

# AQUATIC VEGETATION SURVEY AT CLEAR AND BEAVER LAKES, SEPTEMBER 2005

PREPARED FOR  
Skagit County, Washington

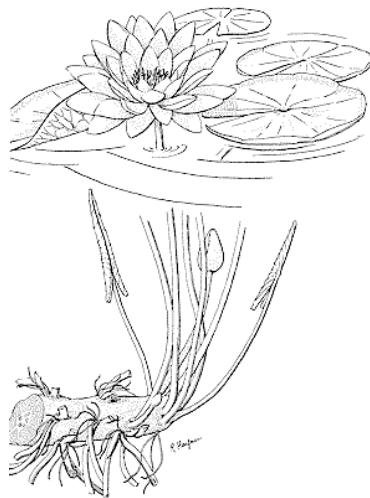
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Eurasian watermilfoil



Brazilian elodea



Fragrant waterlily

## Overview

Clear and Beaver Lakes are located in Skagit County, Washington, approximately 4 miles south of the City of Sedro Woolley. Clear Lake is a 200-acre lake with a maximum depth of 44 feet and Beaver Lake (located immediately south of Clear Lake) is approximately 75-acres in size with a maximum depth of 10 feet. Both lakes are heavily infested with several state listed noxious weeds including, Eurasian watermilfoil (*Myriophyllum spicatum*), fragrant waterlily (*Nymphae odorata*), and yellow flag iris (*Iris pseudacorus*). The presence of noxious weeds diminishes the beneficial uses of a lake by destroying native plant and animal habitat, damaging recreational opportunities, lowering property values, and clogging waterways.

Through a grant received by the Washington State Department of Ecology (Ecology), Skagit County is beginning to develop an Integrated Aquatic Vegetation Management Plan (IAVMP). As part of this process, a comprehensive aquatic vegetation survey of the submersed plant zone of both lakes was required. The goal of the survey was to characterize the aquatic plant community and map the location of aquatic invasive non-native plants. An additional goal was to obtain depth measurements in order to create a bathymetric map of both lakes. This report provides the results of the survey.

Clear Lake had 129 acres of state listed noxious weeds, including 53 acres of fragrant waterlily and 76 acres of Eurasian watermilfoil. This essentially represents the entirety of the littoral zone in this lake. Aquatic plant diversity was also observed to be generally low. Beaver Lake is so shallow that all 75 acres of the lake is littoral zone and contained Eurasian watermilfoil. In addition, a pioneering infestation of Brazilian elodea (*Egeria densa*) was discovered at Beaver Lake. This was found in the same vicinity as three bristly sedge (*Carex comosa*). Additional aquatic plant species observed at the lakes are listed in Tables 1 and 2.

## Methods

Surveys of Clear and Beaver Lakes were conducted on September 6-8, 2005. The objective was to identify the composition and distribution of the open-water aquatic plant community and obtain depth measurements to produce a bathymetric map for each lake. Notes were also taken on the plants observed in the emergent plant zone; however the survey of the emergent zone was limited to what could be observed from the boat. Where the boat could reach the shore, a thorough list of observed plants was made, however in some cases (e.g. where the waterlily extended far into the open water zone), it was not possible to reach any closer than within a few hundred feet of shore. Therefore, information provided here does not represent a comprehensive survey of the emergent plant community.

The bathymetric survey of Clear Lake was completed on September 6. Seven transects were established in the office prior to the survey – three running north and south and four running east to west. The goal was to obtain a sufficient number of depth measurements throughout the lake to develop a bathymetric map (Figure 1). For the bathymetry data, GPS locations were recorded at every five foot change in depth as the boat progressed slowly along a transect. Depth measurements were obtained using a Garmin Fishfinder which had been installed on the boat. Most transects began at the edge of the fragrant waterlily line on one shore and then ran forward through the open water to the edge of the fragrant waterlily line on the opposite shore. It was not possible to navigate

the boat through the dense foliage to obtain GPS readings close to the shoreline, though in a few locations, residents had cleared some lilies making it possible to navigate closer.

