Barnes Lake

2022 Aquatic Macrophyte Control Program

Prepared By
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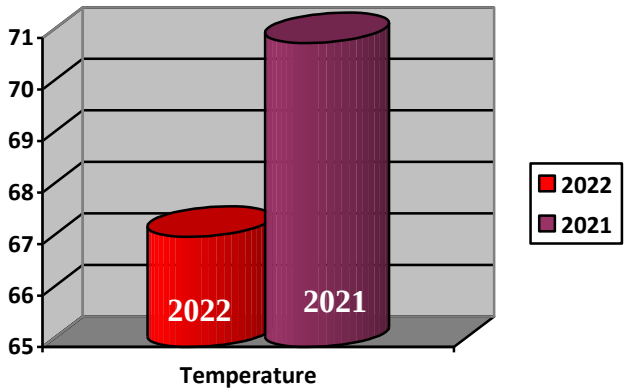
Project Overview

2022 noted record low temperatures for the month of April and above normal rainfall for June. The summer produced a record number of days exceeding 90 degrees with reduced rainfall through the summer months. There was anticipation that control activities would continue to target lily pad shoreline growth in conjunction with the need to control sporadic bladderwort and pondweed growth. The 2020 whole lake fluridone treatment was hindered as a result of early seasonal water loss that required the booster fluridone application to be performed earlier than scheduled. Some of the bladderwort nestled within the wetland areas became landlocked and did not receive the necessary exposure timeline required to ensure lake-wide control. The success of the 2020 treatment eliminated but did not eradicate the bladderwort infestation from Barnes Lake. Low water level and the late treatment start date required the second fluridone booster application to be applied earlier than anticipated. Water level issues likely created bladderwort plants that may have become landlocked within the floating islands resulting in a reduced exposure interval for these plants.

The main component for 2022 was to observe the lake's continued response related to the 2020 fluridone treatment, provide timely minimal shoreline control activities for lily pad control and use spot applications for submersed weeds when deemed appropriate. Areas of the lake that would be considered for weed control would be determined after the spring survey.

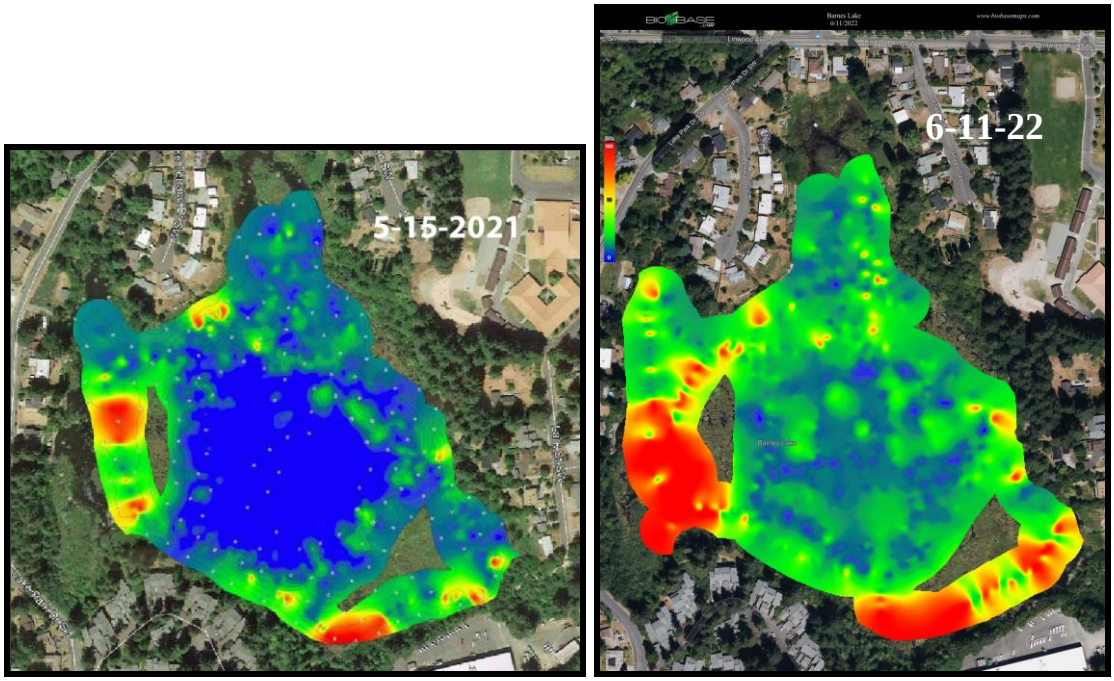
Survey 6-11-22

The spring survey was performed later in the year than past surveys in an effort to compensate weed growth shortfalls that might have occurred due to the cooler April and May temperatures. The initial survey was performed on June 11. Water level was adequate to access all the lake areas. Our 2021 survey was undertaken approximately one month earlier than the 2022 survey. Average water temperature for our 2021 survey was 70.9 degrees while our 2022 survey (one month later than 2021) was just 67.14.



One would anticipate that a lower spring water temperature for 2022 would have resulted in reduced weed growth lake-wide. Our spring 2022 surveyed identified greater weed densities lake-wide than what was expected. The dominant plant noted was the non-

native bladderwort. As water levels began to rise at the close of 2021 and into the early spring of 2022 viable, bladderwort plants were dislodged from within the floating wetland islands that then spread throughout the lake. This increase was noted visually and further documented through the electronic survey.



All of the dark blue areas represent biomass densities within the water column of 0 %. The remaining green areas represent densities of less than 40%. Red areas constitute densities of 100%.

Survey Protocol

A macrophyte survey map is produced each year and incorporated into the baseline IAVMP for Barnes Lake. The surveys are then utilized to monitor yearly weed growth and assist in establishing potential management sites. Electronic bottom surveys have been conducted since 2015.

