Chara*, *Nitella*, *Potamogeton robbinsii*, and *Potamogeton foliosus* continue to be dominant in most areas of the lakes. With one exception, all plants observed in the 2003 pre-treatment survey were observed in the 2012 survey. The exception was *Fontinalis* (Table 2); a plant that has not been observed in any recent years. There is also one species (*P. foliosus*) that has been observed in the past few years (including in 2012) that was not observed during 2003. However, as has been noted previously, *P. foliosus* may have been mistaken as *P. zosteriformis* in the 2003 survey. *Potamogeton foliosus* was positively distinguished from *P. zosteriformis* in 2010 based on the structure of the top (flowering) leaves (Ecology 2001; Brayshaw 1985). Although not observed along the transect lines that were established in 2003, *Potemogeton gramenious* was observed in Section 2 during the 2011 survey, but not in the 2012 survey, and was not observed in either lake in 2003.

Table 1. List of aquatic plants and macroalgae observed at Pipe/Lucerne Lakes in August 2012.

Scientific Name	Common Name
EMERGENT PLANTS	
Iris pseudacorus	Yellow-flag iris
Juncus sp.	Rushes
Polygonum hydropiperoides	Waterpepper
Solanum dulcamara	Bittersweet, nightshade
Typha latifolia	Cattail
Veronica scutellata	Skullcap speedwell
FLOATING-LEAVED PLANTS	
Ludwigia palustris	Water purslane
Nymphaea odorata	Fragrant waterlily
Potamogeton amplifolius	Big Leafed pondweed
Potamogeton gramineus	Grass-leaved pondweed
SUBMERSED PLANTS	
Najas spp.	Slender water-nymph, common water-nymph
Potamogeton foliosus (1)	Leafy pondweed
Potamogeton robbinsii	Fern-leaf pondweed
Potamogeton zosteriformis	Fern, Flat-stem, or eelgrass pondweed
Ruppia sp.	Widgeongrass, ditch-grass
Utricularia spp.	Bladderworts
ALGAE	
Chara	Muskgrass, stonewort
Nitella sp.	Nitella
Periphyton	Filamentous Algae

(1) *P. foliosus* may have been misidentified in previous studies as *P. zosteriformis*.

Plant density estimates this year indicate changed conditions compared to 2003. Plant density overall has continued to increase. The 8 survey transects were divided into 2 to 3 depth intervals which resulted in 23 segments that were assessed for density differences (Table 2). In 19 of these 23 segments, the plant densities were either the same or had increased when compared to 2003; in only 4 segments had density appeared to decrease.

Observations made during the aquatic plant community survey (i.e., the eight transects) (Appendix B) suggest greater densities and diversity of plants this year as compared to 2011; this was especially the case with the density of *P. foliosus* along Transect 1, which transitioned from low in 2011, to high in 2012. This increase in diversity and density represents a continuing trend since herbicide treatments ended.

Observations of plant densities made during the hydrilla search portion of the survey (i.e., the 14 sections) also indicate there was an overall increase in vegetation density between 2011 and 2012 (Appendix A). Also, the trend of increasing abundance of *P. amplifolius*, in both lakes that was first noted in 2010, has continued. Plant diversity also was greater than was observed in 2003 across all transects (Table 2). The diversity is also greater than was observed in 2011, as summarized by the following:

- *Najas* was newly observed in Transects 1,6 and7,

- *P. foliosus* was newly observed in Transects 3 and 4,
- *P. amplifoliius* was newly observed in Transects 1, 2, 3, 4, 5, 7, and 8,
- *P. zosteriformis* was newly observed in Transects 1 and 8,
- *N. odorata* was newly observed in Transect 5,
- *Utricularia* was newly observed in Transects 5 and 6.

In addition, vascular plants were observed at greater depths compared to previous monitoring years in Transect 4 and Transect 6 (Herrera 2011).

Table 2. Submerged aquatic plants found in reference transects during SCUBA diver surveys at Pipe and Lucerne Lakes in August 2003 and August 2012.