The survey to characterize the plant community of Clear Lake was completed on September 7<sup>th</sup>. To accomplish this task, the survey team established eleven transects at locations around the lake and recorded the latitude and longitude of each transect using a Trimble GeoExplorer™ GPS unit with sub-meter accuracy. The intent of establishing GPS transect locations is to allow the survey to be more easily replicated in future years, which will facilitate more accurate comparisons of plant community changes over time. A certified SCUBA diver swam each transect along a perpendicular line from the shoreline to the edge of the submersed plant zone, and reported observations of plant species and abundance to a survey team member responsible for recording the data. It is important to note that the diver was unable to swim to the shoreline at transects 4, 6, and 9 due to dense waterlily growth that prohibited safe access.

The September 8 survey of Beaver Lake included the collection of bathymetric data along with aquatic plant species and abundance data. A dive survey was not planned for Beaver Lake due to reports that had indicated dense milfoil growth existed throughout the lake. This decision was affirmed in the field; Eurasian watermilfoil was found throughout the lake. Another factor to consider if planning future surveys is the opaque nature of the water would have limited diver visibility. Methods at this lake to collect bathymetric data were slightly different than Clear Lake since the use of an electronic depth finder was not feasible due to the shallow nature of the lake and potential interference from high plant density in the water column. Two north-south transects and two east-west transects were established. As the boat progressed forward along a transect, every 20-30 feet a weighted line was dropped to measure the depth to the lake bottom. The corresponding latitude and longitude of the location where the depth measurement was obtained was also recorded with a GPS unit. To collect data on aquatic plant species and abundance, a weighted rake was lowered to obtain plant samples randomly along each transect. Although the use of a rake is a subjective method for determining abundance, it did confirm the validity of some initial observations, which will be discussed in the results section of this report. Aquatic plant composition and abundance were noted. As with Clear Lake, it was not always possible to navigate to the shoreline because of dense yellow waterlily growth.

Water transparency was measured at both lakes by lowering a black and white Secchi disk and recording the depth where the disk was no longer visible.

## ***Results***

The three day survey of Clear and Beaver Lakes resulted in complete aquatic plant lists for both lakes (Tables 1 and 2). Observed and recorded plant distributions and depth measurements were used to create maps showing the aquatic plant communities and depth contours (Figures 1 and 2). The transect positions are listed in the appendix and can be used to repeat the survey in future years to determine changes in aquatic plant distribution.

The survey results were used to define different communities defined by the dominant plant species observed in that area. Within a community, the compositional make-up can also include sub-dominant species. Minor locational differences in these communities are described when they occur. In both lakes, the plant community compositions were fairly simple and consisted of a

floating-leaved plant zone comprised of one dominant floating leaved species with submersed plants growing below and between the leaves and a submersed plant zone that was dominated by Eurasian watermilfoil. For these lakes, native aquatic plants were interspersed throughout these defined communities, however non-native aquatic plant species clearly dominated both lakes.

### Clear Lake

Table 1 lists the aquatic plants observed at Clear Lake along with an estimate of their distribution. It should be noted that the emergent plant community was not thoroughly surveyed because it was largely inaccessible. Emergent plants listed here were those that were clearly visible from the boat.

Table 1. List of aquatic plants and macroalgae observed at Clear Lake		
Scientific Name	Common Name	Distribution Value*
<b>EMERGENT PLANTS</b>		
<i>Impatiens sp.</i>	Jewelweed	1
<i>Iris pseudacorus</i>	Yellow flag iris	2 – small patches
<i>Phalaris arundinacia</i>	Reed canarygrass	3
<i>Scirpus subterminalis</i>	Water bulrush	2
<i>Scirpus sp.</i>	Bulrush	2
<i>Typha latifolia</i>	Common cattail	3
<b>FLOATING-LEAVED PLANTS</b>		
<i>Brasenia schreberi</i>	Watershield	1 – patch on east end
<i>Nuphar polysepala</i>	Yellow pondlily	2
<i>Nymphaea odorata</i>	Fragrant waterlily	4
<b>SUBMERSED PLANTS</b>		
<i>Ceratophyllum demersum</i>	Coontail; hornwort	2
<i>Elodea sp.</i>	Common elodea	2
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	4
<i>Najas sp.</i>	Water-nymph	2
<i>Potamogeton amplifolius</i>	Big-leaf pondweed	3
<i>Potamogeton gramineus</i>	Grass-leaved pondweed	2-3
<i>Potamogeton robbinsii</i>	Fern leaf pondweed	2-3 – in deeper zones
<i>Potamogeton sp.</i>	Thinleaf pondweed	1 – in shallow zones
<i>Potamogeton zosteriformis</i>	Flat-stem pondweed	2
<i>Utricularia vulgaris</i>	Common bladderwort	2
<i>Vallisneria americana</i>	Water-celery	2 – in shallow zones
<b>ALGAE</b>		
<i>Nitella sp.</i>	Nitella	1

