

2021 Big Lake Aquatic Weed Control Program



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

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January 2022

Project Overview

Two permit related issues and a low lake water level directed the 2021 management activities at Big Lake during the 2021 season. The issuance of the new statewide NPDES permit nullified the previous observed June 15 treatment window and instituted the original July 15 start date. Prior to the issuance of the new permit the LMD board and the regional fish biologist had discussions addressing the changing of the treatment window from July 15 to June 15. It appeared that the regional fish habitat manager was in agreement with the change and the LMD began operating under the June 15 date during the 2017 season. When the revised 2021 Big Lake permit was issued NWAE noted that the fish timing window had been changed back to July 15. Under the assumption that the July 15 date was a typographical error, NWAE initiated discussion with Fish & Wildlife that such a change had been approved. Typically, the process involves the regional fish habit biologist first agreeing to the date change and then that recommendation is circulated throughout the department for final approval. Fisheries could not find any paper trail associated with the requested change and no one within the region had any recollection of discussing the issue in house. Upon further investigation into the matter, it was discovered that the regional fish habitat biologist that was in correspondence with the LMD had retired shortly after. The new regional biologist had no knowledge of what may or may not have transpired between the LMD and the retired habitat manager. One thing for sure was that no one within the Department of Fisheries, except for the retired habit biologist, was aware of any discussions associated with changing the fish timing window for Big Lake.

NWAE did initiate conversation with the current habitat manager to once again try to have the date changed as directed through the new 2021 statewide NPDES permit. Initial discussions concluded that the date change would likely not be granted. One must realize that this issue was confusing to all parties and the frustration level exhibited by all parties may have influenced the final outcome. Perhaps a new structured approach as mandated within the current permit guidelines would result in a more favorable outcome. I estimate that the timeline required would be two to three months.

The July 15 treatment window creates other issues associated with treatment that we encountered this year. By July 15, weeds have already started forming surface mats and densities that restricted drift of the herbicide outside of the targeted zones. With shoreline treatment restricted to 30%, the ability for the material to drift and control plants outside of the treatment zones is an important component of the Big Lake program. As July 15 approaches, the lake water level has already started to decline exposing a greater percentage of the muck bottom to wave action and resuspension of sediment. Diquat is neutralized upon contact with suspended sediments resulting in less diquat use and greater use of Aquathol K. Aquathol K is a much more expensive product.

Prior to 2021, NWAE had requested Ecology to increase the allotted 30% shoreline treatment percentage as mandated in the statewide general permit. Ecology denied the request stating that the requested change was specific to Big Lake and that lake specific changes could not be considered until the current statewide permit expired and a new one

was issued. The new five-year permit was issued at the onset of the 2021 season. During the public comment period NWAEE again requested that Ecology include within the new permit a mode of action that would allow Big Lake to petition the state so that a modification to the current littoral zone treatment percentage could be considered. Ecology refused to consider our request and NWAEE challenged the validity of the requirement.

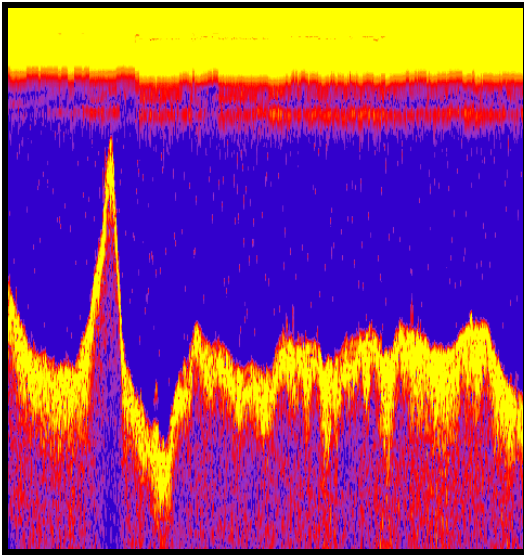
In an effort to increase the 30% guideline as noted in the current Big Lake permit, NWAEE has appealed that requirement to the Hearings Board. Our hearing, addressing the Big Lake 30% requirement, is scheduled for late April 2022. We have not found any literature or peer reviewed studies that support the Department of Ecology's position on this issue. Ecology generically believes that every single lake in the state is the same. We believe each lake is a separate, individual ecological unit that should be evaluated on its own merits. NWAEE is requesting that the Department of Ecology allow the Big Lake LMD to provide data that would support an increase over the 30% current mandate. How Ecology arrived at this 30% figure is unknown. It has become increasingly difficult to try to explain to property owners why their property technically cannot be treated yet they are still financially responsible to pay for the program.

Algae related problems continue to occur seasonally. Some years the blooms produce thick surface scums that are windblown lake-wide. Other years the blooms are short and barely noticeable.

