# 2015 Big Lake
# Aquatic Weed Control Program

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Prepared for

Big Lake LMD #1
Skagit County Public Works
Mount Vernon, Washington

Prepared by

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## Project Overview

This was Northwest Aquatic Eco-Systems (NWAE) fourth year of providing aquatic weed control services for the Big Lake LMD #1 district. Much of the past historical data included in the previous reports has been incorporated into the 2015 report. Big Lake has been actively involved for at least ten years with an intense program to eradicate noxious aquatic macrophytes from the system. Targeted species include Eurasian watermilfoil, Egeria densa (Brazilian elodea), Nymphaea odorata and yellow flag iris. Densities of Eurasian watermilfoil is limited now to a few small infestations located along the southwest shoreline of the lake. This shoreline area has consistently supported milfoil growth and has maintained very light densities of single plant populations for a number of years. As noxious weed species declined lake wide, native species have increased their range throughout the lake's littoral zone. Native plant growth has now become so dense in areas that shoreline use is being severely restricted and native species currently pose the same recreational problems often associated with noxious species. Management practices of the lake now also incorporate the control efforts necessary to maintain native species at an acceptable level. Such efforts were initiated during 2012 and continue to be implemented. This report reviews all activities undertaken at Big Lake during the year 2015.

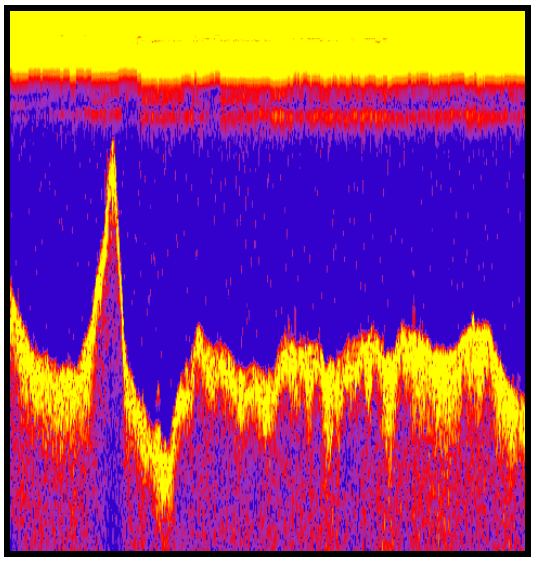
Under the current Big Lake NPDES permit, treatment of native species is limited to no more than 30% of the lake's shoreline. Our 2014 reported misquoted this figure at 40%. Noxious weed control is permitted lake wide with no restrictions associated with treatment acreages.

## Survey Protocol

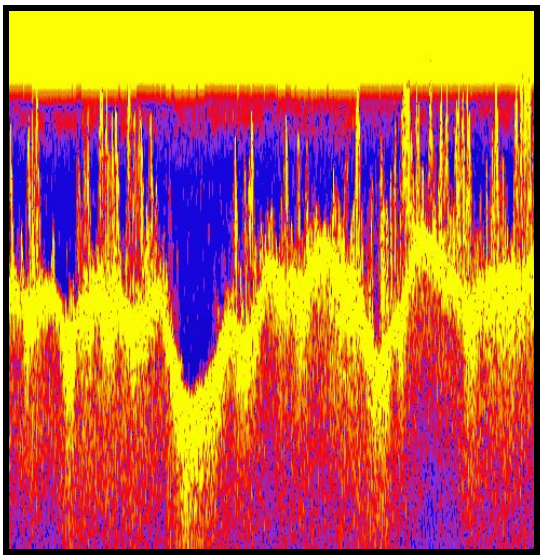
Survey techniques for 2015 once again utilized the new sonar mapping technology initiated during the 2013 treatment season. This new mapping technology incorporates sonar technology with on board chart recording. Sonar data is collected on board and processed to produce an on screen map of the lake bottom surface. When weeds are no longer observed along the lake bottom the collection of sonar data is terminated. Once collected, the SD card is uploaded via cloud based technology and the processing of the data is finalized. The resulting product is a color coded map of the lake bottom identifying weed growth areas and plant densities. Not only is a well-defined map produced, but a sonar log of the survey is saved allowing a complete review and evaluation of the survey to occur in house. Past Big Lake surveys consisted of manually retrieving weed samples from numerous locations lake wide while also observing growth through the water column. Although effective, individual bottom sampling can only identify plants within the immediate area sampled. This new protocol avoids the possibility of missing plants between manual bottom surveying data points. This updated protocol encompasses a surface vehicle transecting the lake along the littoral zone. Boat

tracks are designed to be approximately 100 feet apart. To ensure the efficacy of the survey, a bottom sampling rake is thrown from the boat at various locations lake wide. The rake is then drawn across the lake bottom, brought to the surface and into the boat. Plants attached to the rake are identified and confirmed as being the same species as noted through the structure scan or visually through the water column. The system automatically calculates and stores the position of every transect data point enabling the mapping of thousands of data points on a daily basis.

When individual milfoil plants were identified from the surface, waypoints were added to the transect line.



