The Case for an Accessible Path for Vermont Lake Associations to Use ProcellaCOR to Control Invasive Milfoil

THE FEDERATION OF VERMONT LAKES AND PONDS

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To: Act 57 Study Group **Date:** November 10, 2023

Topic: The case for an accessible path for Vermont lake associations to use ProcellaCOR to control invasive milfoil

From: Federation of Vermont Lakes and Ponds (FOVLAP)

Executive Summary

Our lakes are stressed on many fronts and timely action and care is needed. Eurasian watermilfoil infestation is a major stressor on Vermont waterbodies. Lake Associations partner with state agencies to provide this care. Experience fighting widespread infestations has demonstrated that using herbicide is essential to achieve sustainable control. The herbicide, ProcellaCOR, is particularly effective, with little or no harm observed. It is well documented on lakes with widespread infestations, that controlling established and dense infestations of milfoil by only non-chemical methods has been unsuccessful. The evidence of low risk when using this herbicide - and observing the inevitable loss of lake habitat, property values, and tourism without it - favors a permitting application and review process that remains rigorous but without unjustified new burdens.

Introduction - Balancing Risk

Vermont's lakes are a precious resource for the state. They are valuable public assets that provide environmental, ecological, economic, and recreational benefits to all our citizens and to our many visitors. The state's lakes attract tourists that boost revenue for the state's economy and shoreline properties are important contributors to state and municipal tax bases.

Aquatic Invasive Species (AIS) threaten lake ecosystems and impair recreation in an ever-growing fraction of Vermont lakes. AIS are biological pollutants that can permanently alter the aquatic ecosystem, squeeze out native species, inhibit recreation, and reduce water quality. Once established in a waterbody, AIS is extremely difficult to contain, control, or eradicate. AIS can damage aquatic ecosystems, and if not prevented or adequately controlled, can cause serious and permanent environmental damage. The most widespread AIS in Vermont's lakes is Eurasian watermilfoil (EWM), an invasive aquatic plant that spreads rapidly, forming dense surface mats, and which has no natural predators or controls in our environment.

To maintain the state's vital public waters requires action on many fronts. By state statute, the responsibility for such action lies with the Agency of Natural Resources (ANR). There is a dedicated but small team in the Lakes and Ponds Program tasked

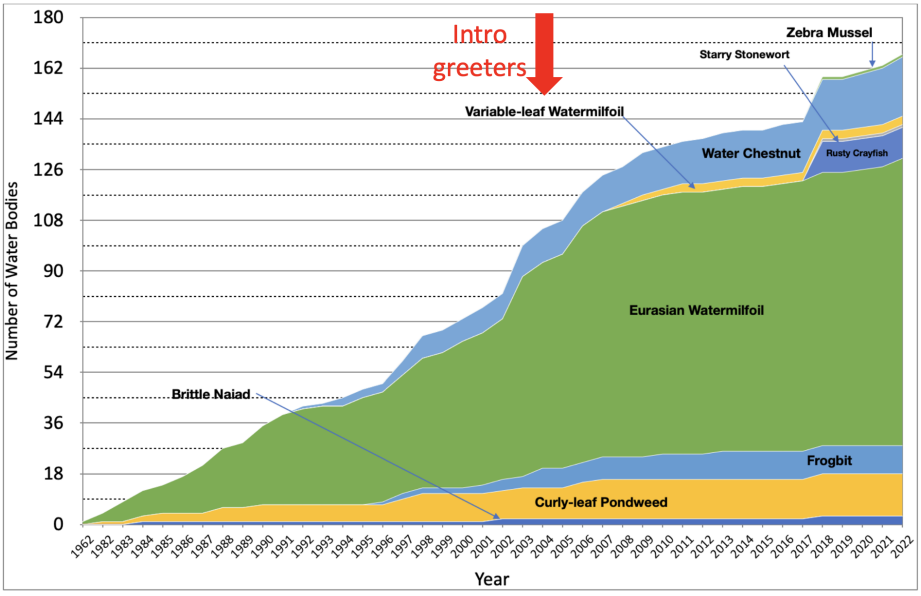
with AIS management – permitting, control, spread prevention, education and grant assistance. They work in partnership with Lake Associations to address these stressors - to reverse or at least to slow the degradation taking place.