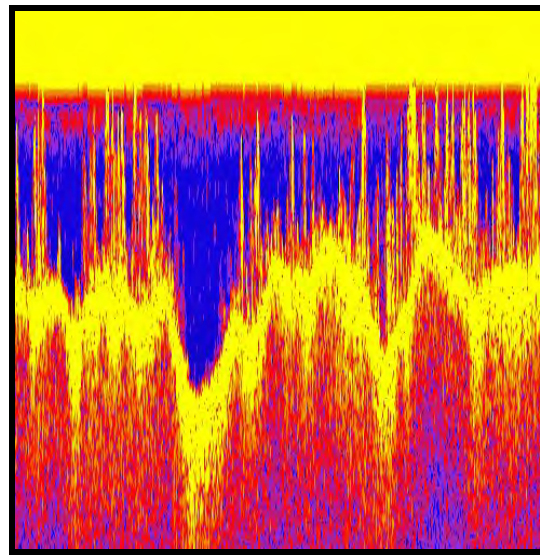
Survey Protocol

Survey techniques for 2021 once again utilized the sonar mapping technology initiated during the 2013 treatment season. The current mapping protocol is now an industry standard utilized worldwide. Current 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 as the boat transects the lake. 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. 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

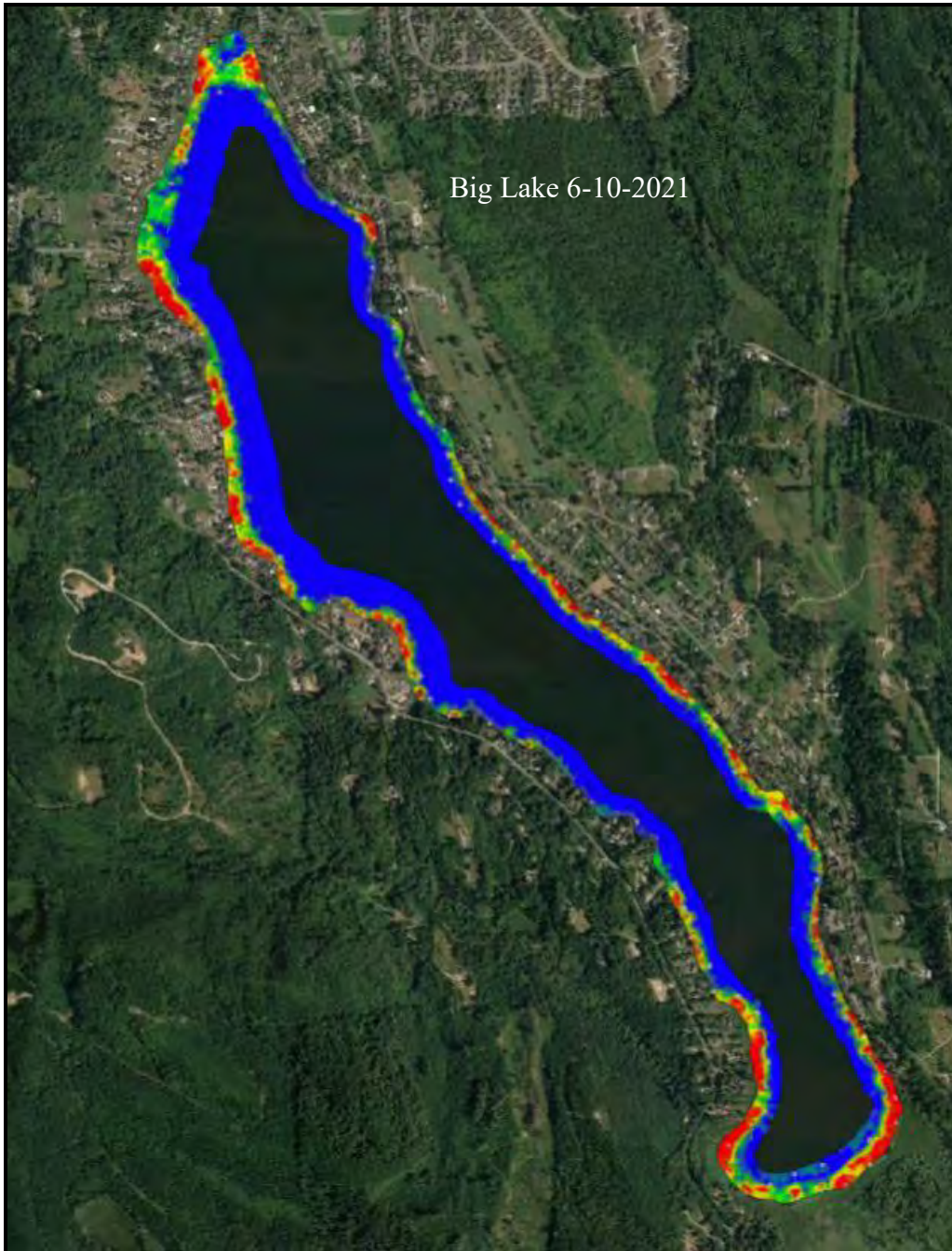
Big Lake Pre-Treatment Survey Results

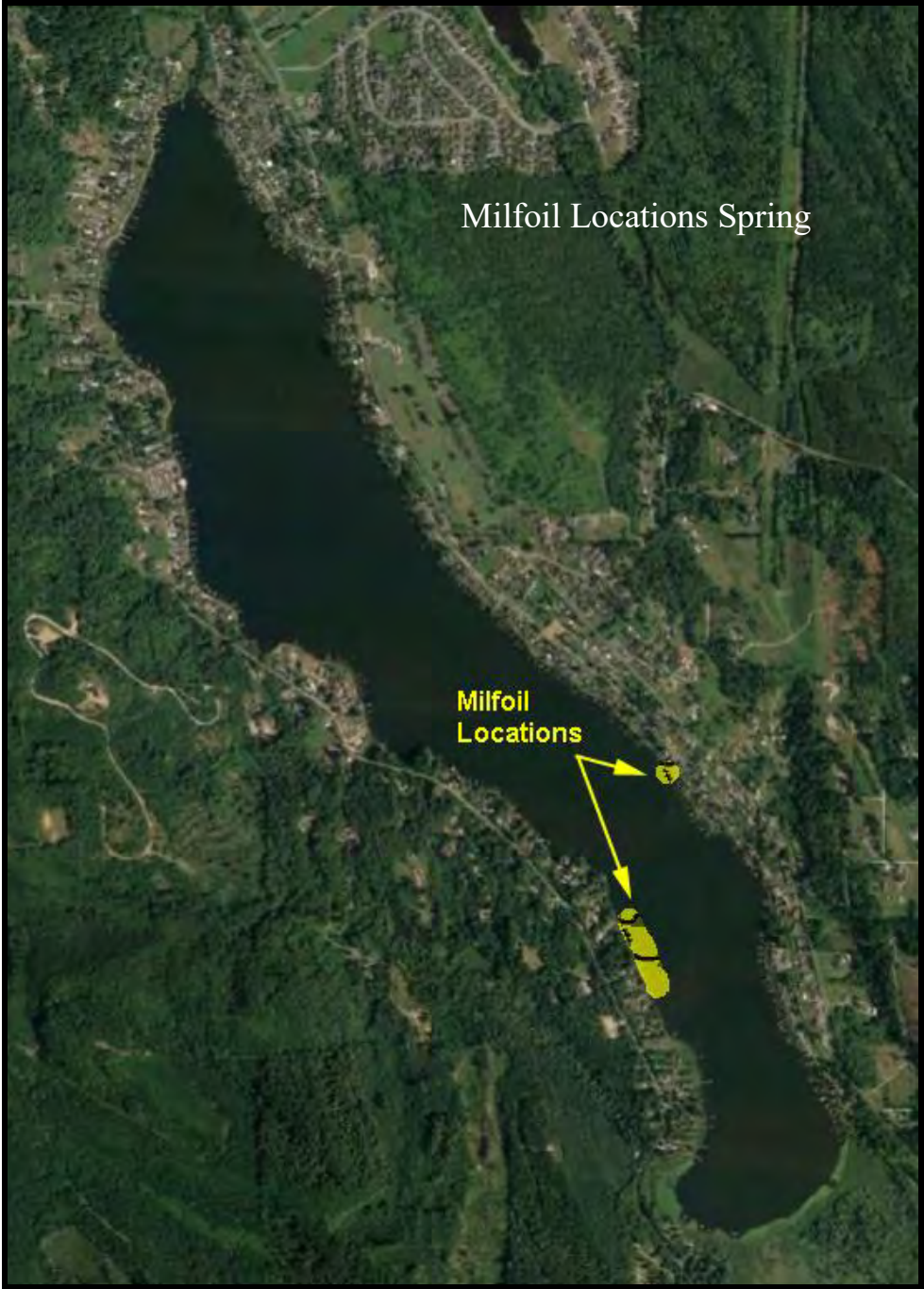
Big Lake was surveyed on June 10, 2021, within the same timeline as the past four spring surveys. Weed growth within some of the lake areas was already dense as noted by the red shadings on the survey map. Results were similar to what has historically been noted. Macrophyte growth had decreased in some lake areas while increasing in