Weed Free Lake Bottom

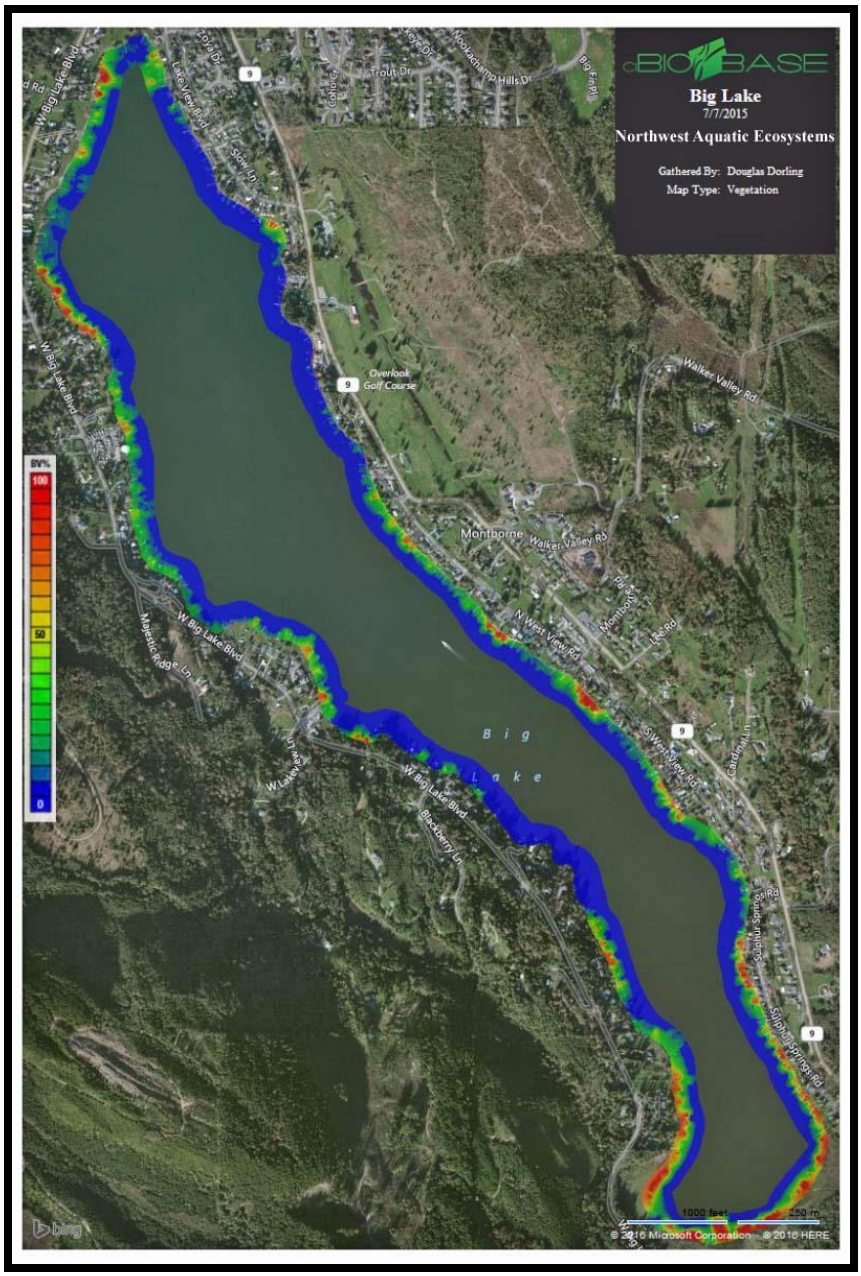


Dense Weed Growth Lake Bottom

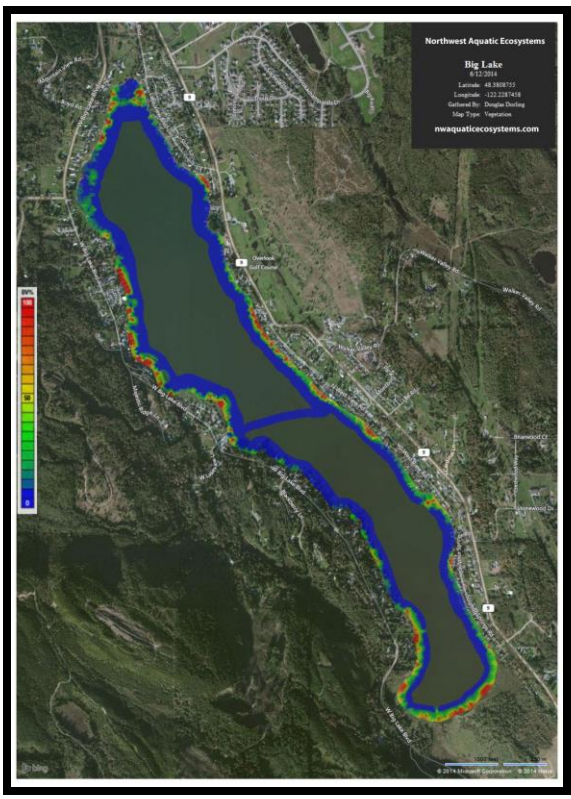
## Big Lake Pre Treatment Survey Results