Transect #	Depth (ft)	Submerged Plant Species Observed in 2003 Survey [1]	Density (2)	Submerged Plant Species Observed in 2012 Survey [1]	Density (2)	Increase or Decrease in Density since 2003
T1	0-3	FA, PZ, PR, C/N	L	PF, PR, C, PA, NA	H	Increase
	3-6	FA	H	PF,PR, PA, , NA	H	Same
	>6	FA, PZ, PR	L	PR,PF,N, PZ, NA, PA	H	Increase
T2	0-5	PZ, C/N	L	PR, PA, C/N	L	Same
	5-13	C/N	H	PF,N, PA	L	Decrease
	13-16	PZ	L	N, PF, PA	L	Same
T3	0-4	None - gravel bottom	-	PS, PR, PF, C/N	L	Increase
	4-8	PZ, C/N	L	PA, PF, PR, C/N	L	Same
	8-13	PR, C/N, (HY)	M (L)	N, PF, PR	L	Decrease
T4	0-4	PZ, PR	L	PR, PF, PA	M	Increase
	4-6	PZ, PR, C/N	M	PR,PF, N	H	Increase
	>6	None	-	PF, PR	H	Increase
T5	0-5	C/N	L	NO,PF, PR, PA	L	Same
	5-10	PZ, C/N	L	PF, PA. PR, C/N, UT	M	Increase
	10-15	C/N, UT	M	PR, PA, PF, N	L	Decrease
T6	0-5	PZ, PR, PA, C/N	L	PR, UT	L	Same
	5-8	PZ, C/N, FT	L	PF, UT, PZ, NA, PA	H	Increase
	>8	None	-	C/M, NA, PR, PS	L	Increase
T7	0-10	PZ, PR, C/N, (HY)	M (L)	C/N, PF, PR, PA, NA	M(L)	Same
	10-13	C/N	H	N, PR, PF, PA, NA	M	Decrease
T8	0-6	PZ, PR, C/N, (HY)	L (L)	PZ, PA	L	Same
	6-12	PZ, PR, C/N, (HY)	L (L)	PZ, PA, PF, PR, N	M	Increase
	12-15	C/N	M	PF, PR, N	M	Same

[1] FA = *filamentous algae*, NA = *Najas* spp., PR = *Potamogeton robbinsii*, PA = *Potamogeton amplifolius*, PF = *Potamogeton foliosus*, PS= *Potamogeton strictifolius*, PZ = *Potamogeton zosteriformis,* C/N = *Chara/Nitella*, UT = *Utricularia,* spp., *NO= Nymphaea odorata,* 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.

The two surveys (i.e., the hydrilla search and the transect survey) were completed in 6 hours. During the hydrilla search portion of the survey, each section required between 10 and 25 minutes to survey. Each transect of the aquatic plant community survey (i.e., the transect survey) required approximately 10 to 15 minutes to survey. Appendix A shows the times that the divers entered each section of the lake. The hours reported reflect time that divers and snorkelers were actively surveying the lakes for hydrilla, and do not reflect hours spent on travel, setup, and other survey logistics.

Conclusion

The survey team did a thorough search of Pipe and Lucerne lakes and found no hydrilla. The last hydrilla plant in Lucerne Lake was found over 8 years ago (June 2004), and it has been 5 years since herbicide was applied to this lake. Hydrilla has not been found in Pipe Lake for nearly 6 years (August 2006). The last herbicide treatment in Pipe Lake occurred 3 years ago in July 2009, so its eradication status is less certain. However, the continued absence of hydrilla is encouraging.

Comparison of plant communities along the eight reference transects to the original 2003 survey indicates that plant recolonization is proceeding well. Overall, plant community densities are increasing to above the densities observed in 2003, and there is also a greater diversity of species in 2012. Plant density is medium to high along some of thetransects, and throughout several other areas of the lake.