others. Reduced water clarity impacts the depth to which seeds will germinate. Favorable water clarity increases the depth in which seeds have the ability to germinate. With the new July 15 treatment window, it was anticipated that weed related issues would be widespread throughout the lake.

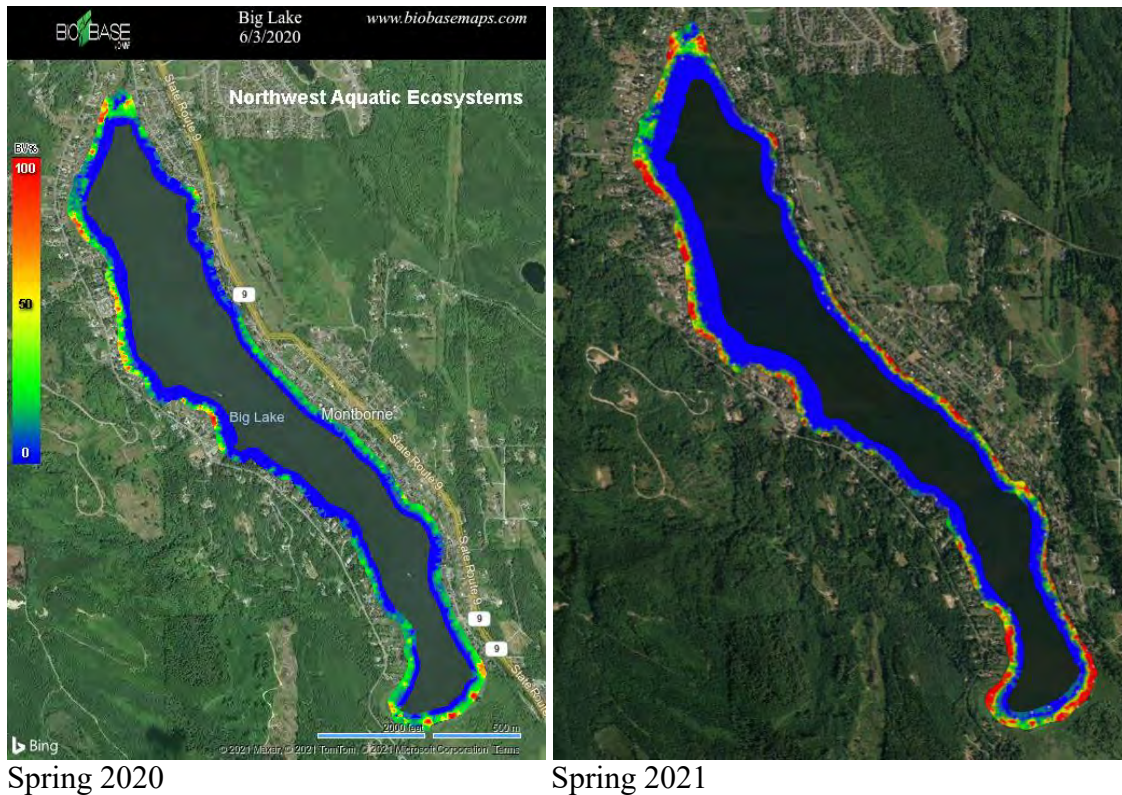
Weed species noted during the 2021 survey were similar to those identified in prior surveys. No *B. elodea* was noted in the southeast quadrant of the lake. Plant growth was dense and individual *B. elodea* plants may have been hidden within the dense biomass of native elodea and pondweeds. No new native species were recognized. The lake's littoral zone is dominated by *P. robbinsii*, *P. zosteriformis*, *P. epihydrus*, *P. richardsoni*, *vallisneri* and elodea. Different weed species were dominant depending on the shoreline area sampled. In general *P. robbinsii* is dominant lake-wide.