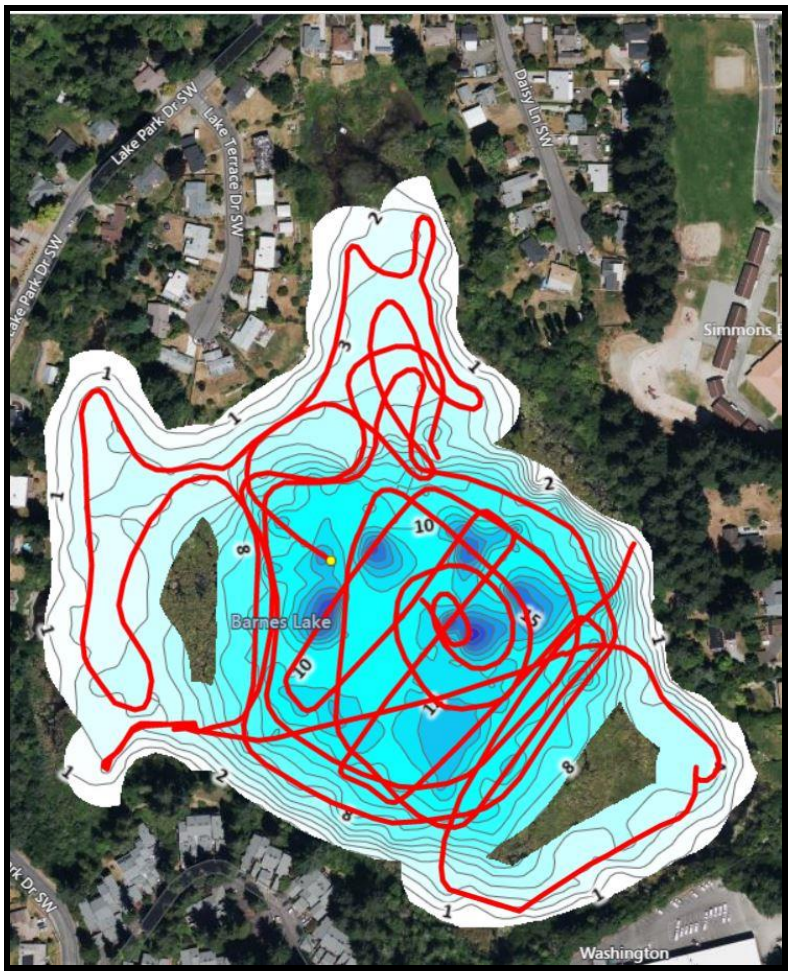
The NWAE mapping protocol utilizes state of the art Bio Base mapping technology. This system produces three map types consisting of a bathymetric contour, a sediment composition profile and a macrophyte density map. All maps are GIS friendly and can be exported into any GIS program. Maps are color coded so they can be easily evaluated by any viewer.

Mapping technology utilizes specialized transducers that electronically collect thousands of data points as the survey boat transects the lake's littoral zone. Data is recorded and viewed onboard. Each file contains one hour of survey data. A completed survey may be comprised of one or more files. Upon completion, all the program files are downloaded

and processed. The survey and sonar log produces a stored electronic file of the lake bottom that can be viewed in house at any time and allows the ability to view plant growth along the boat's survey track.

Our protocol encompasses a surface vehicle transecting the lake along the entire littoral zone. Boat tracks are designed to be approximately 150 feet apart. Sonar beam data collection extends approximately 150 feet from all directions surrounding the boat. 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 noted through the water column. This sampling point is then incorporated into the data log file as a single point of reference, noting the species captured during the rake tow. These points are then added to the final project map.

BioBase survey technology provides accuracy in water depths of greater than 2.5 feet. Data collected below the three foot threshold may be skewed because of signal related issues from the reflected bottom transducer readings. These depth issues and data acquisition distributions are typical for the Branes Lake shallow canal and island sections of the lake. In general, survey efficacy was limited to the main lake basin.