Big Lake was surveyed on July 7, 2015. One would have expected that weed growth during the 2015 survey would have been elevated over the 2014 survey results. Several factors would have influenced the 2015 survey. The 2015 survey was performed approximately one month later into the growing season when water temperatures state wide elevated over those noted during 2014. Surprisingly although the locations of weed growth remained relatively the same, density within those growth zones were reduced. The only area of the lake that was experiencing elevated growth was along the southern shoreline were no treatments have been permitted. Reduction in plant densities can likely be associated with the control efforts of 2014. Reduction in seed production associated with treatment prior to seed formation and the further depletion of established seed beds are exhibiting a positive direction for future years of biomass reduction. The later survey during 2015 also provided easy visual identification of weed species since the relative shallow shoreline had many species piercing the waters surface. The 2015 NWAE survey

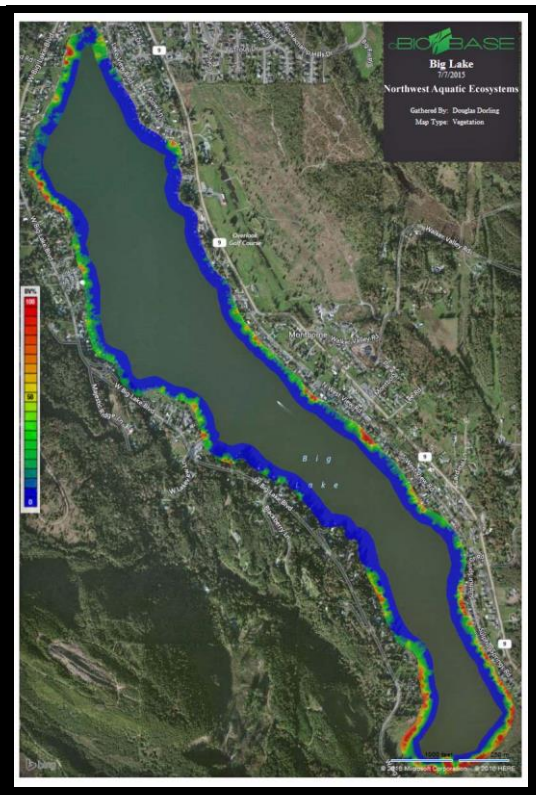
identified the same species as noted in prior surveys; minor occurrences of P. amplifolius, while most of the native growth included P. richardsonii, P. robbinsii, P. praelongus, P. foliosus and P. epihydrus. Problematic non pondweed species included Elodea canadensis and Vallisineria americana. Different shoreline sections of the lake were dominated by dissimilar pondweed species.




Blue map areas indicate the absence of vegetation.
Red areas identify 100 percent plant coverage.