2021 weed growth was elevated over densities observed during 2020. Treatment during 2020 was delayed until early July in an effort to ensure all plants had germinated. The 2021 scenario noted much heavier growth during the same mid-July timeline. The 2020 survey map had limited red shaded areas while the 2021 survey had nearly 50% of the shoreline identified as red dense weed growth areas.

Only two locations lake-wide exhibited milfoil growth. Plants were sparse and non-problematic.







July 22, 2021 Treatment

Our approach during 2021 was to continue to provide maximum coverage under the current NPDES guidelines. The 2021 treatment model was designed similar to the prior models expanding treatment outward from the shoreline with continued use of Aquathol K liquid, Diquat and Aquathol K/Diquat tank mixes. Glyphosate has been replaced with imazapyr for lily pad and iris control. Aquathol K has been found to exhibit systemic herbicide properties related to the ability of the active ingredient to be translocated into the root systems of targeted species. Past use of Aquathol K has increased the efficacy of treatments in those lake areas plagued with shallow rich organic muck bottoms. The use of Diquat/Aquathol K mixtures is now an industry standard supported by the recent manufacturing of this same herbicide composition under the trade name Strike.

Shoreline posting was conducted on July 21. A two-person crew, comprised of one watercraft, completed the posting task within a 10-hour timeframe. One crew member posted the docks as the boat circumnavigated the shoreline. If dock access was not available, then the crew member was off loaded, and signage was placed along the water's edge. Similar to years past, the local newspaper was contacted addressing the upcoming treatment and notice was published in the newspaper. The public boat launch was posted with a large sign requesting that no boating occur during the treatment. The boat launch signage was in place no less than 24 hours prior to treatment. On the day of treatment new signage was posted at the boat launch displaying the areas of the lake that were targeted for treatment and the water restrictions associated with the treatment.

Material was offloaded from a locked container truck and transferred into two 25-gallon spray tanks mounted on the application boat. Containers were triple rinsed on site and returned into the truck empty. 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 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 the targeted sites were treated on July 22nd. Native submersed weeds were treated with both a Diquat/Aquathol K mixture and also a conventional diquat mix. Diquat was applied at a rate of one to two gallons per surface acre while Aquathol K was applied at a five gallon per acre rate in a tank mix consisting of five gallons of Aquathol K and one/two gallons of diquat.

The July 15th treatment date proved to be problematic. This year July 15th occurred on a Thursday and our LMD guidelines limits treatment to the early part of the week. July 15th is also the opening of the timing window for many lakes in the state including Lake Washington. Many of the treatments centered on July 15 had already been planned prior to identifying the change in Big Lake from June 15th to July 15th.

The southern shoreline area of the lake is designated as a No Spray Zone. Limited native plant and floating plant control occurs at three or four private docks. Since our presence on the lake in 2011, no *Egeria densa* had been observed lake wide. This particular area of the lake is heavily infested with native plant growth. Surveying within a close proximity to the shoreline is nearly impossible and problematic. Boat prop entanglement within weed beds in conjunction with associated clogged water intakes render in-depth surveys of this area challenging. This southeast zone of the lake was again treated with a diquat mixture of 2 gallons per surface acre in an effort to ensure control of any *B. elodea* that may have been overlooked.

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Drift related control is an important component of the Big Lake treatment script. Some areas of the lake depend on the drift from treatment sites to control plants that do not receive a direct application of herbicide. Many factors contribute into the drift component. On a yearly basis, how treatments respond to drift is unpredictable. However, if the proper conditions exist, drift can prove to be a very reliable and important tool in weed management. At times, expected drift zones do not materialize, resulting in some lake areas remaining untreated or exhibiting varying degrees of control.

Secondary Treatment

No secondary treatments were performed during 2021. With a July 22nd or even a July 15th treatment date it requires approximately three weeks to have the ability to evaluate the outcome of a prior treatment. The Big Lake LMD had requested that no submersed