\* Distribution value is an estimate of density: 1- few plants in only one or a few locations; 2 – few plants, but with a wide patchy distribution; 3 – plants growing in large patches, co-dominant with other plants; 4 – plants in nearly monospecific patches, dominant; and 5 – thick growth covering the substrate at the exclusion of other species.

*Species in red are non-native aquatic plants.*

Two basic plant communities were observed at Clear Lake (Figure 1) and are defined to be the fragrant waterlily (*Nymphaea odorata*) dominated community and the Eurasian watermilfoil (*Myriophyllum spicatum*) dominated community. The fragrant waterlily dominated community extended from the shoreline to a water depth of 8-10 feet, while the Eurasian watermilfoil dominated community extended from the edge of the lilies to a depth of approximately 14 feet.



Throughout these areas, native plant species were present but were definitely subdominant and typically at sparse densities as described further below.

The fragrant waterlily dominated community was estimated to be approximately 53 acres in size which represents 27% of the open water area in Clear Lake. The lilies exist as a solid band along the shoreline, extending as much as three hundred feet from shore to a depth of 8-10 feet. The only openings in the lily band were near the County maintained swimming area, in front of the sawdust burner (Transect 10), and in areas maintained by residents for access to the lake. The southern end of Clear Lake had the widest and densest band of lilies, which corresponds to the wide shallow shelf at this end of the lake. The mat of lilies on the western shoreline was patchier.

Submersed plants also occurred within the fragrant waterlily dominated community with Eurasian watermilfoil being the primary submersed plant within this area. Other sub-dominant submersed species in the fragrant waterlily zone included grass-leaved pondweed (*Potamogeton gramineus*), thin-leaved pondweed (*Potamogeton* sp.), bladderwort (*Utricularia vulgaris*) and water celery (*Vallisneria Americana*). These native plants were observed to have a wide, patchy distribution throughout this zone. Big-leaf pondweed (*Potamogeton amplifolius*) was also observed at transects 1, 5 and 7 at moderate densities and a patch of watershield (*Brasenia schreberi*), approximately 0.21 acres in size, was observed at Transect 5. Though these plants were present in the fragrant waterlily community, their occurrence was sparse.

The Eurasian watermilfoil dominated community began at a water depth of 8-10 feet (the edge of the fragrant waterlilies) and ended at approximately 14 feet (the edge of the submersed aquatic plant zone). An estimate of the size of this zone based on GIS calculations indicates that approximately 23 acres (or 11% of Clear Lake) is Eurasian watermilfoil dominated.

Eurasian watermilfoil was clearly visible throughout the lake in this zone. At the south end, a very large surface mat of milfoil stretched out from the lilies. Areas with lower milfoil densities included just outside the vicinity of the County maintained swimming area, and in front of the sawdust burner (Transect 10).

Other sub-dominant native species within the Eurasian watermilfoil community included coontail (*Ceratophyllum demersum*), common elodea (*Elodea* sp.) and fern leaf pondweed (*Potamogeton robbinsii*). Coontail densities increased with depth and appeared to increase in dominance at the outside edge of the submersed aquatic plant zone. Fern leaf pondweed was the more pervasive pondweed species noted in this zone, though flat stem pondweed was also noted. Common elodea was observed throughout the lake in this zone. Though these plants were present in the Eurasian watermilfoil dominated community, their occurrence was at lower densities.