This is the third consecutive systematic survey of the aquatic plant community in these lakes, and the results indicate an overall increasing plant density and diversity between 2010 and 2012. While in the past two years Pipe Lake exhibited lower diversity and density than Lucerne, as of this year Pipe Lake exhibited a similar density and diversity. Therefore both lakes appear to have recovered in terms of restoration of the native plant community.

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APPENDIX A

Informal Observations of Aquatic Plants Made During the Hydrilla Search of All 14 Sections of Pipe and Lucerne Lakes in August 2012

Pipe and Lucerne Lakes Submersed Vegetation Survey. August 20 , 2012

Lake	Section	Time	Hydrilla? (yes/no)	Veg. Dens. (H,M,L)	Species Identified	Relative Abundance	Other Notes
Pipe	1	9:16	No	High	*P. robbinsii*	co-dominant	Greater variety of vegetation compared to previous years.
					P. foliosus	co-dominant	
					P. zosteriformis	present	
					Najas	present	
					P.amplifolius	present	
					Nitella	present	
					Chara	present	
Lucerne	2	9:45	No	Low/ Medium	*P. robbinsii*	co-dominant	*N. oderata* found in pea gravel. Thermocline at 12 feet.
					Nitella	present	
					Chara	present	
					Utricularia	present	
					P. foliosus	co-dominant	
					N. oderata	present	
					P. amplifolius	co-dominant	
Lucerne	3	10:00	No	Low	*P. foliosus*	present	Overall low density. Several medium-high density patches of *p. strictifolius and p. robbinsii* at the beginning and end of section. Several medim-high density patch of *chara/nitella* in the 3 to 8 feet depth.
					Chara	co-dominant	
					Nitella	present	
					Najas	present	
					P. robbinsii	co-dominant	
					Utricularia	present	
					Najas	present	
					P. strictifolius	co-dominant	
Lucerne	4	10:30	No	Low, High (mid-high depth range)	*P. robbinsii*	co-dominant	Greater diversity and density in the 8-15 feet depth compared to previous monitoring. Dense patch of *p. robbinsii* near end of transect 6. Dominant vegetation continues to be *p. foliosus* .
					P. foliosus	co-dominant	
					Nitella	present	
					Chara	present	
					Utricularia	present	
					P. zosteriformis	present	
					Najas	present	
					P. amplifolius	co-dominant	
Pipe	5	11:20	No	Low	*P. robbinsii*	co-dominant	Greater diversity compared to previous monitoring. Large snails at the 8-15 feet depth.
					Chara	present	
					Nitella	co-dominant	
					Najas	present	
					P. foliosus	present	
					P. amplifolius	present	

Pipe and Lucerne Lakes Submersed Vegetation Survey. August 20, 2012

Lake	Section	Time	Hydrilla? (yes/no)	Veg. Dens. (H,M,L)	Species Identified	Relative Abundance	Other Notes
Pipe	6	11:35	No	Low	*P. robbinsii*	present	Vegitation density within the depth range of 0 to 3 feet was low until the end of the section where there was a dense stand of vegetation. End of section 6 had very dense *Nitella.*
					Chara	co-dominant	
					Nitella	co-dominant	
					P. amplifolius	present	
					P. foliosus	present	
Pipe	7	12:00	No	Low/ Medium	*P. robbinsii*	co-dominant	Mucky substrate at 0-3 feet depth. Fairly dense areas of *Nitella* from 8-12 ft.
					Nitella	co-dominant	
					Chara	present	
					P. foliosus	present	
					P. amplifolius	co-dominant	
					N. odorata	present	
					Najas	present	
Pipe	8	1:00	No	Low/ Medium	*P. robbinsii*	co-dominant	First half of middle depth (3-8 feet) survey, no vegetation. *Nitella* at 18 feet in depth in some places.
					Nitella	co-dominant	
					P. zosteriformis	co-dominant	
					P. amplifolius	co-dominant	
					P. foliosus	co-dominant	
Pipe	9	1:20	No	Low, High (mid-high depth range)	*P. robbinsii*	co-dominant	Very few *p. zosteriformis.*
					p. zosteriformis	co-dominant	
					Chara	present	
					Nitella	co-dominant	
					P. amplifolius	present	
Pipe	10	1:40	No	Medium /High	*P. robbinsii*	co-dominant	At depth of 0-3 feet, *p. robbinsii* was dense near beginning and sparse in area with logs. At depth of 8-15 feet, *p. robbinsii* is dense to very dense.
					Nitella	present	
					P. foliosus	present	
					P. amplifolius	present	
					P. foliosus	co-dominant	