Action involves risks. In the context of the rapid spread of milfoil and the resulting damage to aquatic ecosystems, inaction may carry more risk. This document makes the case that EWM management using the best available herbicide, ProcellaCOR, is an action justified by an evidence-based risk assessment.

Background - Controlling invasive milfoil is a growing problem putting significant stress on Vermont's lakes and ponds and volunteer lake associations

The number of Vermont lakes infected with milfoil continues to grow and is now around 100. (Figure 1 below). Figure 2 shows that costs associated with milfoil management are growing as well. (Figures from a presentation by Kim Jensen, VTDEC, at a FOVLAP event on funding for AIS management.) Since 2003, the yearly Aquatic Nuisance Control (ANC) Grant in Aid Funding totals have remained roughly constant, while the number of lakes requesting funding has increased from ~30 to ~50, and the yearly request totals have increased dramatically (Figure 2).

This means that municipalities and lake associations are facing an increasing financial burden to maintain control. Lake associations also need to use their resources to address other lake stressors, like nutrient loading and to encourage more lake-friendly shoreline development. One factor holding milfoil control costs down is the ability to use aquatic herbicides.



Historical Infestation of Vermont Water Bodies Based on DEC Data Set

Figure 1 – Eurasian Watermilfoil is a serious and growing problem for Vermont Lakes

What about non-chemical means to control milfoil? If addressed early, eradication by non-herbicide means is possible. However, with dense or widespread infestation over many years,the experience of our member lakes is that benthic mats, hand-pulling and Diver Assisted Suction Harvesting (DASH) slowed the spread but did not stop or reverse it.

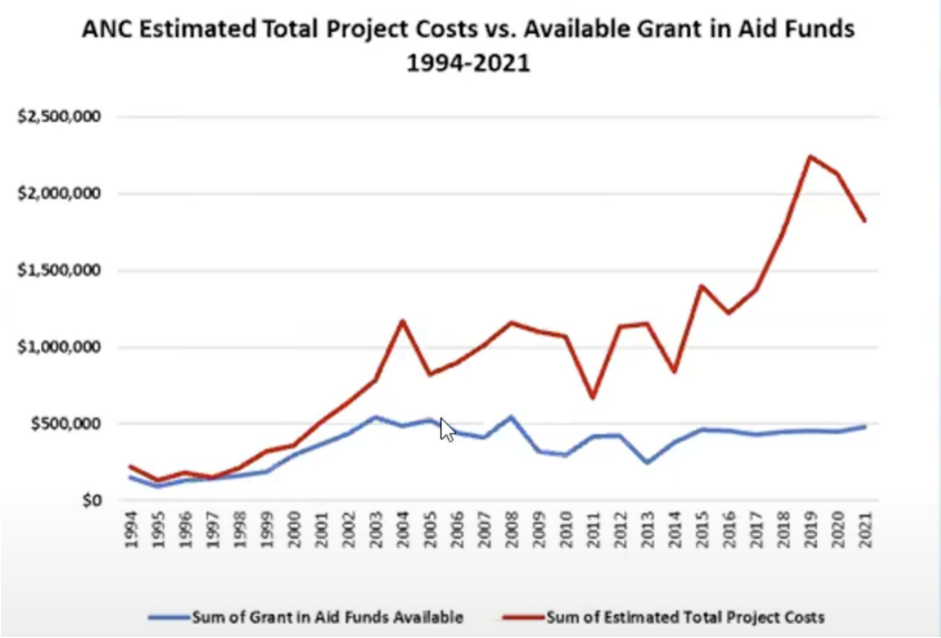


Figure 2 – There is a growing gap between funding needs and available state funding

These non-chemical techniques have known problems and require vigilance. In some cases, if extreme care is not taken while performing DASH, fragmentation can occur, which can spread the infestation. Hand pulling is less disruptive but not applicable to dense patches. Benthic mats kill everything underneath and are difficult to maintain.

In late August, 2023, the FOVLAP ad-hoc Committee on Milfoil Control was formed representing a group of 11 lake associations that have used or applied to use ProcellaCOR for milfoil management on 14 lakes. These are Beebe, Bomoseen, Burr, Dunmore, Fairlee, Hortonia, Iroquois, Lily, Little, Morey, Pinneo, St. Catherine, Salem, and Sunrise. Those associations that have used it are unanimous in rating ProcellaCOR as a highly effective milfoil control tool without harmful effects.