The plant community at Transect 10 differed from other areas. At this location, from a water depth of 0-14 feet, fragrant waterlilies were dominant with a few elodea and Eurasian watermilfoil plants scattered throughout. At 14 feet depth, elodea was the dominant species. The diver noted that the lake bottom at this location appeared to be man-made fill that was of a heavy, gravel cobble which could have restricted the growth of other submersed aquatic plants.

The shoreline community (i.e. emergent plant zone) at Clear Lake was characterized as being dominated by cattails (*Typha latifolia*) with scattered patches of bulrush (*Scirpus* sp.) growing in front (water side) of the cattails. Willow and spirea were interspersed with the cattails. Non-native plants

observed along the shoreline included reed canarygrass (*Phalaris arundinacea*) and yellow flag iris (*Iris pseudacorus*). Yellow flag iris was observed in a few small patches along the shoreline. Observable reed canarygrass occurred in a dense patch near the public boat launch and in the vicinity of the sawdust burner. As described previously, the survey of the emergent plant zone was limited to what could be observed from the boat and in some places it was not possible to reach shore. Therefore, it is possible that additional patches of these plants exist along the shore.

Although, the fish and wildlife community were not part of this survey, freshwater mussels were observed on a piling along the western shoreline. This piling was in the vicinity of Transect 10.

### Beaver Lake

Table 2 lists the aquatic plants observed at Beaver Lake along with an estimate of their distribution. It should be noted that the emergent plant community was not thoroughly surveyed because it was often inaccessible. Emergent plants listed here were those that were clearly visible from the boat.

<b>Table 2. List of aquatic plants and macroalgae observed at Beaver Lake</b>		
<b>Scientific Name</b>	<b>Common Name</b>	<b>Distribution Value*</b>
<b>EMERGENT PLANTS</b>		
<i>Carex comosa</i>	Bristly sedge	1 – 3 plants observed
<i>Impatiens</i> sp.	Jewelweed	1
<i>Iris pseudoacorus</i>	Yellow flag iris	2
<i>Phalaris arundinacea</i>	Reed canarygrass	3
<i>Polygonum hydrophiloides</i>	Common smartweed	4
<i>Potentilla palustris</i>	Marsh cinquefoil	2
<i>Schoenoplectus acutus</i>	Hardstem bulrush	3
<i>Schoenoplectus tabernaemontani</i>	Softstem bulrush	2
<i>Scirpus</i> sp.	Bulrush	1
<i>Solanum dulcamara</i>	Bittersweet nightshade	2
<i>Sparganium angustifolium</i>	Narrow leaf bur-reed	2
<i>Typha latifolia</i>	Common cattail	4
<i>Typha</i> sp.	Cattail	2
<b>FLOATING-LEAVED PLANTS</b>		
<i>Lemna minor</i>	Lesser duckweed	2
<i>Ludwigia palustris</i>	Water purslane	2
<i>Nuphar polysepala</i>	Yellow pond-lily	4
<i>Nymphaea odorata</i>	Fragrant waterlily	2 – found in patches
<i>Spirodela polyrhiza</i>	Giant duckweed	2
<i>Wolffia</i> sp.	Water-meal	2
<b>SUBMERSED PLANTS</b>		
<i>Ceratophyllum demersum</i>	Coontail; hornwort	4
<i>Egeria densa</i>	Brazilian elodea	1 – only in 1 cove
<i>Elodea</i> sp.	Common elodea	3-4
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	4
<i>Potamogeton amplifolius</i>	Big-leaf pondweed	2

**Table 2. List of aquatic plants and macroalgae observed at Beaver Lake**

Scientific Name	Common Name	Distribution Value*
<i>Potamogeton ephibhydrus</i>	Ribbonleaf pondweed	2
<i>Potamogeton gramineus</i>	Grass-leaved pondweed	2
<i>Potamogeton natans</i>	Floating leaf pondweed	2
<i>Potamogeton</i> sp.	Thinleaf pondweed	1
<i>Potamogeton zosteriformis</i>	Flat-stem pondweed	2
<i>Stuckenia pectinata</i>	Sago pondweed	2
<i>Utricularia vulgaris</i>	Common bladderwort	3
ALGAE		
<i>Nitella</i> sp.	Nitella	1