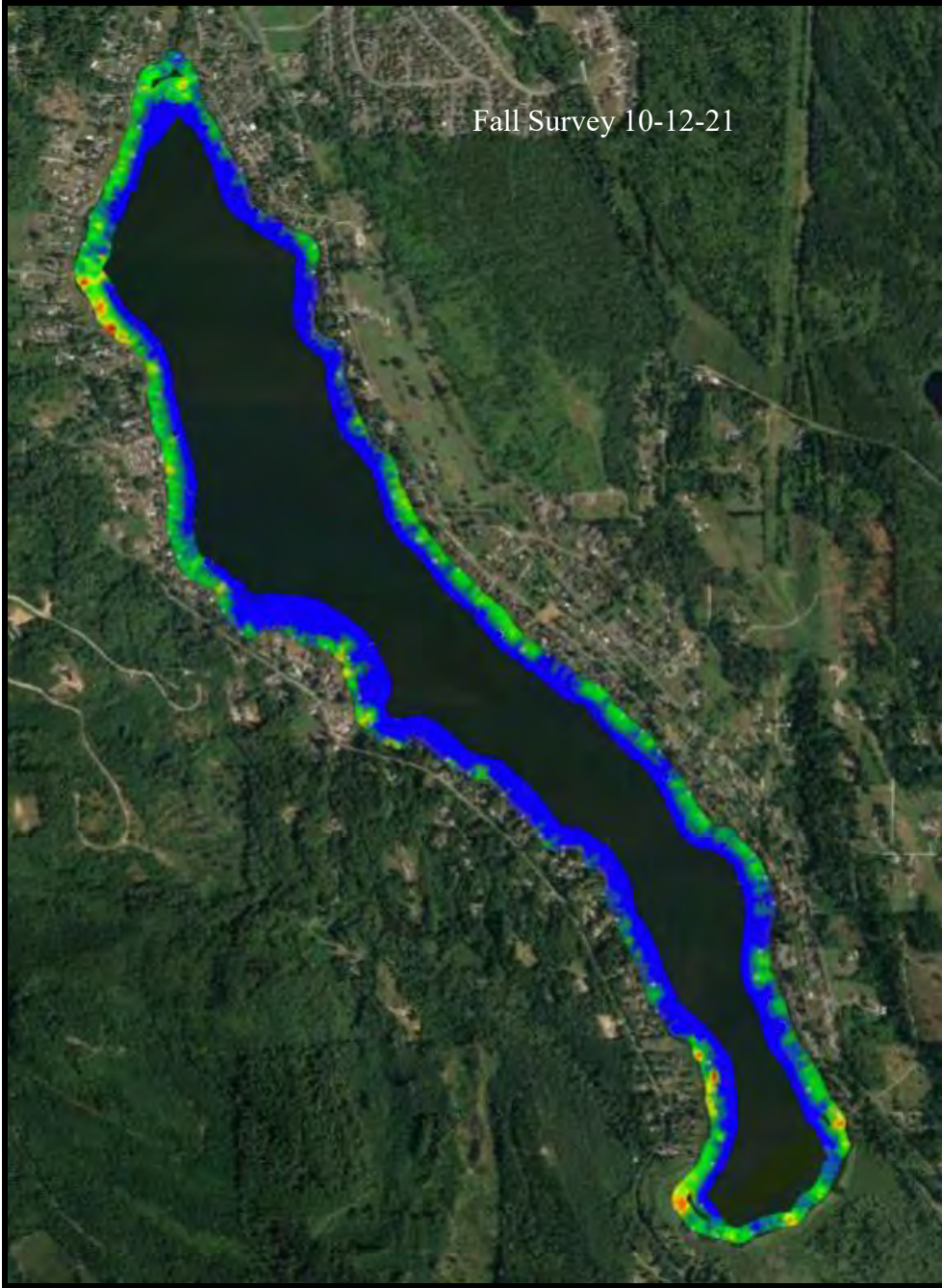
weed control activities commence after August 1st. The initial application was designed to incorporate that requirement into the treatment model by increasing application rates in an effort to clearly provide enough material to impact weeds for the entire season by utilizing only one application. This approach appeared to be successful until the lake level declined, creating new zones for plants to grow while also reducing the depth which then exposed plants that would typically stay submerged.