Of note, the Vermont DEC recently issued a draft denial for the Lake Bomoseen Association's ProcellaCOR permit application. FOVLAP submitted a comment in response to this denial expressing concern about the misinformation regarding the use of herbicides to control milfoil which arose around this application. FOVLAP also addresses this misinformation in the Q&A section at the end of its milfoil webpage.

FOVLAP is working with association representatives from these lakes to share information and to advocate for continued careful and judicious access to the use of this herbicide. Importantly, there are ~85 other lakes with milfoil infestations that may eventually need to consider using herbicide.

For these lake associations milfoil control is the most time-consuming and costly activity. Typically volunteer association board members apply for and implement the requirements for permits, inform stakeholders, and hire dive crews, herbicide treatment specialists, water sample analysis services, and aquatic plant surveyors. They must also work with municipalities to apply for ANC grants and other sources of funding, as well as conducting fundraising campaigns. And they must educate their membership and the surrounding communities about these activities. These burdens are testing the capacity of lake associations to manage milfoil and their ability to fulfill their roles in the partnership with the state. If local management ends, will the state fill this role?

Vermont lake associations are non-profit organizations with missions typically to protect and preserve their lakes for future generations. Their work to control AIS benefits not only association members but also the Vermont public and visiting tourists who enjoy these vital resources.

Risk of using ProcellaCOR - As vigilant use is increasing and more years pass with no or little negative impact, unknown risk of long-term impacts is falling

ProcellaCOR was certified by the EPA in 2018 for use in aquatic invasive weed control and for aquatic weed control in rice fields. It was approved for invasive weed control in Vermont shortly thereafter. Prior to certification, it was used in required registration trial studies (Experimental Use Permitting) in several states. Since certification, it has been approved for use in many states in the US, with good results. Figure 3 shows a map of certified specialist locations in the US from SEPRO, the manufacturer.

Figure 3 – ProcellaCOR treatments are taking place in much of the US

Compared to earlier herbicides (Sonar, Renovate) previously permitted for use in Vermont, ProcellaCOR's benefits include significant reductions in required use rates, better selectivity, and better spot treatment performance. Since ProcellaCOR is narrowly targeted to milfoil and can be used in much lower dosage levels, it is now the only herbicide permitted by the state to control EWM in Vermont.

In 2015, the State of New Hampshire was authorized under Sepro's EPA issued Experimental Use Permit to use ProcellaCOR. Since full EPA registration in 2018, ProcellaCOR has been used in 50 New Hampshire lakes with good results and only minor impacts on native plants. (See talk by limnologist Amy Smagula of NH Department of Environmental Services in video at 1:04:00)

The specificity of ProcellaCOR is well documented in Vermont Lakes, where pre- and post-treatment plant surveys are part of the permitting requirements. The product label does list a few plants native to Vermont that can be impacted by ProcellaCOR, for example, coontail and yellow water lily. When spot ProcellaCOR treatments are permitted to control milfoil in a lake, by statute, permit decisions consider impacts to non-target plants with known sensitivity in determining permit issuance or denial. Following several years of use and using data from the pre- and post-treatment aquatic plant surveys, DEC performed a statistical analysis of ProcellaCOR use in Vermont lakes. This analysis showed statistically significant decreases in milfoil, and statistically significant increases in native plants, as they reestablish in previously infested areas.

In the roughly 8 years since laboratory studies began characterizing ProcellaCOR's effects on aquatic plants and animals, its use has become widespread as an approved tool for milfoil control, with tolerable, temporary impacts on a few native plant species in Vermont and no evidence of effect on aquatic or terrestrial fauna. Long-term use may have risks yet to be identified. Continued permit required aquatic plant surveys and data sharing should identify negative effects if they exist.

Risk of not having accessible path to use herbicide is known - Lakes unable to control milfoil by other means and unable to obtain herbicide permit will lose control, resulting in reduced lake health, falling property values, declining tax base, and reduced tourism

From decades of managing milfoil in Vermont waterbodies, case studies from three lake associations, the Lake Dunmore Fern Lake Association (LDFLA), the Lake Iroquois Association (LIA) and the Salem Lakes Preservation Association (SLPA) address the risk of not having a permitted herbicide available as a management tool. **(More details, including maps and graphs are available in the Appendix**)

Lake Dunmore Fern Lake Association – Volunteer divers were able to control milfoil for many years in these two lakes, 985 and 69 acres, respectively, when it was in isolated bays. As it spread more widely, non-chemical methods, benthic mats, hand pulling, and DASH were all employed. In the late 2000's harvest yields and costs began to sharply increase, despite expanding efforts to bring milfoil under control. At one point there were 15 divers and 4 DASH boats, and even this effort failed to control the infestation. It was only after spot herbicide treatments (<10% of littoral zone) that yields and costs stabilized. ProcellaCOR was particularly effective. After one treatment in 2020, costs and yields are down, and divers spent more of their time pulling scattered plants, as opposed to DASH.