\* Distribution value is an estimate of density: 1- few plants in only one or a few locations; 2 – few plants, but with a wide patchy distribution; 3 – plants growing in large patches, co-dominant with other plants; 4 – plants in nearly monospecific patches, dominant; and 5 – thick growth covering the substrate at the exclusion of other species.

*Species in red are non-native aquatic plants.*

Two basic plant communities were observed at Beaver Lake; both were dominated by submersed plants. They were (Figure 2) defined as the Eurasian watermilfoil (*Myriophyllum spicatum*) dominated community and the coontail (*Ceratophyllum demersum*) dominated community. The Eurasian watermilfoil dominated community extended from the shoreline to a depth of approximately 6 feet. From a depth of 6 feet to the center of the lake, coontail became the dominant species.

The Eurasian watermilfoil dominated community (Figure 2) was estimated, to be 52 acres in size and represented 70% of the open water area of Beaver Lake. Eurasian watermilfoil grew throughout this zone in thick mats. Floating-leaved plants (primarily native yellow pond-lily (*Nuphar polysepala*)) were patchier in this lake, which apparently allowed more room for milfoil. Although fragrant waterlily was also observed, it was in scattered patches. The largest patch of fragrant waterlilies was on the eastern side of the lake and was approximately 0.023 acres in size.

Other sub-dominant native aquatic plant species in the Eurasian watermilfoil dominated community include common elodea (*Elodea* sp.), yellow pond-lily (*Nuphar polysepala*), bladderwort (*Utricularia vulgaris*), and coontail (*Ceratophyllum demersum*). Yellow pond-lily was more widely distributed at Beaver Lake than it had been at Clear Lake. Several pondweed species were also noted in this community but in wide patchy distributions (Table 2).

The coontail (*Ceratophyllum demersum*) dominated community extended from a depth of 6 feet throughout the rest of Beaver Lake. The size of this zone was estimated to be 21 acres and represents 28% of the open water area of Beaver Lake. This community also contained scattered groupings of Eurasian watermilfoil (*Myriophyllum spicatum*). There were few other native plants observed and those present were primarily found at shallower depths within this zone.

Of particular note at Beaver Lake was the discovery of a pioneering infestation of blooming Brazilian elodea (*Egeria densa*), a state listed noxious weed. A patch, estimated to be 0.03 acres in size was discovered in a cove on the west-side of the lake (Figure 2). Brazilian elodea had not been previously observed at the lake.

Also on the western shoreline, three bristly sedge (*Carex camosa*) plants were noted. This is a Washington State listed sensitive species. These bristly sedge plants were located in the same vicinity as the Brazilian elodea.

The shoreline of Beaver Lake contained a wider variety of species than Clear Lake (Table 1 & 2); the difference was most significant in the emergent plant community and may be due to the lack of shoreline development in this lake. Along the shoreline, reed canarygrass (*Phalaris arundinacia*) and yellow flag iris (*Iris pseudoacorus*) was observed mixed with three bulrush (*Schoenoplectus*) species and two species of cattails (*Typha*). Though the shoreline was largely inaccessible, there were a few locations where it was possible to navigate in close enough proximity to note the different varieties present.