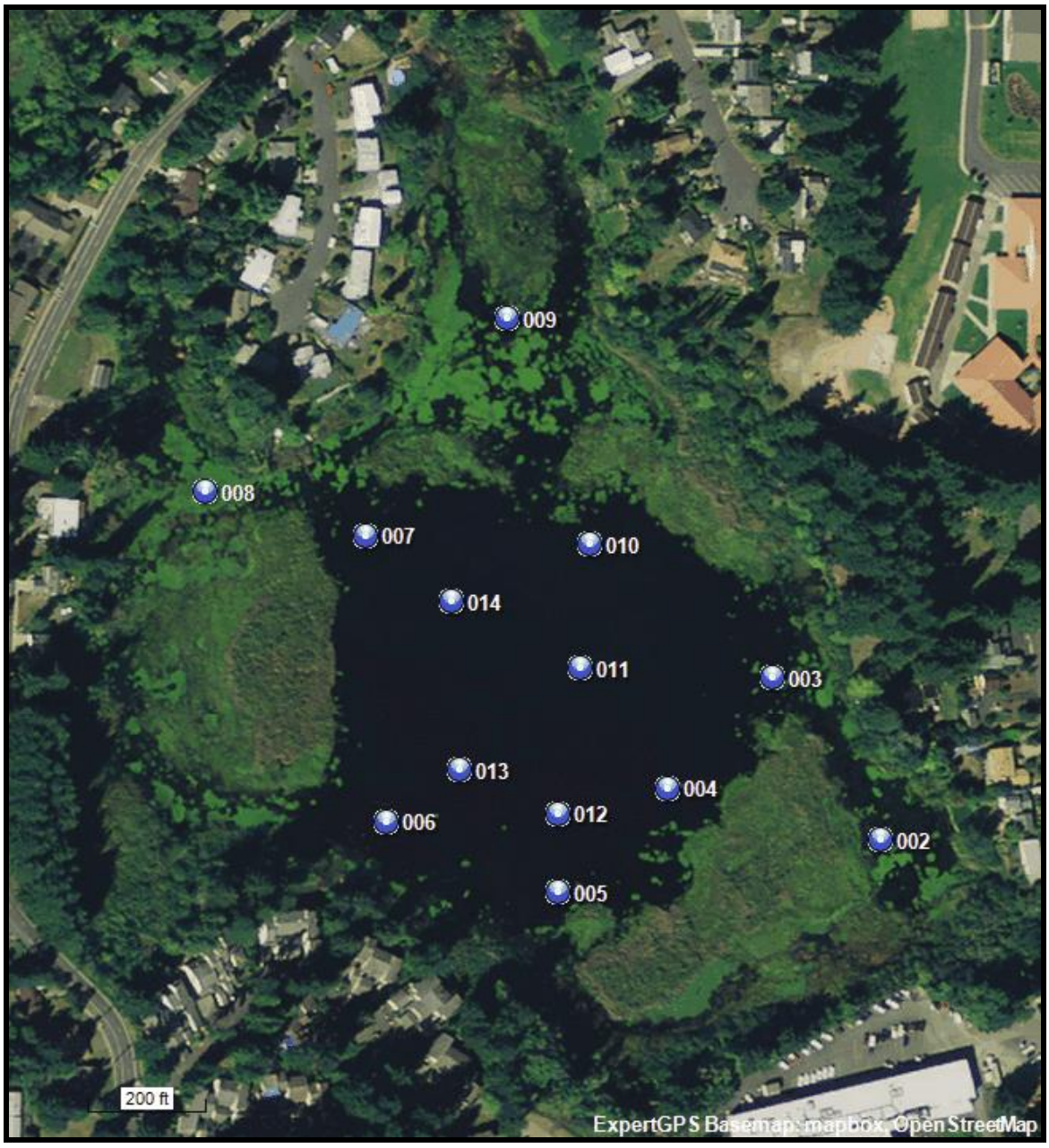
June 2022 Survey Tracks

NWAE had only one successful drone survey of the lake performed on Oct 3, 2021. Although an earlier spring survey was performed, the data was processed later in the year and the file was found to be corrupt. These drone surveys establish a clear visual interpretation of lake conditions at the time of the aerial survey. Pre-treatment pictures/video are typically evaluated against post treatment aerials taken at the end of the season.

GPS Grab Sample GPS Coordinates

During the survey, 13 sampling data points were collected at the same locations as noted during 2021. Grab samples were collected and recorded. Previously stored data points were uploaded and observed on the onboard chart recording screen. The survey boat is directed to each data point for sampling. Our 2021 survey identified only one site (003) supporting bladderwort growth while the remaining sites exhibited no weed nitella growth. Four sites exhibited the presence of nitella.

2022 results identified ten sites containing bladderwort, four sites containing pondweeds and three sites containing coontail. Much of the lake bottom was supporting nitella growth similar to the 2021 survey. This species is typically associated with post fluridone treatments. Nitella looks similar to aquatic macrophytes but is an algae species. When trying to identify aquatic plants many residents misidentify this species as a plant simply because of its physical and growth characteristics. Nitella seldom creates water related recreational issues.



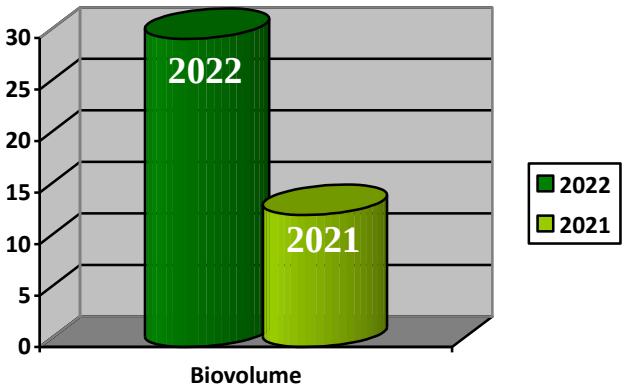
Data Point	Lat	Long	2021 Species	2022 Species
002	N47 00.185’	W122 54.814’	NO	BL, NI, P
003	N47 00.230’	W122 54.858’	BL, NI	BL, NI, P, C
004	N47 00.199’	W122 54.900’	NO, NI	BL
005	N47 00.171’	W122 54.945’	NO	BL, NI, P
006	N47 00.190’	W122 54.014’	NO, NI	NO
007	N47 00.269’	W122 54.023’	NO, NI	BL, P, C, NI
008	N47 00.282’	W122 54.088’	NO	BL, NI
009	N47 00.330’	W122 54.965’	NO	NO
010	N47 00.267’	W122 54.932’	NO	BL, NI

011	N47 00.233’	W122 54.936’	NO	NI
012	N47 00.192’	W122 54.945’	NO	BL, NI
013	N47 00.205	W122 54.984’	NO	NO
014	N47 00.251	W122 54.987’	NO	BL, C

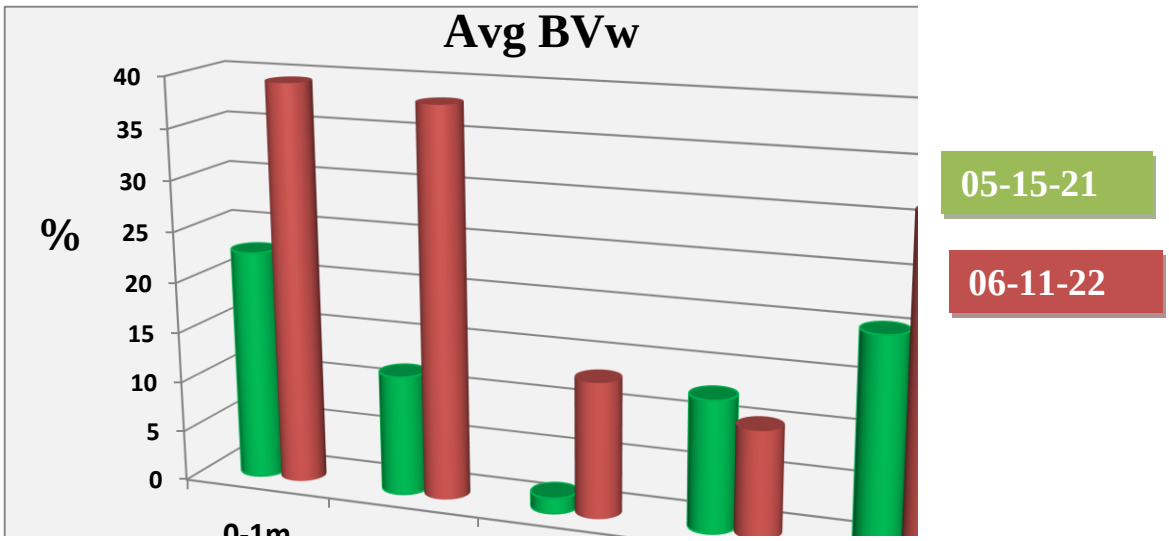
Grab Sample Point Dictionary

NO - No Macrophytes present, algae not included
BL – Bladderwort
P – Pondweed
C - Coontail
NI - Nitella