Lake Iroquois Association – In this 247 acre lake, heavy infestation was discovered in 2014 with infestation in >70% of the littoral zone. After obtaining permits in 2016, benthic mats and DASH were used, but it quickly became clear that using these approaches would be prohibitively expensive to achieve effective, lake-wide control. A professional plant survey in 2019 indicated an increase in the infestation and a decline in the native species abundance. This data triggered an extensive effort to file an herbicide permit application - a submittal which was over 100 pages. Nearly a year later, a decision allowing the use of ProcellaCOR was issued, and treatment followed in June of 2021. Comparison of pre- and post-treatment plant surveys indicated significant increases in several native species and a minor decrease in coontail, which was predicted. Milfoil was not visible in the treated areas in the fall of 2021, and the following year scattered plants were hand pulled in other parts of the lake.

Salem Lakes Preservation Association – Unable to achieve sustained control of milfoil using non-chemical means, SLPA treated 78 acres on Big Salem Lake in August, 2023. A fall 2023 professional plant survey showed one small sparse patch in an untreated area of the lake.

Impact of uncontrolled milfoil on a lake *– Left unchecked, scientific research and Vermont's own experience shows milfoil will spread throughout the littoral zone of a lake, will form extensive, dense beds, and outcompete and suppress native plants, including rare, threatened, and endangered species.*

Unmanaged milfoil can also:

- Impede recreational activities like fishing, boating, kayaking, and swimming
- Decrease light penetration – limits photosynthesis and can cause algae blooms
- Decrease habitat complexity – reduces biodiversity and impacts the food web
- Decrease oxygenation – lower oxygen can lead to algae blooms
- Increase sedimentation – a buildup of 'muck' and loss of water depth

- Increase nutrient loading – a release of phosphorus from the sediments causing algae blooms
- Accelerate eutrophication – enriching the lake with nutrients (phosphorus) which can lead to excessive plant and algae growth
- Affect pH and temperature levels – many aquatic organisms have a preferred pH and temperature range

Figure 4 – Uncontrolled milfoil growth on Silver Lake in Leicester.
Photo taken less than 2 years after infestation was first observed.

As a perennial invasive aquatic plant, milfoil 'keeps coming back.' Whether an area was cleared of milfoil by hand removal, DASH, benthic barriers, or spot treatments of ProcellaCOR, milfoil is prolific, aggressive, and can grow in a wide range of environmental conditions - temperatures, light regimes, nutrients and sediment types.

Milfoil spreads primarily by stem fragments that can easily reinfest newly controlled areas. By no means are control efforts, time, and cost wasted, as the goal of these programs is to keep milfoil at manageable levels where lake health or recreational use are not significantly impacted.

Impact of uncontrolled milfoil on property values *– The 14 lakes represented by the ad-hoc committee have a combined total of roughly 3000 shoreline property owners holding property totaling almost $1 billion in value. In many cases these properties comprise the bulk of the tax base for these communities. If property values are stable or rising, these communities also see a healthy market for property maintenance and improvement. Studies have shown that uncontrolled milfoil infestation leads to significant loss in property values. For example, a 2014 study in Washington showed reductions of 19% or an average of approximately $94k/unit after adjusting for house size and other factors affecting real estate values.*

With 85 more Vermont lakes with milfoil infestations potentially in need of treatment in the future, the cumulative impact of a lack of access to the use of an effective herbicide like ProcellaCOR on property values and the economic health of lake communities is substantial.