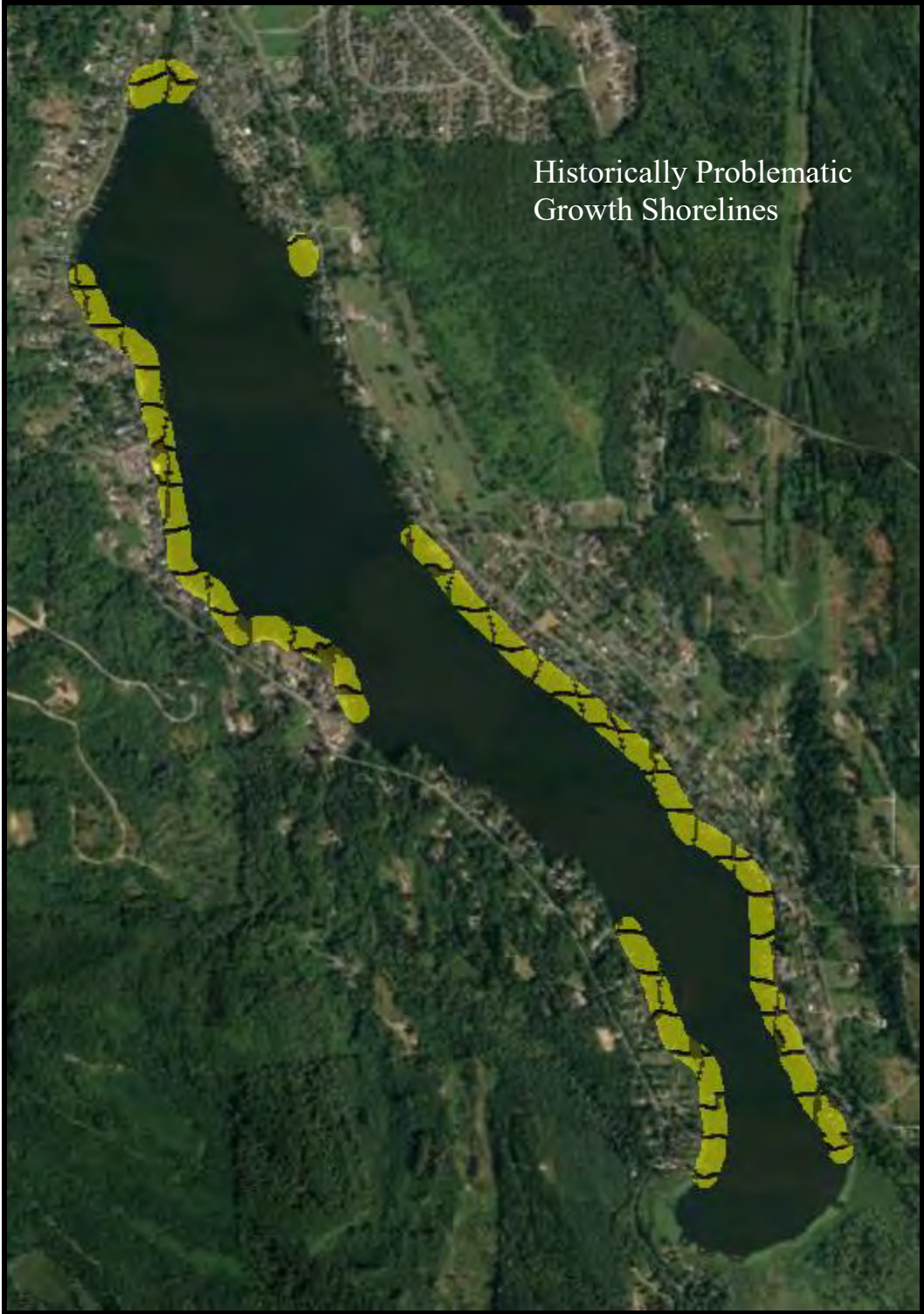
Fall Survey 10-12-2021

Our fall survey was performed on October 12, 2021 approximately one week later than our 2020 campaign. Surprisingly, many of the red areas (100% coverage) identified during the spring survey were now green shaded areas representing only a 20% - 30% weed density coverage. Although many of the original treatment sites still supported weed growth densities, they had decreased considerably.

Prior to the fall survey, NWAE was expecting much higher plant densities than those noted during the survey resulting from low water levels. Many of the docks main sunbathing platforms were now only supporting 4 to 5 foot water depths while spring depths exceeded 6 feet. Historically problematic areas still exhibited typical late seasonal growth. These areas will likely require treatment on a continued yearly basis.

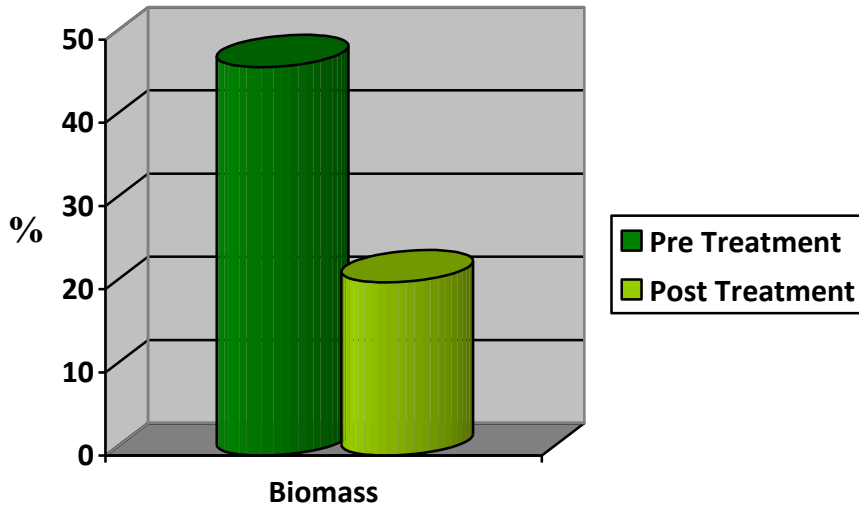
No milfoil or Brazilian elodea was noted during the 2021 fall survey.





Historically Problematic
Growth Shorelines

Pre & Post Plant Densities 2021



2022 BUDGET

Surveys (pre)	1	@	\$1,800.00	\$ 1,800.00
Surveys (post)	2	@	\$1,500.00	\$ 3,000.00
NPDES Permit	1	@	\$ 750.00	\$ 750.00
Noxious Weed Control	15	@	\$ 250.00	\$ 3,750.00
Native Weed Control (Diquat)	80	@	\$ 325.00	\$ 26,000.00
Native Weed Control Aquathol K	40	@	\$ 750.00	\$ 30,000.00
Purple Loosestrife Lily Pad Control	4	@	\$ 400.00	\$ 1,600.00
Communication				\$ 450.00
Mailings				\$ 700.00
Newspaper Notice Signs Boat Launch				\$ 550.00
Total				\$ 69,600.00