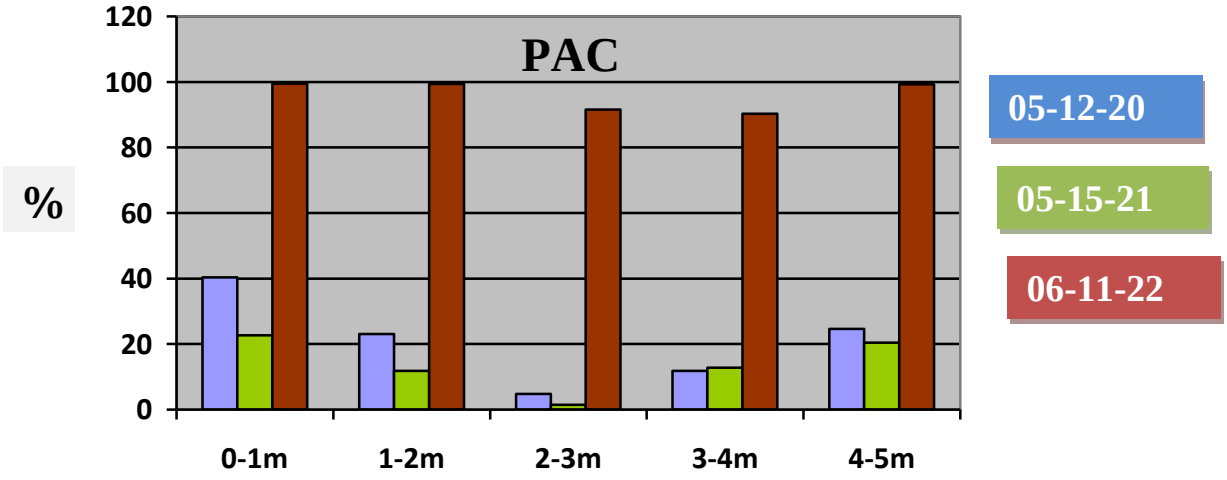
In evaluating all of the data utilizing a grid format (considered within the industry to be the most accurate summary of a surveyed area) and a plant bio volume matrix, the following volumes were noted. Plant biovolume is the percentage of plant biomass taken up in the water column by vegetation when plants exist. When no plants are noted a zero is added into the calculations. The complete 2022 survey identified that 29.9% of the surveyed water column supported plant growth in comparison to 12.8% in 2021.

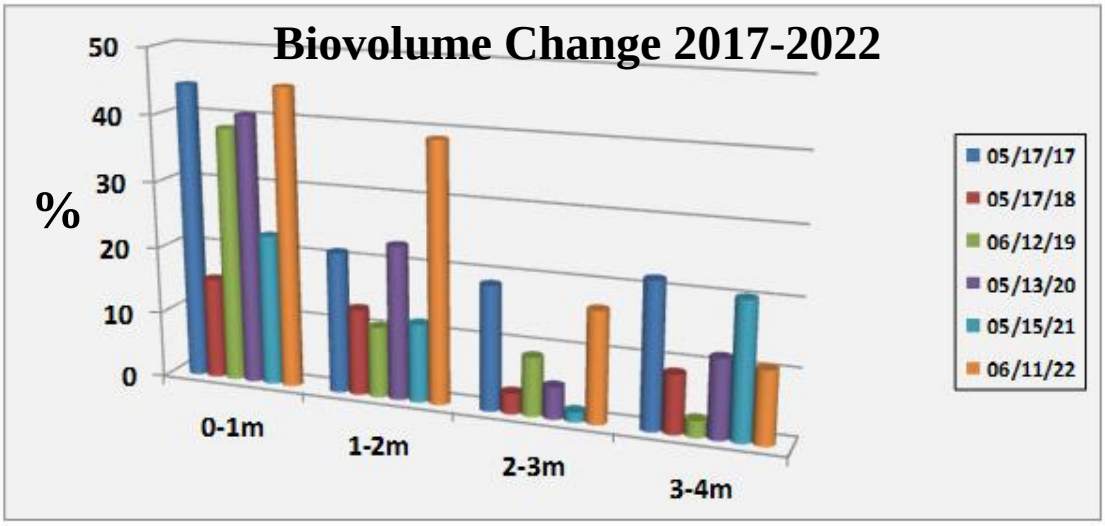


One can further fine tune the analysis and determine bio volumes at one meter intervals.



PAC
Percent Area Covered: Refers to the overall surface area that has vegetation growing





Historical data associated with biovolumes, densities and bottom coverages has been catalogued since 2014. Typically much of the shallow lake sediments that are exposed during the late summer typically support varying densities of emergent, floating and submerged species. Mid basin growth through the years has fluctuated and is associated with the treatment schedule. One would expect that the longer lag time between treatment would result in denser weed growth. Bladderwort is a free floating plant that resides dormant on the lake bottom in small ball like configurations. These free floating masses drift along the lake bottom and eventually become loosely attached to the bottom. Plants landlocked within the wetland areas as the water level declines stay viable. As the basin recharges and the wetlands are now inundated with water these plants now are capable of floating throughout the entire lake.

Pre-Treatment Residential Notice

Notices were mailed to all of the property owners within the lake management district from a mailing list provided by the City of Tumwater. The notice identified the materials to be used and the approximate time-frame when spraying would occur. Mailings were delivered on or about May 4, 2022. An updated mailing list should be made available for the 2023 treatment year.