Impact of uncontrolled milfoil on tourism *– Conditions such as those represented in the photo in Figure 4 will eventually impact all recreational uses of these waterbodies. Swimming, fishing, kayaking, canoeing, paddleboarding, sailing, waterskiing, wake sports, leisure boating all become much less desirable in these conditions. A 2021 report by the US Commerce Department found that outdoor recreation accounts for 4.1% of Vermont's GDP. "Tourists account for $3.0 billion in annual spending on lodging, food and drink, goods and services'' according to a Vermont Department of Tourism 2022 Report. A 2014 Department of Tourism survey conducted by UVM found that 16% of tourists visiting Vermont engaged in canoeing and kayaking. Lakes are homes to many state parks and summer camps that attract tourists. A 10% reduction in these visitors would mean about $50M loss to the tourist economy.*

Summary – An assessment balancing unknown long-term risk of ProcellaCOR usage with known and serious risks to lake health, to property values, and to tourism if lake associations lack access to this tool, favors continued vigilant access to using ProcellaCOR

An increasing share of the burden of preserving Vermont's lakes and ponds falls on the volunteer associations, who must address a host of challenges to ensure the protection and the long-term health of these vital Vermont aquatic resources. Currently, management of invasive milfoil is Vermont's most pressing AIS problem. The current regulations governing this management provides a means to manage milfoil with a high but sustainable cost and with a bearable permitting burden.

Ongoing action is needed to care for and protect Vermont lakes and ponds from the threat of milfoil and other AIS. The Act 57 Study Group's recommendations for changing herbicide use permit regulations should carefully consider the concerns of

the volunteer organizations who are passionately devoting time and resources to milfoil management. The State of Vermont has the statutory responsibility to preserve the public waters of the state. This common goal leads to a vital partnership between the State and the associations. An effective partnership can improve lake health, avoid loss of lakeshore property values, and continue to attract the robust tourist economy that Vermont lakes and ponds provide.

There are numerous examples of lake associations in Vermont who, with the help of State and municipal funding along with their own fundraising efforts, have achieved effective control of milfoil with no evidence of serious harm to lake health - but only after using a permitted aquatic herbicide. The strength of this evidence compels us to argue that lake associations should continue to have access to the use of ProcellaCOR without unjustified new permitting burdens.

If the Act 57 Study Committee findings result in a delay or in significant changes to the permitting process that make the process yet more complex and burdensome, many milfoil infested lakes with active, successful, long term management programs could be negatively impacted, as they seek ANC permit renewals for ProcellaCOR. There would be similar negative impacts to those lakes that will, out of necessity, newly seek herbicide permits to control growing infestations.

Appendix – Lake Association Case Studies

Lake Dunmore Fern Lake Association

The two lakes are home to over 400 households. Over 50% of the property value comprising the tax base in the two municipalities (Leicester and Salisbury) is located on the lakes. Thousands visit the lakes in the summer season to stay at public and private campgrounds as well as large boys and girls camps and a music camp. The Middlebury College crew team uses Lake Dunmore to train and hold regattas.

Lake Dunmore (985 acres) and Fern Lake (69 acres) are served by LDFLA. Both lakes have deep sections, but most of the area of the lakes is less than 20' deep, making them vulnerable to invasive milfoil and its impacts.

For many years LDFLA documented the quantity of milfoil removed each year and the costs associated with managing milfoil. Figure 5 shows the yearly harvest totals for the two lakes. Prior to 2008, milfoil control consisted of volunteers hand-pulling in isolated bays. Benthic mats were also used but proved impractical for the ever-increasing infestation area. Once the infestation spread to many parts of the littoral zone, a crew of divers was hired. Soon, they were equipped with DASH capability to address dense patches. For several consecutive years, harvest yields and yearly costs increased. While some control was achieved on Fern Lake, the situation on Lake Dunmore showed little sign of improvement. During peak cost years, there were 15 divers using 4 DASH pontoon boats. Even this level of effort and cost were insufficient to control the infestation.