Lake	Section	Time	Hydrilla? (yes/no)	Veg. Dens. (H,M,L)	Species Identified	Relative Abundance	Other Notes
Pipe	11	2:00	No	Low	*P. robbinsii*	co-dominant	Dominant species primarily *Nitella* and *Chara.*
					Nitella	co-dominant	
					P. strictifolius	present	
					Chara	co-dominant	
					P. amplifolius	present	
					P. foliosus	present	
Pipe	12	2:20	No	Low	*Nitella*	co-dominant	Low plant density
					Najas	present	
					P. foliosus	co-dominant	
					P. robbinsii	co-dominant	
					P. amplifolius	present	
Pipe	13	2:40	No	Low	*Chara*	present	Low plant density
					Nitella	co-dominant	
					P. foliosus	co-dominant	
					P. amplifolius	co-dominant	
					P. robbinsii	present	
Pipe	14	3:10	No	Med/Low	*Nitella*	co-dominant	Medim density at 3-8 feet.
					P. amplifolius	present	
					P. foliosus	co-dominant	
					p. zosteriformis	present	

APPENDIX B

Results of Aquatic Plant Community Surveys of Eight Transects in Pipe and Lucerne Lakes in August 2012

Pipe and Lucerne Lakes Submersed Vegetation Survey. August 20, 2012

Transect	Section	Depth	Veg. Dens. (H,M,L)	Species Identified	Relative Abundance	Other Notes
1	1	0-3	H	*Najas*	present	Greater vegetation density compared to previous monitoring.
				P. robbinsii	present	
				P. foliosus	dominant	
				P. amplifoliius	present	
				Chara	present	
1	1	3-8	H	*P. robbinsii*	present	Greater vegetation density compared to previous monitoring.
				P. foliosus	dominant	
				P. amplifoliius	present	
				Najas	present	
1	1	8-15	H	*P. robbinsii*	dominant	Greater vegetation density compared to previous monitoring.
				Nitella	present	
				P. foliosus	present	
				P. zosteriformis	present	
				Najas	present	
				P. amplifolius	present	
2	13	0-3	L	*Nitella*	present	Low plant density, same as previous monitoring.
				Chara	present	
				P. foliosus	co-dominant	
				P. amplifolius	co-dominant	
2	13	3-8	L	*P. foliosus*	dominant	Low plant density, same as previous monitoring.
				Nitella	present	
				P. amplifolius	present	

Pipe and Lucerne Lakes Submersed Vegetation Survey. August 20, 2012

Transect	Section	Depth	Veg. Dens. (H,M,L)	Species Identified	Relative Abundance	Other Notes
2	13	8-15	L	*Nitella*	co-dominant	Lower vegetation density compared to previous monitoring.
				P. foliosus	co-dominant	
				P. robbinsii	present	
3	11	0-3	L	*Nitella*	co-dominant	Low plant density, same as previous monitoring. Greater diversity compared to previous monitoring.
				Chara	co-dominant	
				P. Strictifolius	present	
				P. robbinsii	co-dominant	
				P. foliosus	present	
3	11	3-8	L	*Nitella*	co-dominant	Low plant density, same as previous monitoring. Greater diversity compared to previous monitoring.
				Chara	co-dominant	
				P. amplifolius	present	
				P. robbinsii	present	
				P. foliosus	present	
3	11	8-15	L	*Nitella*	dominant	Low plant density, same as previous monitoring. Greater diversity compared to previous monitoring.
				P. foliosus	present	
				P. robbinsii	present	
4	10	0-4	M	*P. robbinsii*	co-dominant	Greater vegetation density and diversity compared to previous monitoring.
				P. foliosus	co-dominant	
				P. amplifolius	present	