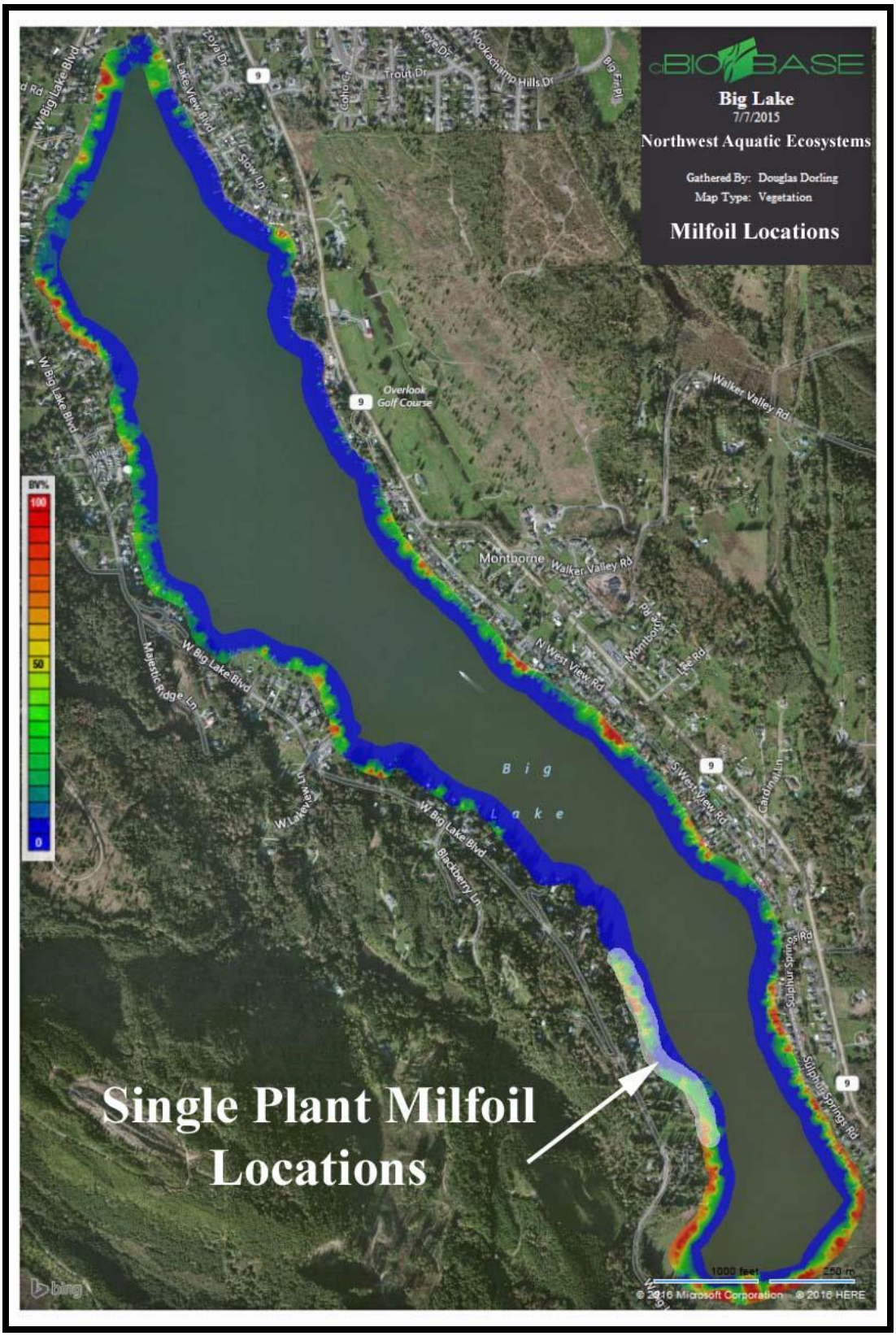

2014 Spring Macrophyte Survey




2015 Spring Macrophyte Survey


2014 Spring


2015 Spring


BIOBASE
Big Lake
7/7/2015
Northwest Aquatic Ecosystems
Gathered By: Douglas Dorling
Map Type: Vegetation
Milfoil Locations
BV%
100
50
0
Single Plant Milfoil Locations
Big Lake
Montborne
Overlook Golf Course
W Big Lake Blvd
Walker Valley Rd
N West View Rd
Majestic Ridge Ln
Blackberry Ln
Sulphur Springs Rd
1000 feet
250 m
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## July 15, 2015 Treatment

Under current NPDES guidelines, native macrophyte control is limited to no more than approximately 10,000 feet of the lake shoreline. Noxious weeds can be controlled lake wide having no impact on the 10,000 feet designated for native plant control.

Our approach during 2015 was to continue to provide maximum coverage under the current NPDES guidelines. The 2015 treatment model was designed similar to the 2013 & 2014 models expanding treatment outward from the shoreline. This approach is commonly referred to as the "block treatment" scenario. The successful use of Aquathol K during 2014 encouraged expanded experimental use throughout the lake basin once again during 2015. The use of Aquathol K increases material costs considerably as the material is injected into the spray mixture at specific individual treatment sites. The diquat Aquathol K mixture increases the efficacy of treatment enhancing control within those targeted sites.

Shoreline posting was conducted on July 14 one day prior to treatment. A two person crew completed the posting task. Similar to past treatments the local newspaper was contacted addressing the upcoming treatment. Information about the treatment was also forwarded to the local radio station. One public boat launch was posted with a large sign requesting that no boating occur during the treatment. Posting was completed by 6:00 PM. On the day of treatment, July 15 material was offloaded from a locked truck container and transferred into two 25 gallon spray tanks mounted on the application boat. Containers were triple rinsed on site and returned empty, back into the truck. Herbicides, diquat and Aquathol K, were applied utilizing an 18 foot Airgator airboat. Lake water was drawn into the boat through intake ports located in the hull of the boat. Herbicide was then metered into the lake water via an injection manifold. Once the herbicide was injected into the on board lake water, the lake water/herbicide mixture was then discharged back into the lake. Weighted hoses were then used to place the material at the appropriate depth in the water column.

Prior to treatment a lake treatment map, identifying treatment plots, was downloaded into the onboard GPS system. The treatment boat utilized the onboard GPS to identify treatment site boundaries. All of the targeted submersed sites were treated on July 15. Floating plants received treatment a few weeks later. Submersed weeds were treated with Diquat at a rate of one to two gallons per surface acre. Aquathol K was applied at a five gallon per acre rate in a tank mix with diquat.


Weed
Control
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Once the submersed weed portion of the application was underway a second boat was then utilized to apply material to the lily pad infestations. Weather conditions posed no problems throughout the day and permitted the entire basin to receive treatment for lily pads. An 18 foot aluminum boat equipped with one 25 gallon spray tank was utilized during this spray event. Use of a smaller maneuverable boat permitted access to the entire lake shoreline. The 25 gallon tank was filled with lake water, herbicide and surfactant was then added directly into the tank. Once mixed the application boat drove along the shoreline identifying targeted floating plants and the spray mixture was then discharged using a spray gun. When emptied, the tank was refilled and dispensed as needed. Lily pads received a 1.0% solution of glyphosate sprayed directly onto the floating leaves. Similar areas treated during 2014 received treatment again during 2015.

The increased effort to inform residents of the treatment and problems associated with high speed recreational boat use during treatment similar to 2014 resulted in a more favorable environment for treatment.

## September 22, 2015 Lily Pad Spray

A second lily pad spray was performed on September 22 at the same locations identified earlier in the year. Materials and spray protocol were identical to the prior treatment. During the spraying event a general inspection of the July 15, 2015 treatment sites were conducted. It appeared that all targeted sites had responded well with noted increased submersed weed control in some lake areas. In general all the sites appeared to be responding more favorable then the 2014 effort. Similar to 2013 & 2014, it is likely that this increased control rate noted over past historical treatments was attributed to the fact that boating on the lake was restricted during the day of treatment and the increase use of Aquathol K.. In the past, wave action increased the dilution rate of the material and also increased the suspended sediment along those shallow shoreline treatment zones. The continued effort to inform residents of the treatment and problems associated with high speed recreational boat use during treatment continues to exhibit positive results. Perhaps the greatest noticeable results were associated with the lily pad control effort. Many of the sites had responded exceptionally well to the initial application resulting in numerous favorable comments directed at the crew from the lake front residents.