6-13-2022 Lily Pad Application

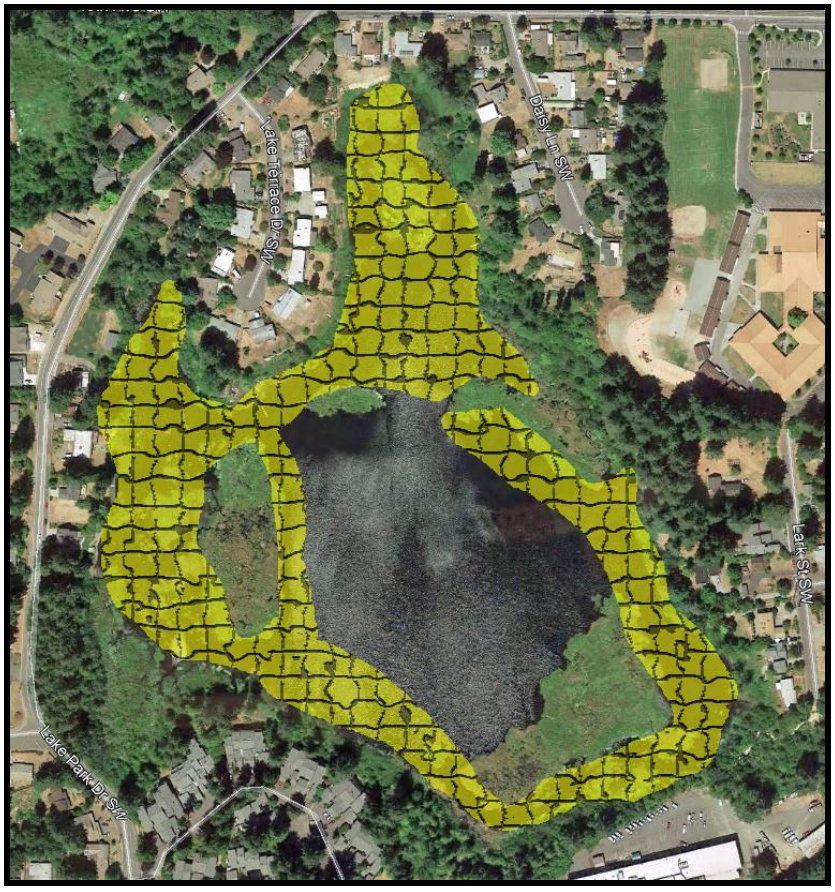
An initial lily pad application was conducted on 6-13-22. This application targeted floating lily pads, brasenia and yellow flag iris. Prior to treatment, shoreline residents were notified of the pending treatment. Notices were hand delivered to each parcel abutting the lake.

Triclopyr and adjuvant was applied to the lake shoreline at a 1% tank solution. In addition to the herbicide, a spray adjuvant was added to the mixture. Spray adjuvants are wetting agent activators that allow for better penetration of the herbicide into the plants'

leaf structures. Spraying was accomplished using a 16 foot Airgator airboat. The application boat was equipped with two 25-gallon spray tanks. Once the herbicide, adjuvant and water were mixed, the boat traveled along the shoreline spraying all infestations noted that were within range of the application equipment.

6-18-2022 Submersed Weed & Lily Pad Application

As a result of the 6-13-22 site visit it was determined that submersed weed control was necessary. Bladderwort was observed floating/flowering along most of the shoreline areas with moderate densities observed between the shorelines and floating islands. The area was visually surveyed and the following treatment map was developed.



Fifteen acres of the lake basin were targeted consisting of complete shoreline coverage. The main basin was not targeted but was expected to receive partial treatment associated with herbicide drift.

Prior to treatment, the residents were hand-delivered notice informing them of the pending treatment. A private residential property was used to stage the event. This was the same site utilized since treatments began a few years ago. Material (diquat) was offloaded from a truck and transferred into a 25-gallon holding tank within the application boat. Once full, the boat operator and applicator proceeded to disperse the material. Lake water was drawn into the boat where a venturi injection configuration

metered the herbicide into the pumping system. Once the herbicide and lake water were mixed, the resulting combination was then injected back down into the water utilizing weighted hoses. The spray mixture was injected approximately one foot below the surface.

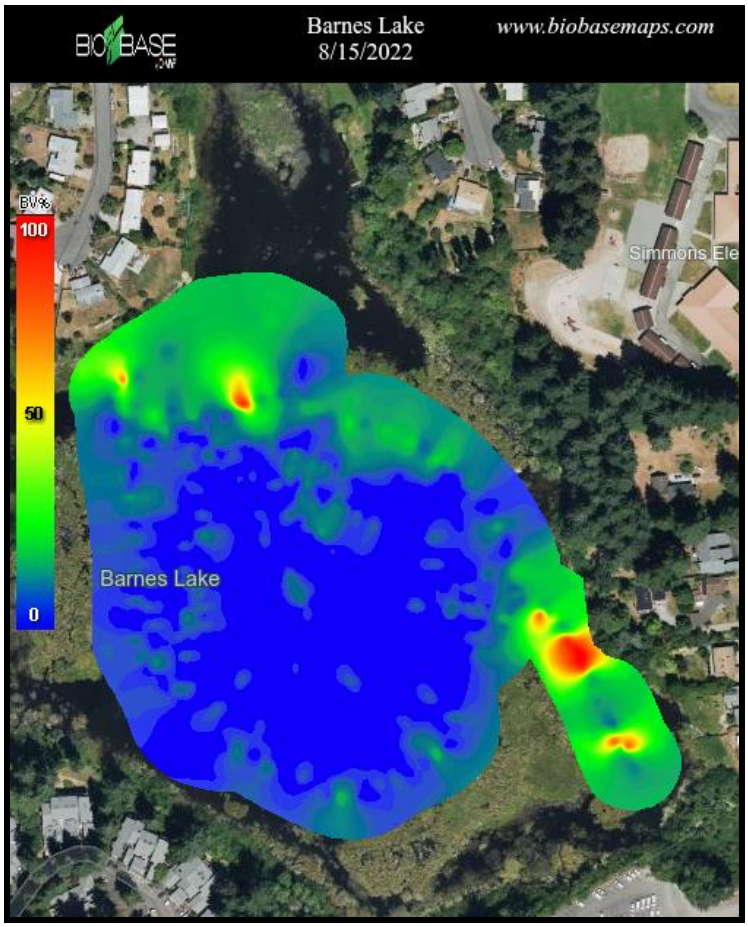
At the conclusion of the submersed weed control, a secondary spraying of the lily pads was conducted. This application targeted those plants that were missed during the 6-13-2022 application.