Pipe and Lucerne Lakes Submersed Vegetation Survey. August 20, 2012

Transect	Section	Depth	Veg. Dens. (H,M,L)	Species Identified	Relative Abundance	Other Notes
4	10	3-8	H	*P. robbinsii*	dominant	Greater vegetation density and diversity compared to previous monitoring.
				P. foliosus	present	
				Nitella	present	
4	10	8-15	H	*P. robbinsii*	dominant	Greater vegetation density compared to previous monitoring.
				P. foliosus	present	
5	2	0-3	L	*N. oderata*	present	Lower vegetation density compared to previous monitoring.
				P. foliosus	co-dominant	
				P. robbinsii	co-dominant	
				P. amplifolius	present	
5	2	3-8	M	*Nitella*	present	Unchanged vegetation density compared to previous monitoring. Greater vegetation diversity.
				Chara	present	
				P. foliosus	present	
				P. robbinsii	dominant	
				Utricularia	present	
				P. amplifolius	present	
5	2	8-15	L	*Nitella*	present	Unchanged vegetation density compared to previous monitoring. Greater vegetation diversity.
				P. foliosus	dominant	
				P. robbinsii	present	
				P. amplifolius	present	

Pipe and Lucerne Lakes Submersed Vegetation Survey. August 20, 2012

Transect	Section	Depth	Veg. Dens. (H,M,L)	Species Identified	Relative Abundance	Other Notes
6	4	0-3	L	*P.robbinsii*	dominant	Diminished plant diversity compared to previous monitoring.
				Utricularia	present	
6	4	3-8	H	*P.foliosus*	dominant	Higher plant density compared to previous monitoring.
				Utricularia	present	
				P. zosteriformis	present	
				Najas	present	
				P. amplifolius	present	
6	4	8-15	L	*Nitella*	co-dominant	*P. strictifolius* was minimal during previous monitoring, during 2012 monitoring it was dominant.
				Chara	present	
				Najas	present	
				P.robbinsii	present	
				P.strictifolius	co-dominant	
7	7	0-3	L	*P. robbinsii*	present	Mucky subratate.
				Chara	dominant	
7	7	3-8	M	*P.robbinsii*	dominant	Same vegetation density as previous monitoring. Greater vegetation diversity compared to previous monitoring.
				Nitella	present	
				P. foliosus	present	
				P. amplifolius	present	
				Najas	present	

Pipe and Lucerne Lakes Submersed Vegetation Survey. August 20, 2012

Transect	Section	Depth	Veg. Dens. (H,M,L)	Species Identified	Relative Abundance	Other Notes
7	7	8-12	M	*P.robbinsii*	dominant	Fairly dense areas of Nitella from 8-12 feet. Greater vegetation diversity compared to previous monitoring.
				Nitella	dominant	
				P. foliosus	present	
				Najas	present	
8	8	0-3	L	*P. zosteriformis*	co-dominant	Less plant diversity compared to previous monitoring. Previous monitoring encountered *chara,* no chara during 2012 monitoring.
				P. amplifolius	co-dominant	
8	8	3-8	M	*P. robbinsii*	dominant	Greater plant diversity compared to previous monitoring. Previous monitoring encountered *chara* , no *chara* encountered in this transect during 2012 monitoring.
				Nitella	present	
				P. zosteriformis	present	
				P. amplifolius	present	
				P.foliosus	present	
8	8	8-15	M	*P. robbinsii*	co-dominant	Greater plant density compared to previous monitoring. *Nitella* at 18 feet depth in some places.
				Nitella	co-dominant	
				P. foliosus	co-dominant	