## **Conclusions**

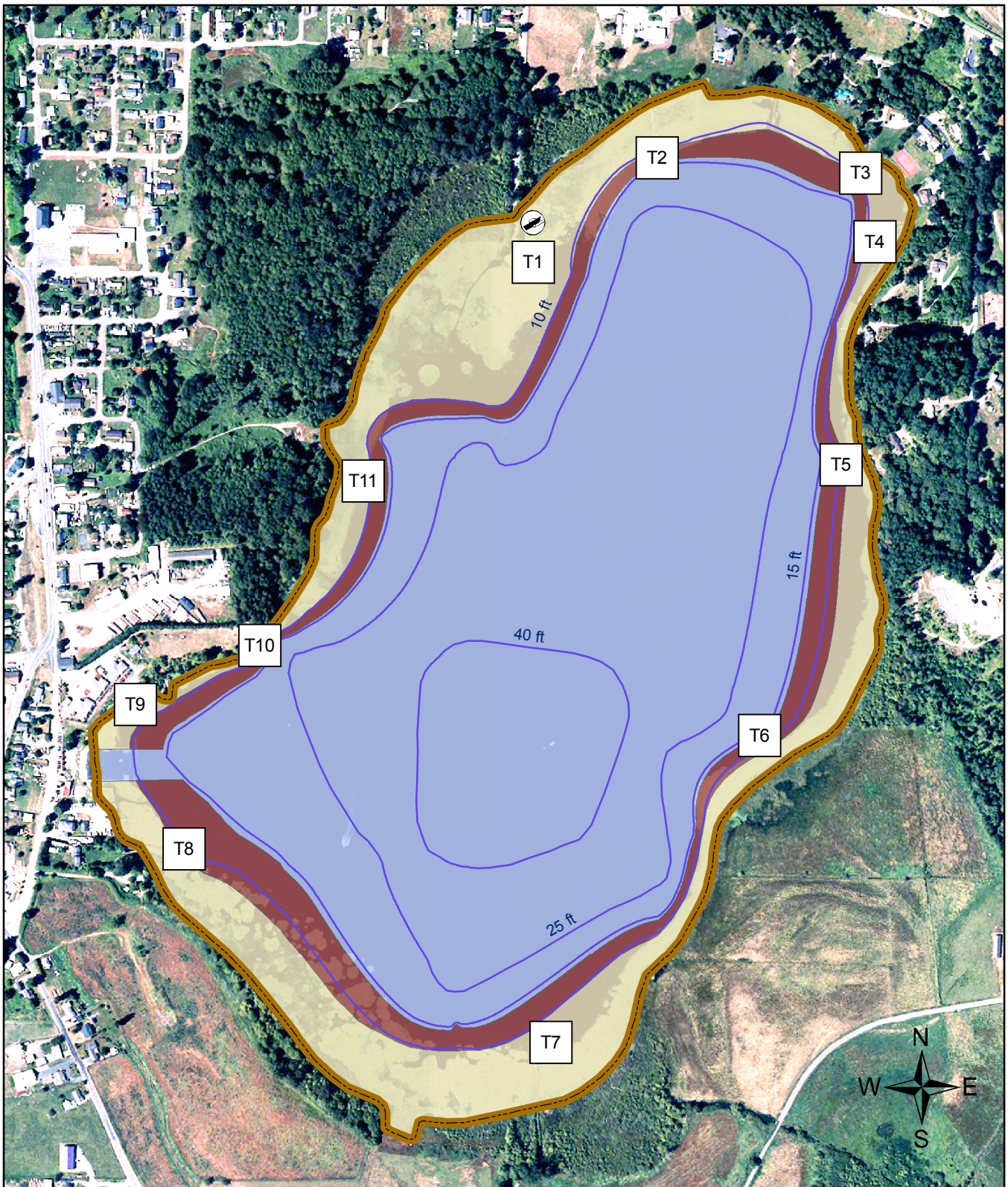
Both Clear and Beaver Lakes have large infestations of non-native aquatic plant species including Eurasian watermilfoil, fragrant waterlily, as well as clusters of reed canarygrass and yellow flag iris. Beaver Lake also has a pioneering infestation of Brazilian elodea.






As is typical in many lakes in Western Washington, the edge of the submersed plant line was at a depth of approximately 14 feet at Clear Lake. At Beaver Lake, there was not a definitive outside edge to the submersed plant zone since the lake only had a maximum depth of 10 feet. Water transparency was notably different between the lakes. At Clear Lake the Secchi disk reading was 7'7" as compared to 2'8" for Beaver Lake. The opaque nature of Beaver Lake may have contributed to the low plant diversity and number in the depth zone greater than 6 feet.