8-15-2022 Lily Pad Application

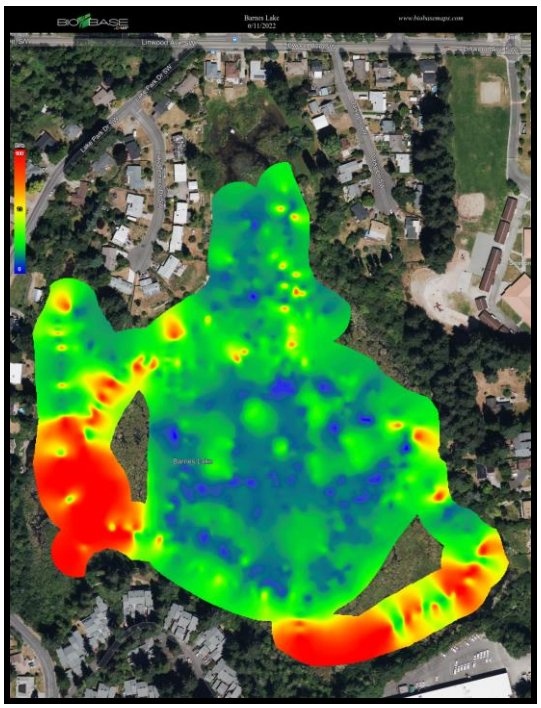
A third and final lily pad spraying event occurred on 8-15-2022. Triclopyr was applied once again in the same manner as prior applications. Because of the low water level it was determined that this would be the final application of the year.

8-15-2022 Fall Survey

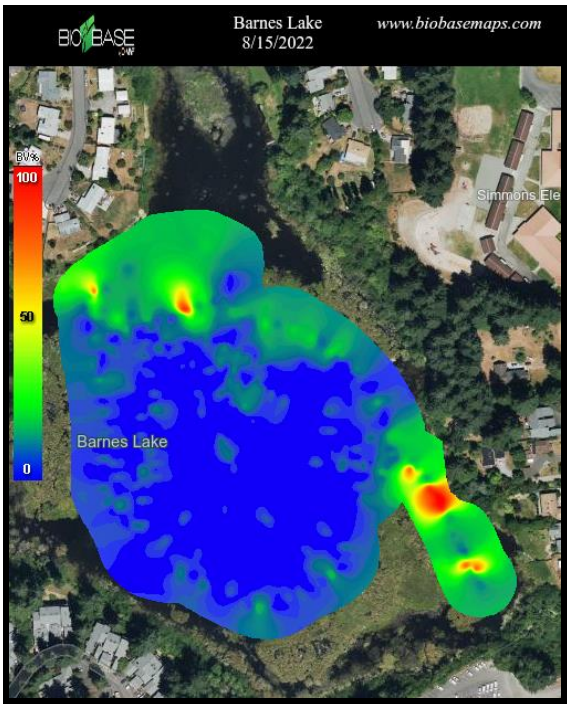
The fall survey was conducted according to the same standards as the early spring survey. Due to the low water level, access to the entire lake basin was limited. The fall survey consisted of data collected from the main basin only.



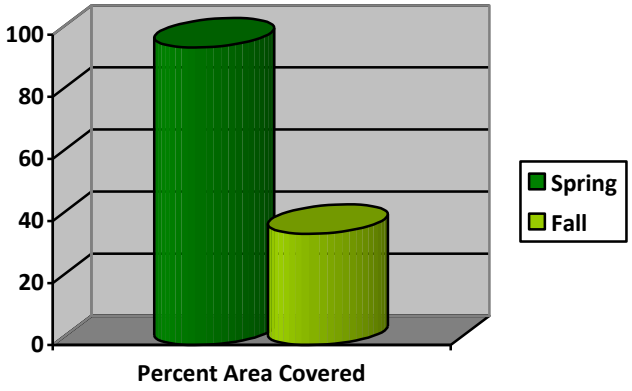
Fall Survey 8-15-22

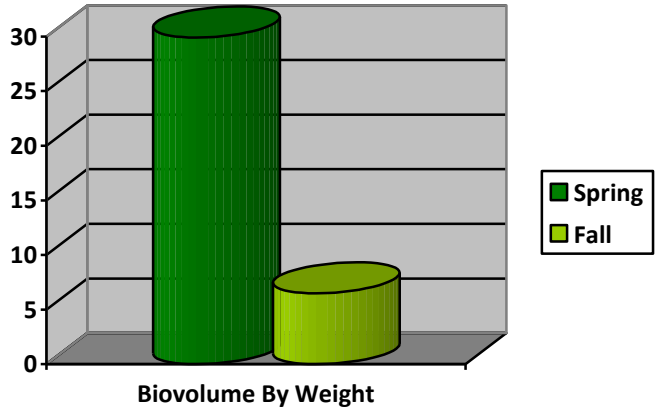


Spring Survey 2022



Fall Survey 2022





Drone Survey 06-26-2022

An aerial survey of Barnes Lake was conducted on June 26, 2022. Imagery was collected from two shoreline locations. Video can be viewed at : https://youtu.be/07Keumo4HjY

Recommendations for 2023

The success of the diquat treatment this year has provided the LMD with another tool for controlling bladderwort. Issues with water level and the timing of fluridone booster applications vary on a year to year basis. Our 2020 fluridone treatment was unable to provide the required timeline and water level to successfully deliver the long term control as expected. Costs associated with diquat use are considerably less than fluridone. However, the longevity of control associated with diquat use at Barnes Lake has not yet been determined. Other projects where diquat has been utilized for bladderwort control had lasted three years. We anticipate no bladderwort issues that would warrant spot treatments for the upcoming 2023 season. However, minor lily pad and pondweed control will likely be required.