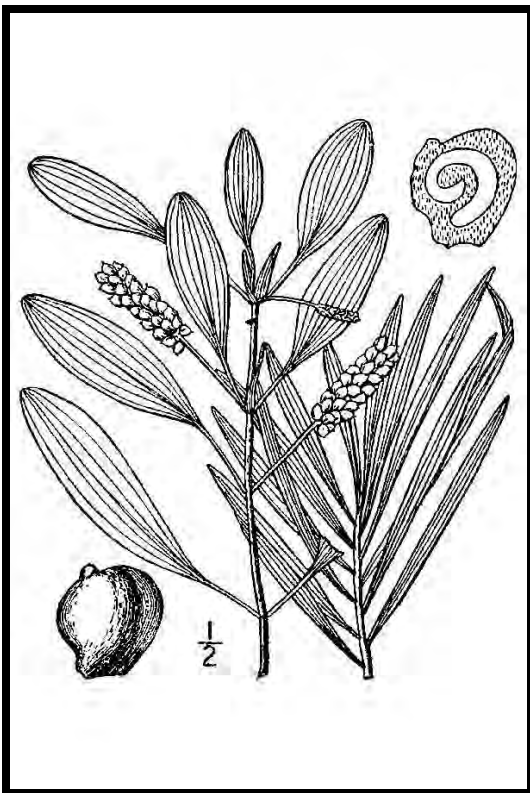
Recommendations

1. Petition the Department of Ecology to change the fish timing window to June 15. Coho salmon are the only species that may be a concern within the Big Lake system. This species spawns in the Nookachamps Creek during the spring and likely reside in the lake until the following spring when Coho migrate to salt water. The historical timeline of when Coho migrate out of any particular system determines the fish timing window date. Typically, the July 15th window is the generic default date established statewide. Many Coho bearing lakes have been able to document that the majority of the fish have already left the system by July 15th. Once that can be established, the timing window can be changed and has been changed for many lakes in the region. Treating after July 15th alters the seasonal treatment plan for the lake.
2. If the July 15th treatment date cannot be altered, will the LMD restrict secondary submersed weed treatments after August 1st?
3. Pursue the ability to change the treatment percentage to a more realistic number. The science behind the current standard simply does not exist and a lake-by-lake evaluation would appear to be the more prudent approach. This was identified as a discussion point within the 2020 Big Lake yearend report. If the LMD board wishes not to pursue the appeal, than the appeal would be terminated.
4. Lily pad control operations should only be conducted during those hours when wind conditions are minimal. Patches consisting of only a few plants should be cut and removed by the property owners.
5. 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 be seasonally controlled with either contact herbicides or specifically targeted with systemic materials. Actions that may or may not be implemented will probably change on a year-to-year basis.
6. 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. A mid-season brief survey should be conducted if the July 15th treatment date is changed. This would allow for secondary treatment if necessary.
7. Continued use of the contact herbicide Aquathol K, utilizing both the liquid and granular formulations. Use of the material 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.
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

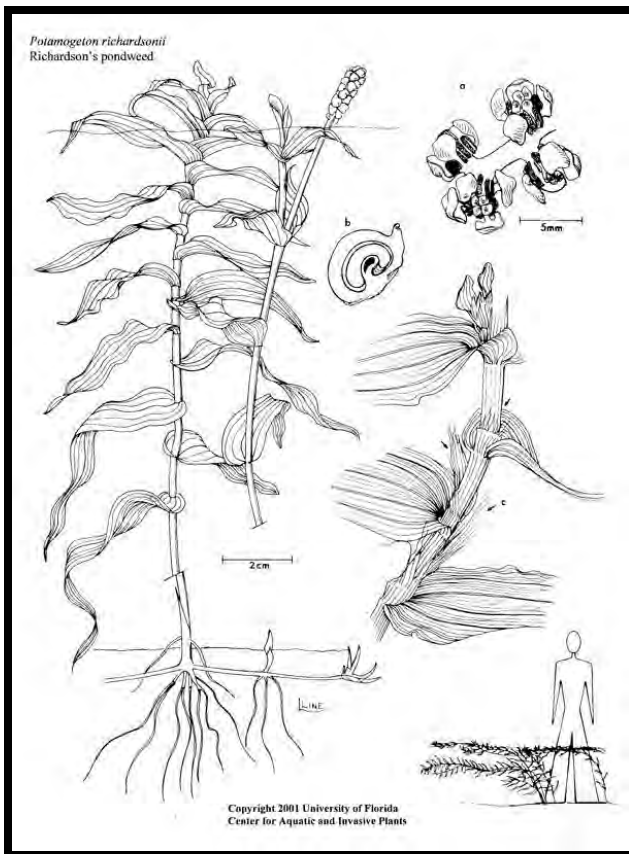
understood by all users of the lake and requires no in-depth technical background for review. The technology also provides an excellent reference to visually show a property owner if problematic weeds are present at their parcel.

9. July 15th falls on a Friday this year. Treatment should be noted in the RFP to occur the week of July 18th if a timing window change is not granted.
10. Continue to work with the LMD and County personnel on nutrient related issues and assist in providing information when requested.
11. LMD should review options directed at the July 15th timing window restriction.