At Clear Lake, approximately 53 acres of fragrant waterlily should be considered for treatment along with approximately 76 acres of Eurasian watermilfoil. At Beaver Lake, since the entire lake contains Eurasian watermilfoil, the entire lake (75 acres) would need to be considered for treatment. The pioneering infestation of Brazilian elodea at Beaver Lake may also be of immediate concern, depending on the goals of the County and area residents. The existing population is small enough to be hand-pulled. However, if the Brazilian elodea is allowed to invade further, it may make future treatment options more complex.

Both lakes contained a variety of native aquatic species including pondweeds, elodea, coontail and yellow pond-lily. Though their presence was noted, non-native aquatic plants dominated the vast majority of the open water area for these lakes.





-  Fragrant waterlily dominated zone
-  Eurasian watermilfoil dominated zone
-  Common cattail dominated zone
-  Boat launch
-  Depth contour (ft)

**Figure 1**

**Clear Lake, Skagit County  
Aquatic Plant Survey**

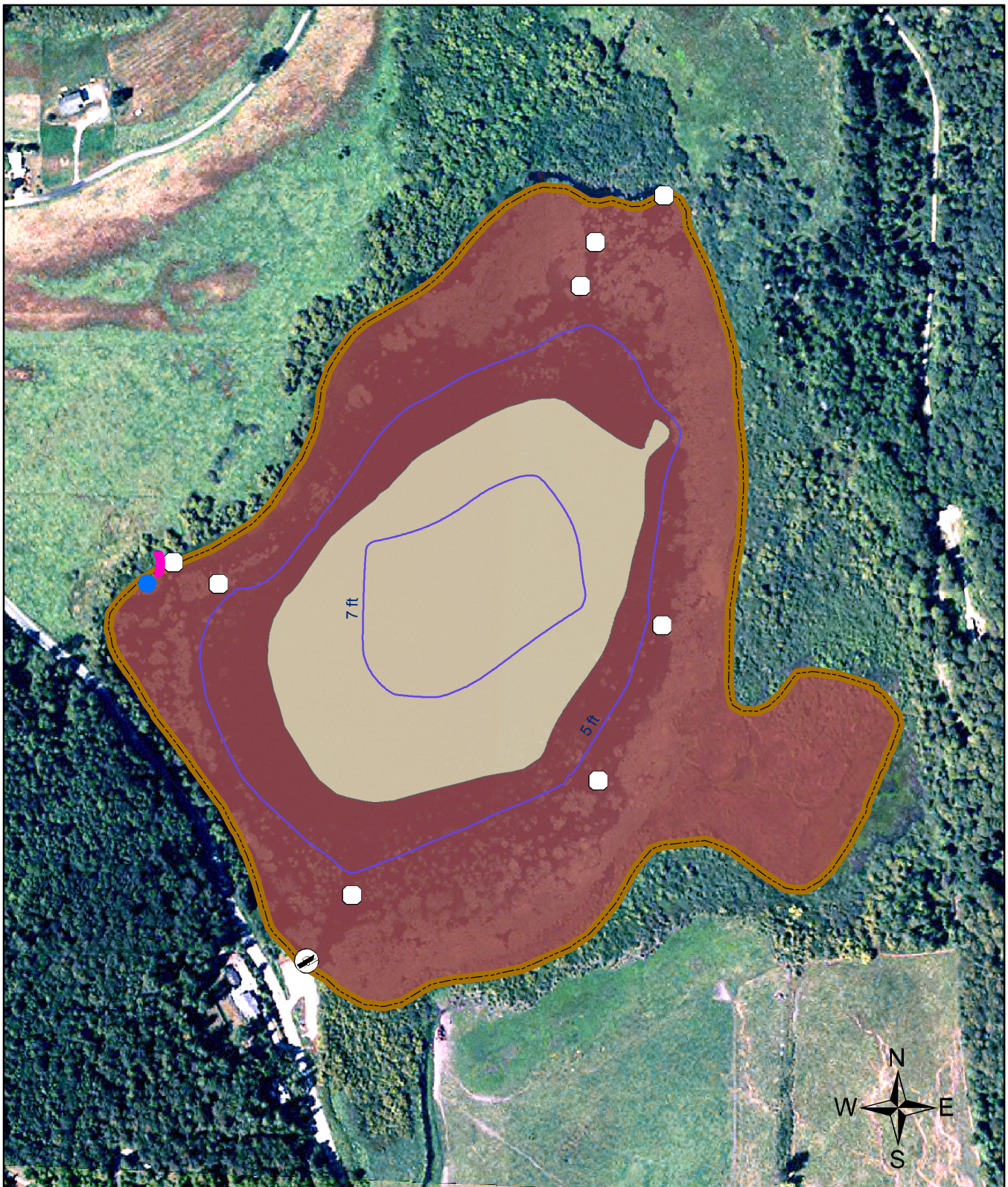
Survey Dates: September 6 & 7, 2005









ENVIROVISION CORP.

0 200 400 800 1,200  
Feet

DAIS 2001 Imagery from Skagit County  
Cartography by Sound GIS





-  Coontail dominated zone
-  Eurasian watermilfoil dominated zone
-  Bulrush dominated zone
-  Brazilian elodea
-  Bristly sedge
-  Fragrant waterlily
-  Boat launch
-  Depth contour (ft)

**Figure 2**  
**Beaver Lake, Skagit County**  
**Aquatic Plant Survey**  
 Survey Date: September 8, 2005  
 ENVIROVISION CORP.  
 0 150 300 600 900  
 Feet  