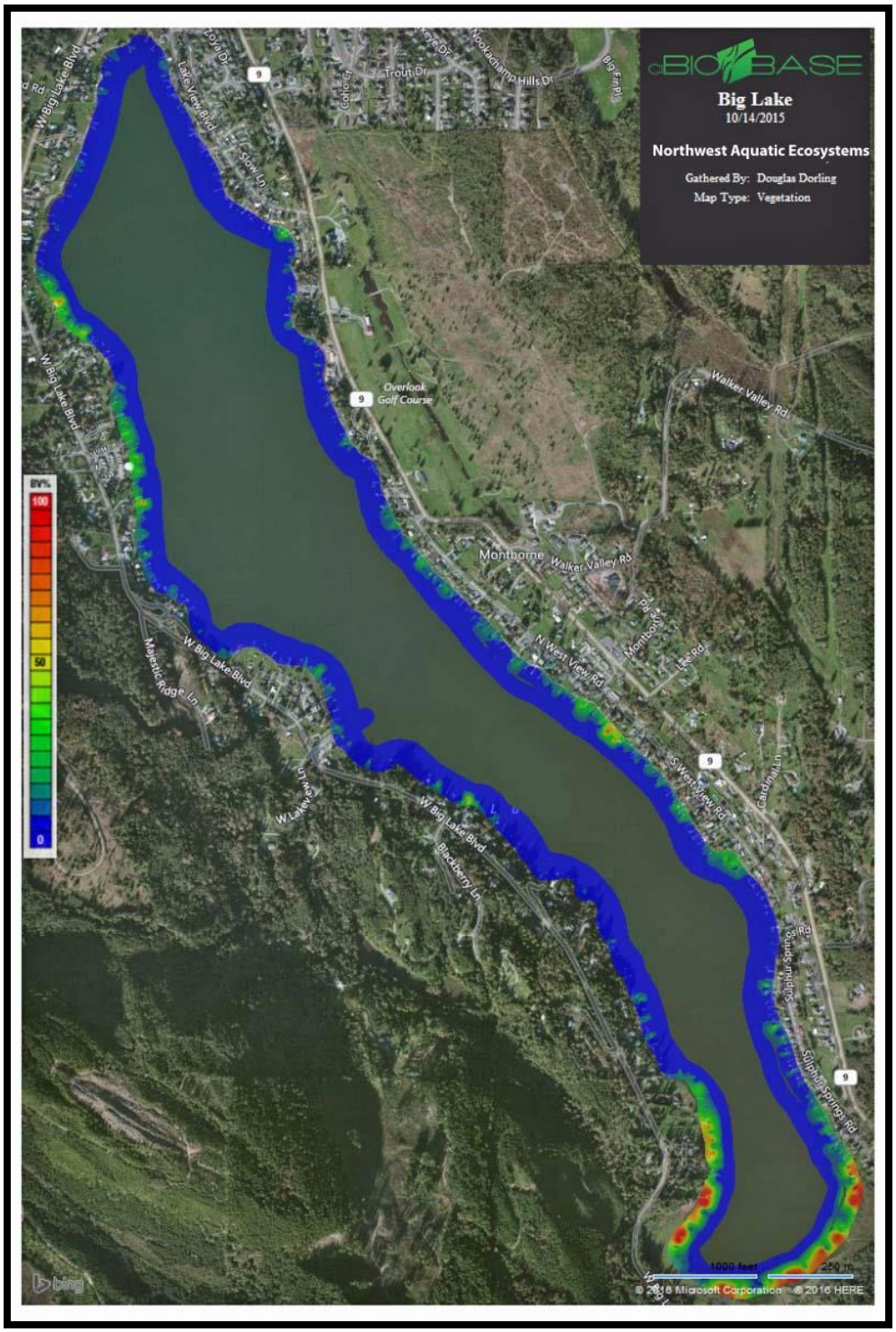
## October 14, 2015 Fall Survey

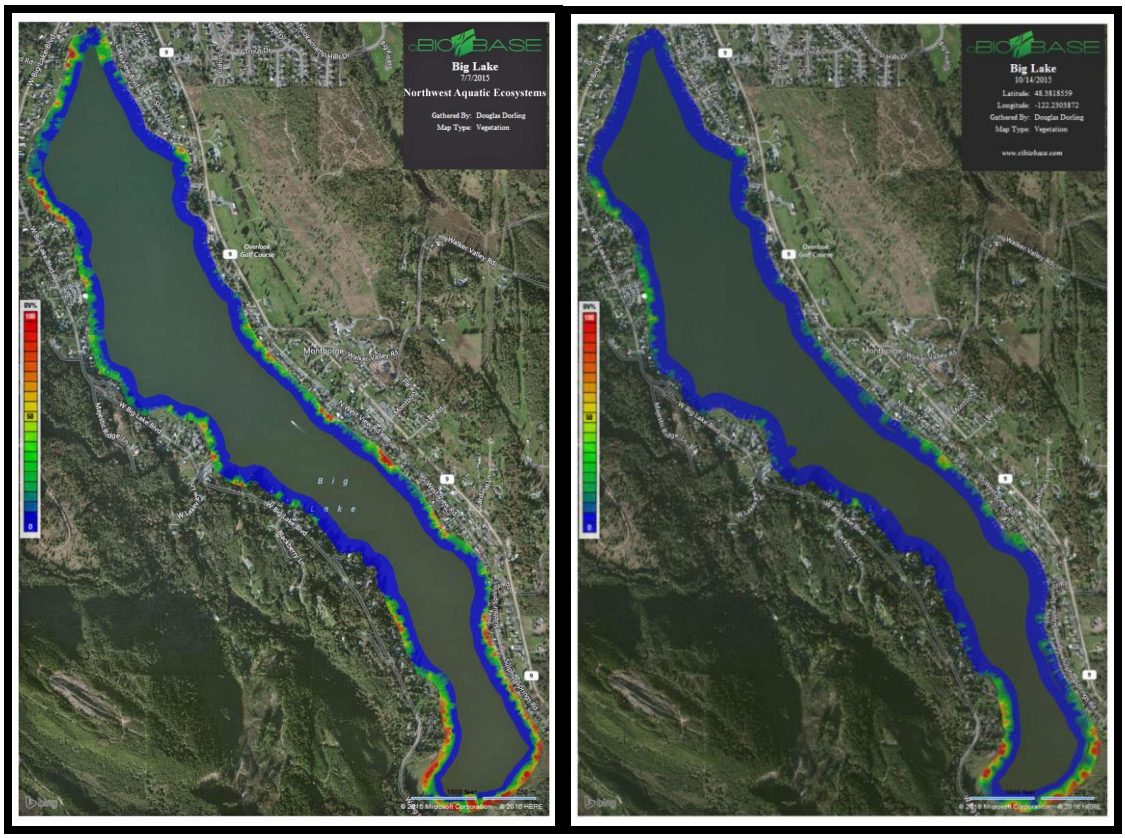
The fall survey was performed on October 14, 2015. Survey protocol followed the same procedures as established during the summer macrophyte inspection. As a follow up to our visual survey performed on September 22, 2015, the fall survey identified reduced plant growth lake wide. Once again control obtained during 2015 was elevated above what we observed during 2014. There were no plants noted on the water's surface. The survey also acknowledged that there were no seed heads present. This is an important component in treatment of those weed species that reproduce from seed production. Since no seeds were produced this year, the total seed bed available for germination next year will be reduced. There were no milfoil plants identified during the survey.

Drifting of the herbicide mixture outside of the targeted treatment plots was more defined during 2015. The only lake area that underperformed as a result of treatment was the far southwest shoreline just north of the closed section of the lake. This area has historically performed below average however our 2015 effort did note improvement. This particular area of the lake appears to be influenced greatest by the wind and wave action created during the day. During 2014 Northwest Aquatic Eco-Systems had identified specific lake shoreline areas that did not respond well to herbicides that are neutralized from suspended organic sediment. Changes were made to the application protocol with such changes resulting in greater control. During 2015 the liquid formulation of Aquathol K was employed. Perhaps within this one remaining problematic shoreline area the 2016 effort should incorporate the granular formulation.

Increased lily pad control was also noted once again this year. The approach of only applying materials when limited wave and wind action are present has resulted in much

improved control. Some areas historically treated now are only experiencing limited growth while some smaller lake infestations have been eradicated.






Pre Treatment

Post Treatment