Our program on the lake continues to evolve as new issues may develop. Pondweed control, if necessary, will be accomplished with the use of Aquathol K or diquat depending on the presence of bladderwort. There are no label restrictions associated with swimming or fishing. Both products require minor irrigation use restrictions. Herbicide costs continue to increase and will impact project budgetary issues.

1. Continue early and late seasonal drone surveys of the lake. Conduct one early (late May) seasonal electronic and bottom sampling lake event. If water level provides access, an additional electronic survey and bottom sampling event should be conducted.
2. Problematic small access issues associated with pondweed growth may surface during 2023. What, if any action taken will be determined by the LMD. Typically once growth exceeds the LMD's threshold levels, treatments are authorized. Control if necessary would be performed utilizing an Aquathol K/diquat tank mix. Costs would range between $910.00 and $1,200.00 per treated acre.

3. Continue use of triclopyr and imazapyr in the control of lily pads and yellow flag iris. Spring and possible late summer applications should be scheduled.

4. Program essentials consist of planned applications when bladderwort densities impede lake use. Threshold levels that determine treatment are under the discretion of the LMD with recommendations being provided by the consultant. It is anticipated that such treatments will be required on a three to five year basis.

5. Diquat use during 2022 proved to be very effective in controlling both pondweed and bladderwort species. Efficacy and cost of any fluridone applications should be evaluated in relation to the cost and efficacy of the 2022 diquat application.

Untreated fluridone bladderwort, as water levels decline, may refloat during the winter months as once exposed muck bogs are now submerged.

5. Modification to the current launch site has been initiated. The only remaining component will be the need to spread some additional gravel at the lake shoreline interface.

6. Barnes Lake continues to be in a management maintenance mode requiring limited treatment.

7. Wetland preservation needs to be considered a top management priority. Recently it was determined that one acre of wetland removes 13 pounds of phosphorous per year. Barnes Lake contains approximately 5 acres of wetlands. It would be an interesting analysis to factor in an additional 65 pounds of phosphorous into the current nutrient levels of the lake.

Budget 2023

Funding for the 2023 program will require increases in associated labor related services and materials. Increases will not be as drastic as experienced in 2022 but will be necessary. Pricing continues to change quarterly.

2022 NPDES permit fee		$ 725.00
Insurance		$ 700.00
Spring Electronic Bottom Survey		$ 2,000.00
Fall Electronic Bottom Survey		$ 2,000.00
Aerial Survey (2)		$ 1,200.00
Pre Treatment Mailing		$ 175.00
Shoreline Posting Day of Treatment		$ 210.00
Mobilization		$ 500.00
Imazapyr 1 gal	@	$ 185.00
Triclopyr 1 gal	@	$ 160.00
Aquathol K 1 gal	@	$ 95.00
Airboat Operator		$ 110.00/hr.
Technician		$ 75.00/hr.
Year End Report @ $90.00/hr.		$ 630.00

COSTS ASSOCIATED WITH ONE DAY ON THE LAKE

Mobilization		$ 500.00
Airboat Operator	8 @ $110.00	$ 880.00
Technician	8 @ $75.00	$ 600.00

State of Washington
Department of Agriculture
Olympia, Washington 98504

PESTICIDE APPLICATION RECORD (Version 3)
NOTE: This form must be completed same day as the application and it must be retained for 7 years. (Ref. RCW 17.21)

3. Date of Application-Year: 2022 **Month:** June **Date:** 11 **Time:** 09:30

2. Name of person for whom the pesticide was applied: Barnes Lake Improvement District, City of Tumwater
Firm Name (if applicable):
Street Address: 555 Israel Road **City:** Tumwater 98512

3. Licensed Applicator's Name (if different from #2 above): Douglas Dorling
Firm Name): Northwest Aquatic Eco-Systems
4426 Bush Mountain Drive SW.
Olympia, WA. 98512
360-357-3285
License # 375

4. Name of person who applied the pesticide (if different than #3 above):

License No(s). if applicable:

5. Application Crop or Site: Barnes Lake

6. Total Area Treated (acre, sq. ft., etc.): 2 acre

7. Was this application made as a result of a WSDA Permit ? No

8. Pesticide information (please list all information for each pesticide in the tank mix):

a) Product Name Pesticide Applied	**b) EPA Reg. No.**	**c) Total Amount of Pesticide Applied in Area Treated**	**d) Pesticide Applied/Acre**	**e) Concentration Applied ppm or other measure)**
Triclopyr	70506-176	2 gal		1.0 %

9. Address or exact location of application NOTE: If the application made to one acre or more of Agricultural land, the field location must also be shown on the map on page two of this form. Barnes :Lake Tumwater, WA. 98512, WA 98512

10. Date: 6-11-22 **11. Name of person making application:** Douglas Dorling

12. License No: 375 **13. Apparatus License. Plate No.:** G424

14. Start: 9:30 **Stop:** 2:30

15. Acres completed : 2

16. Wind Direction: SW **Wind Velocity:** 0-5

17. Temperature: 74

Location of Application (If the application covers more than one township or range, please indicate the township & range for the top left section of the map only):
Township: T18N
Range: E OR W (please indicate) 02W

Section(s): 34
County: Thurston

PLEASE NOTE:
The map is divided into 4 sections with each section divided into quarter-quarter sections. Please complete it by marking the appropriate section number(s) on the map and indicate as accurately as possible the location of the area treated.