 DAIS 2001 Imagery from Skagit County  
 Cartography by Sound GIS

# Appendix

**Table A-1: Transect Positions of Aquatic Plant Survey**

Transect #	Latitude	Longitude	Notes
<b>Clear Lake</b>			
1 Begin	48°27'52"N	122°13'32"W	At boat launch
2 Begin	48°27'57"N	122°13'24"W	
2 End	48°27'56"N	122°13'24"W	
3 Begin	48°27'56"N	122°13'11"W	
3 End	48°27'56"N	122°13'12"W	
4 Begin	48°27'53"N	122°13'9"W	
4 End	48°27'53"N	122°13'10"W	
5 Begin	48°27'43"N	122°13'11"W	
5 End	48°27'43"N	122°13'12"W	
6 Begin	48°27'31"N	122°13'16"W	
6 End	48°27'32"N	122°13'17"W	
7 Begin	48°27'18"N	122°13'29"W	
7 End	48°27'18"N	122°13'30"W	
8 Begin	48°27'26"N	122°13'54"W	
8 End	48°27'26"N	122°13'53"W	
9 Begin	48°27'32"N	122°13'57"W	
9 End	48°27'53"N	122°13'57"W	
10 Begin	48°27'35"N	122°13'49"W	
10 End	48°27'35"N	122°13'49"W	
11 Begin	48°27'43"N	122°13'43"W	
11 End	48°27'42"N	122°13'42"W	
<b>Beaver Lake</b>			
1 Begin	48°26'46"N	122°13'16"W	At boat launch
1 End	48°27'8"N	122°13'3"W	
2 Begin	48°27'8"N	122°13'1"W	
2 End	48°27'51"N	122°13'3"W	
3 Begin	48°27'51"N	122°13'3"W	
3 End	48°26'57"N	122°13'21"W	
4 Begin	48°26'58"N	122°13'18"W	
4 End	48°26'55"N	122°13'00"W	



**Photos of Transect Positions – Clear Lake**

**Transect 1**



**Transect 2**



**Transect 3**



**Transect 4**





**Transect 5**



**Transect 6**



**Transect 7**



**Transect 8**





**Transect 9**



**Transect 10**



**Transect 11**





**Photos of Transect Positions – Beaver Lake**

**Transect 1 – Begin**



**Transect 1 – End**



**Transect 2 – Begin**



**Transect 2 – End**





**Transect 3 – Begin**



**Transect 3 – End**



**Transect 4 – Begin**



**Transect 4 – End**