# Recommendations

1. Continue the expanded notification to the property owners and local residents through newspaper articles, radio and LMD notifications. Emphasis again needs to be directed at no lake use during the treatment.

2. Lily pad control operations should only be conducted during those hours when wind conditions are minimal.

3. Residents need to continue to be informed of the current weed growth conditions and what species are native and noxious species, what plants are targeted for control and what plants cannot be controlled.

4. Noxious species appear to no longer represent the problematic species lake wide. The range and location of milfoil plants have stabilized, not much expansion has been detected. Plants currently coexist in mixed stands of native species. Milfoil can now seasonally be controlled with either contact herbicides or specifically targeted with systemic materials. How these plants are controlled and what materials should be applied requires evaluation preceding the spring survey. What actions may or may not be implemented will probably change on a year to year basis.

5. The spring survey should be considered the more important of the two scheduled surveys. This survey will determine what plants are targeted and what materials will be used during any treatment year. The late summer survey is performed too late in the season to direct any further native weed control operations. In general, this survey will identify where successful control operations occurred and the need for any additional late season milfoil treatment.

6. Continued expanded use of the contact herbicide Aquathol K. Use of the material during has proved to be successful in controlling some pondweeds not susceptible to diquat. Use should also include tank mixes of both diquat and Aquathol K.

7. Initiate use of the granular formulation of Aquathol K within the problematic southwest shoreline area of the lake in conjunction with a late season spraying event within this immediate area. Approach will need board approval. Although NWAE was under budget for 2015 the increased expense of the granular material in conjunction with a late season application may result in exceeding the current budget by approximately $8,000.00.