State of Washington
Department of Agriculture
Olympia, Washington 98504

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3. Date of Application-Year: 2022 Month: June Date: 13 Time: 10:00

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Firm Name (if applicable):
Street Address: 555 Israel Road City: Tumwater 98512

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Firm Name): Northwest Aquatic Eco-Systems
4426 Bush Mountain Drive SW.
Olympia, WA. 98512
360-357-3285
License # 375

4. Name of person who applied the pesticide (if different than #3 above):

License No(s). if applicable:

5. Application Crop or Site: Barnes Lake

6. Total Area Treated (acre, sq. ft., etc.): 15 acres

7. Was this application made as a result of a WSDA Permit ? No

8. Pesticide information (please list all information for each pesticide in the tank mix):

a) Product Name Pesticide Applied	b) EPA Reg. No.	c) Total Amount of Pesticide Applied in Area Treated	d) Pesticide Applied/Acre	e) Concentration Applied ppm or other measure)
Diquat	100-1390	30 gal	2 gal/surface acre	

9. Address or exact location of application NOTE: If the application made to one acre or more of Agricultural land, the field location must also be shown on the map on page two of this form. Barnes :Lake Tumwater, WA. 98512, WA 98512

10. Date: 6-13-22 11. Name of person making application: Douglas Dorling

12. License No: 375 **13. Apparatus License. Plate No.: G424**

14. Start: 10:00 **Stop: 5:30**

15. Acres completed : 15

16. Wind Direction: SW **Wind Velocity: 0-5**

17. Temperature: 76

Location of Application (If the application covers more than one township or range, please indicate the township & range for the top left section of the map only):
Township: T18N
Range: E OR W (please indicate) 02W

Section(s): 34
County: Thurston

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Olympia, Washington 98504

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Firm Name (if applicable):
Street Address: 555 Israel Road City: Tumwater 98512

3. Licensed Applicator's Name (if different from #2 above): Douglas Dorling
Firm Name): Northwest Aquatic Eco-Systems
4426 Bush Mountain Drive SW.
Olympia, WA. 98512
360-357-3285
License # 375

4. Name of person who applied the pesticide (if different than #3 above):

License No(s). if applicable:

5. Application Crop or Site: Barnes Lake

6. Total Area Treated (acre, sq. ft., etc.): .25 acres

7. Was this application made as a result of a WSDA Permit ? No

8. Pesticide information (please list all information for each pesticide in the tank mix):

a) Product Name Pesticide Applied	b) EPA Reg. No.	c) Total Amount of Pesticide Applied in Area Treated	d) Pesticide Applied/Acre	e) Concentration Applied ppm or other measure)
Triclopyr	81927-13	.5 gal		1%

9. Address or exact location of application NOTE: If the application made to one acre or more of Agricultural land, the field location must also be shown on the map on page two of this form. Barnes :Lake Tumwater, WA. 98512, WA 98512

10. Date: 6-13-22 **11. Name of person making application: Douglas Dorling**

12. License No: 375 **13. Apparatus License. Plate No.: G424**

14. Start: 10:00 **Stop: 5:30**

15. Acres completed : .25

16. Wind Direction: SW **Wind Velocity: 0-5**

17. Temperature: 76

Location of Application (If the application covers more than one township or range, please indicate the township & range for the top left section of the map only):
Township: T18N
Range: E OR W (please indicate) 02W

Section(s): 34
County: Thurston

PLEASE NOTE:
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NOTE: This form must be completed same day as the application and it must be retained for 7 years. (Ref. RCW 17.21)

1. Date of Application-Year: 2022 Month: August Date: 15 Time: 9:00

2. Name of person for whom the pesticide was applied: Barnes Lake Improvement District, City of Tumwater
Firm Name (if applicable):
Street Address: 555 Israel Road City: Tumwater 98512

3. Licensed Applicator's Name (if different from #2 above): Douglas Dorling
Firm Name): Northwest Aquatic Eco-Systems
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360-357-3285
License # 375

4. Name of person who applied the pesticide (if different than #3 above):

License No(s). if applicable:

5. Application Crop or Site: Barnes Lake

6. Total Area Treated (acre, sq. ft., etc.): 2 acres

7. Was this application made as a result of a WSDA Permit ? No

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a) Product Name Pesticide Applied	b) EPA Reg. No.	c) Total Amount of Pesticide Applied in Area Treated	d) Pesticide Applied/Acre	e) Concentration Applied ppm or other measure)
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10. Date: 6-13-22 11. Name of person making application: Douglas Dorling

12. License No: 375 **13. Apparatus License. Plate No.: G424**

14. Start: 9:00 **Stop: 3:30**

15. Acres completed : 2

16. Wind Direction: SW **Wind Velocity: 0-5**

17. Temperature: 78

Location of Application (If the application covers more than one township or range, please indicate the township & range for the top left section of the map only):
Township: T18N
Range: E OR W (please indicate) 02W

Section(s): 34
County: Thurston

PLEASE NOTE:
The map is divided into 4 sections with each section divided into quarter-quarter sections. Please complete it by marking the appropriate section number(s) on the map and indicate as accurately as possible the location of the area treated.

Herbicide Treatment
Business and Residential Notice

In Treatment Area Yes In 1/4 Mile Notification Area Yes
Project site is located adjacent to Lake Terrace Drive SW

Distribution Date: 05-04-22 Barnes Lake will be treated with herbicides to control non-native pondweeds, lily pads and shoreline emergent vegetation from May 20 through July 30 as required. Treatment dates are dependent on lake water levels and the ability to access the lake. Targeted treatment dates will be May 25 through June 25. A secondary application may be applied later in the season depending on our ability to access the lake. Notices of applications will be hand delivered to each property owner no longer than 48 hours prior to treatment. Notices will state any water use restrictions or advisories. **Product(s) planned for use: Diquat—diquat dibromide**
Imazapyr (shoreline plant & iris control)
Aquathol K- dipotassium salt of endothall, Triclopyr—triclopyr

Location of Treatment(s): Lily pad control will take place anywhere throughout the lake. Shoreline emergent plant control will only occur at residential properties abutting the lake who have agreed to the treatment. Pondweed control will be limited if required to a few acres. The lake proper is adjacent to Daisy Lane SW. Tumwater. If you are withdrawing water for potable or domestic water use, livestock watering, or irrigation, and have no alternate water source, please contact the applicator Northwest Aquatic Eco-Systems at 360-357-3285 or pondweeds@comcast.net to arrange an alternate water supply.

If you would like to request additional notification prior to treatment, or have further questions, please contact Northwest Aquatic Eco-Systems using the information above.

This herbicide treatment is regulated under a permit (NPDES) issued by the Washington State Department of Ecology. **Permit # WAG 994137**