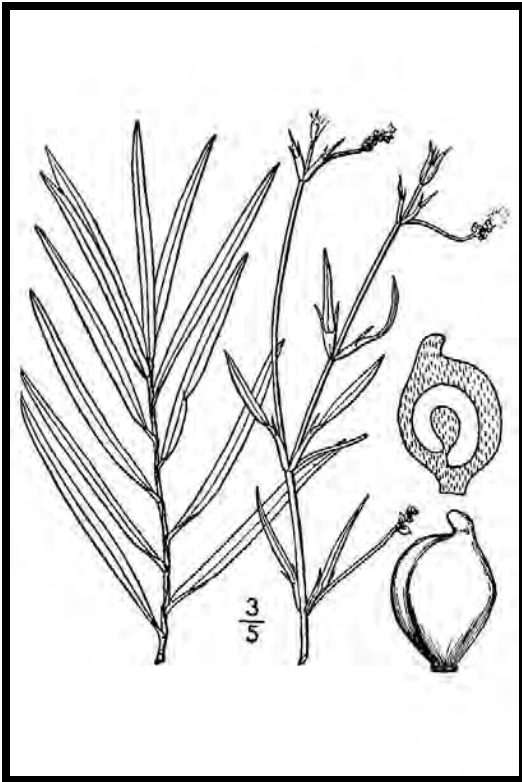
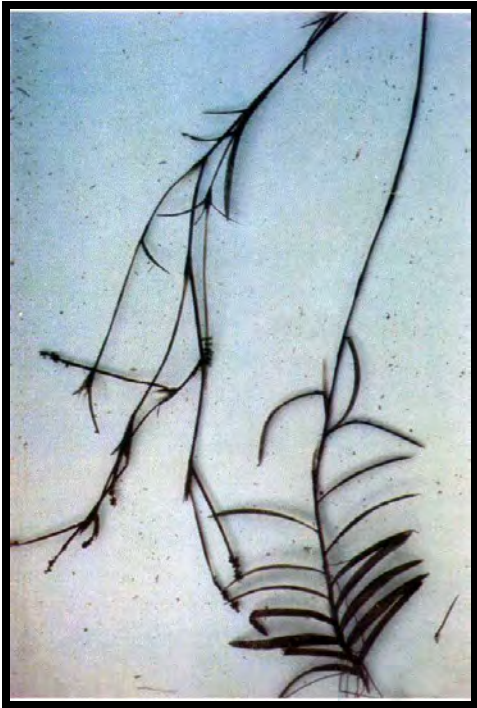
Dominant Submersed Macrophyte Species
Potamogeton epihydrus



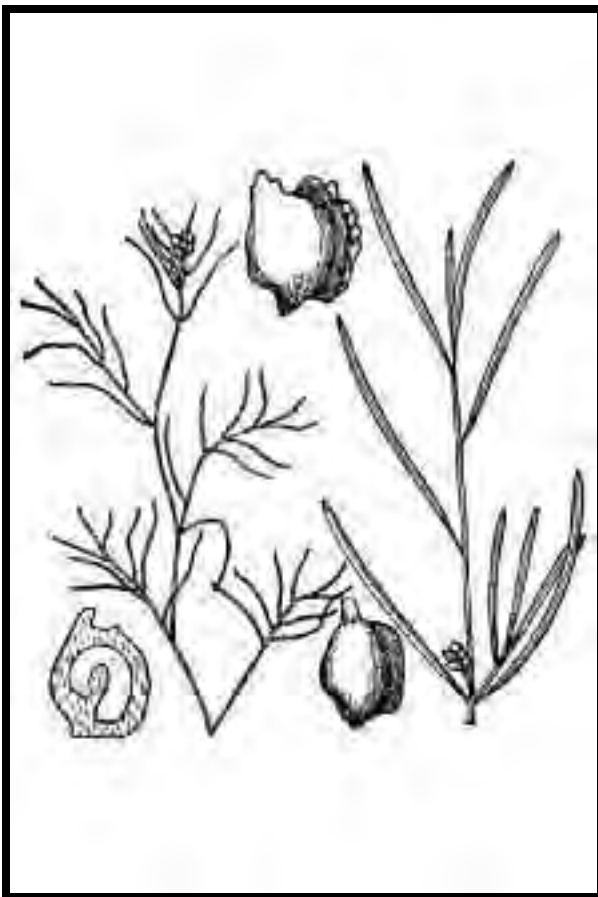
Potamogeton richardsonii



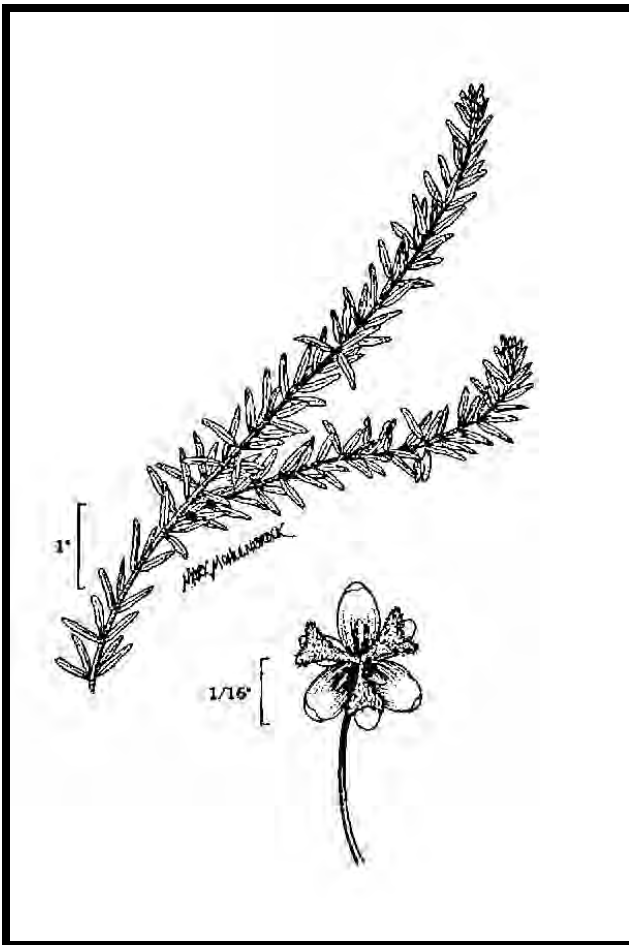
Potamogeton robbinsii



Potamogeton foliosus



Elodea canadensis



Vallisneria americana