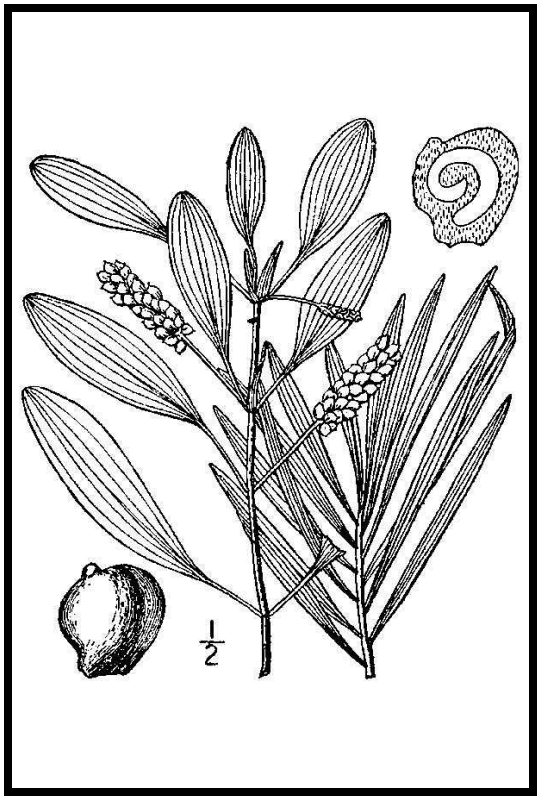
8. Continued use of the new mapping technology. This technology provides an excellent visual evaluation of weed conditions lake wide. The resulting map can be understood by all users of the lake and requires no in-depth technical background for review. The technology also provides an excellent reference to visually show a property owner if problematic weeds are present at their parcel.

9. Use knowledge and experience obtained over the last four years to fine tune future treatments using Aquathol K and diquat mixtures.

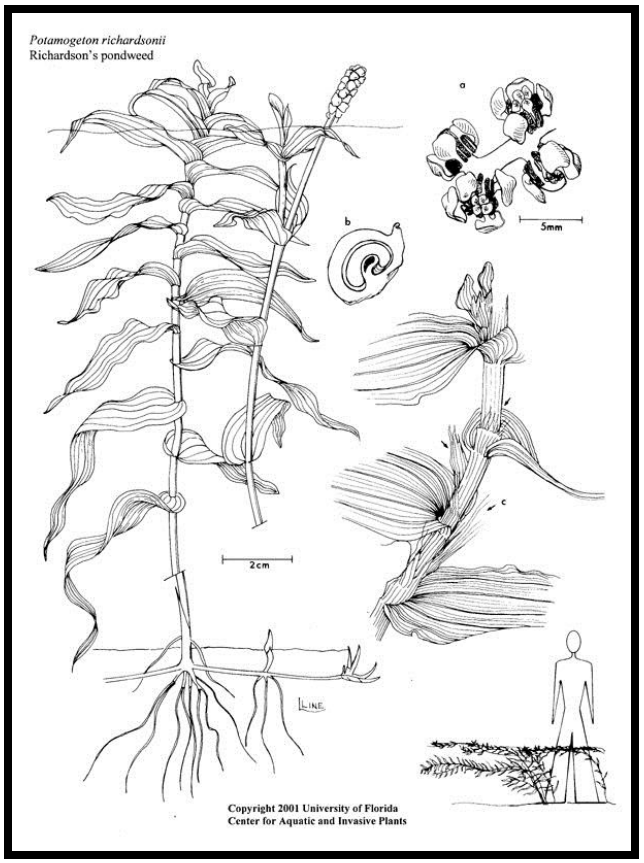
10. Petition the Washington State Department of Ecology to consider changing the fish timing window form July 15 to June 15. By July 15th weeds have already surfaced and their biomass decomposition may encourage algae blooms. By treating earlier in the season biomass decomposition would be reduced.

11. Petition the Department of Ecology to consider changing the maximum treatment area from 30% of the lakes littoral zone to 50%. Big Lake is just over 500 acres with a shoreline that is nearly 100% developed. Lakes under 500 acres are allowed a 50% treatment scenario while those over 500 are only entitled to only 30%.

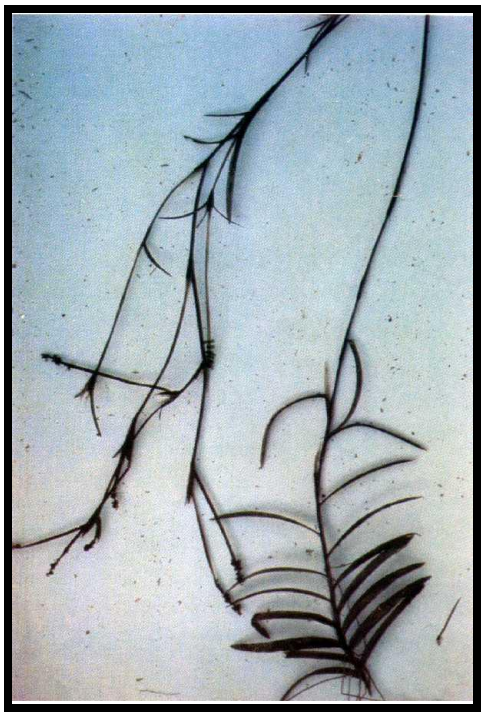
Dominant Submersed Macrophyte Species
Potamogeton epihydrus

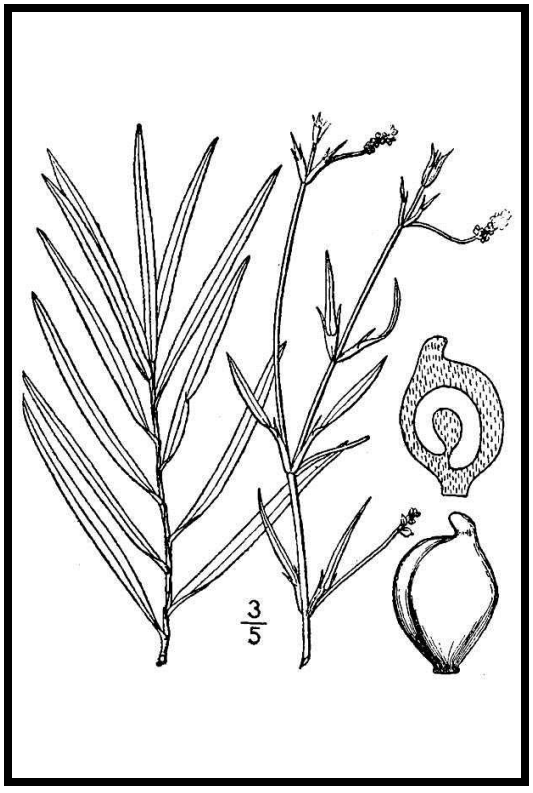


Potamogeton richardonsii

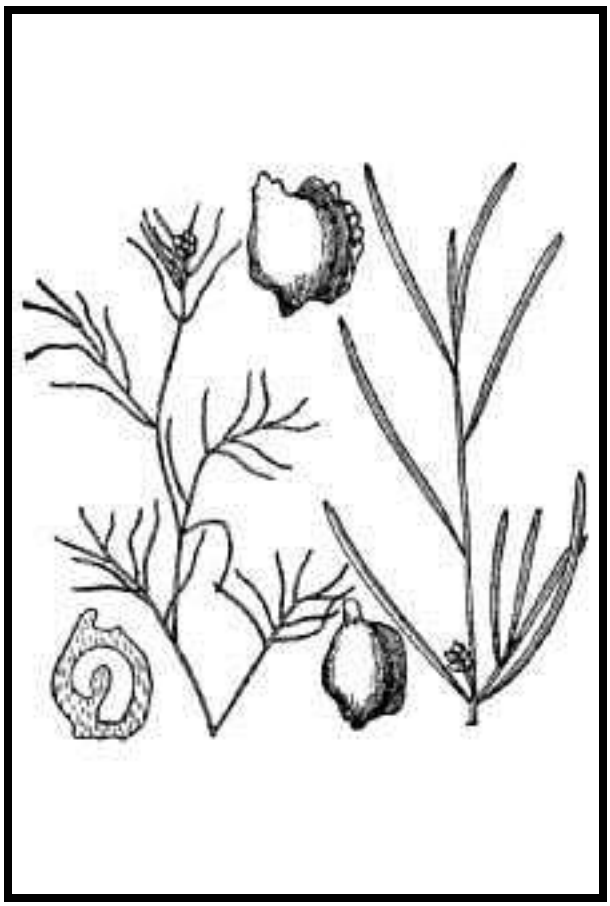



Potamogeton robbinsii

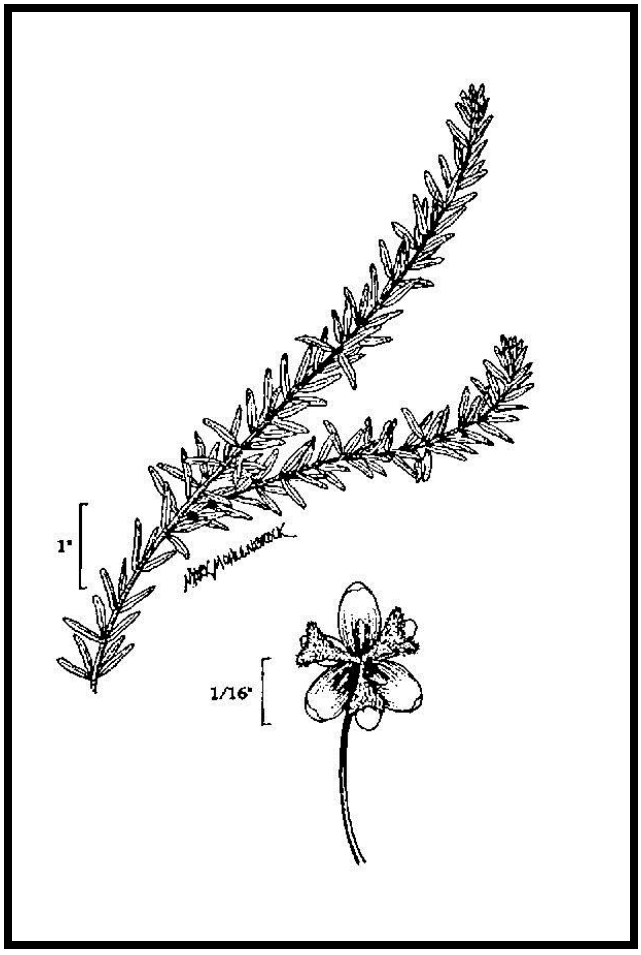




Potamogeton foliosus



Elodea canadensis



Vallisneria americana