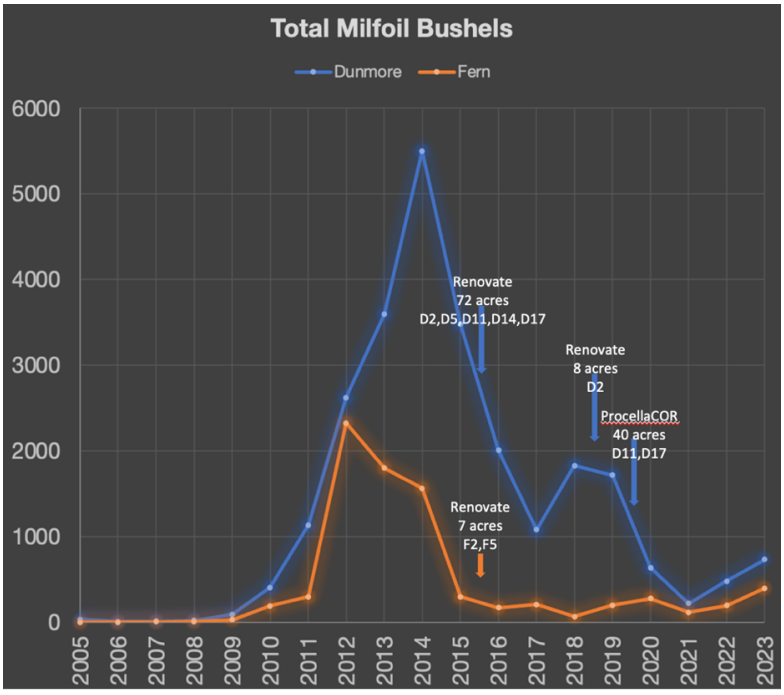


Figure 5 – Yearly milfoil harvest yield in bushels, timing & extent of treatments.

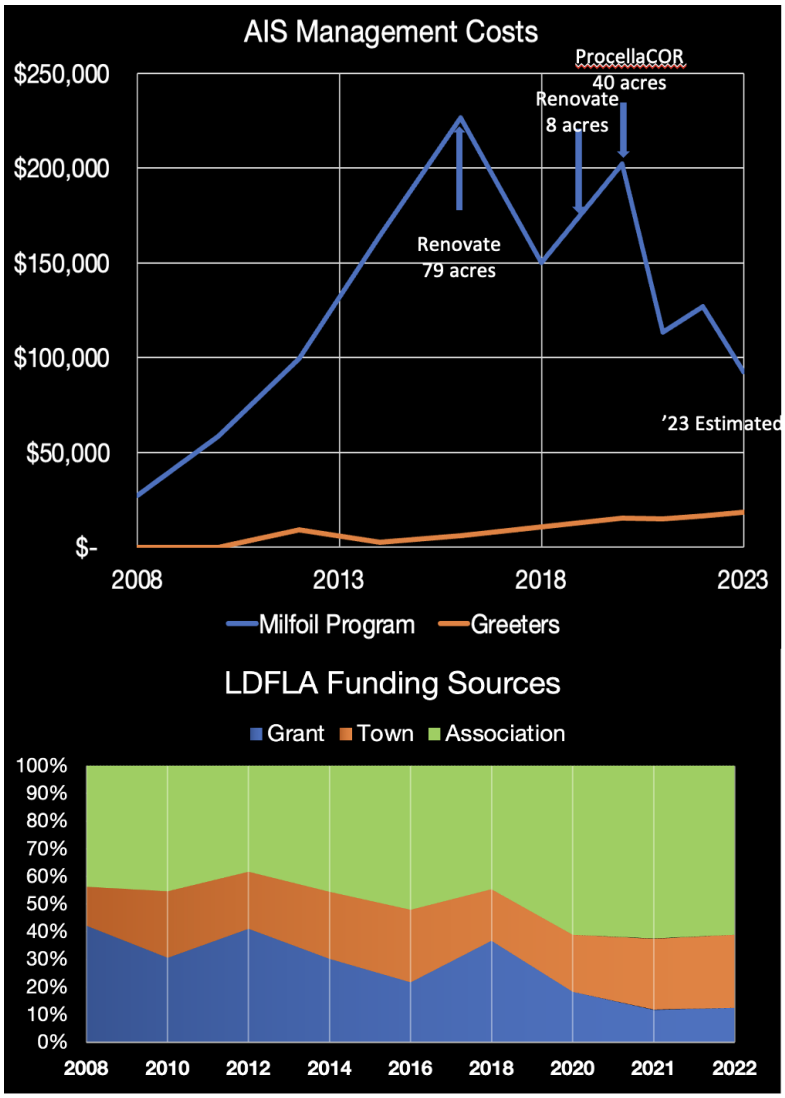


Figure 6 – LDFLA yearly costs for milfoil control and the breakdown of funding

What finally stabilized and eventually reversed cost growth for milfoil control was the use of herbicide for spot treatment of dense patches. Note that relatively small proportions of the littoral zone (≤ 10%) were treated to establish control. Control is even more secure with ProcellaCOR as a management tool. Comparing it to Renovate, LDFLA has data to indicate that its impact on milfoil is greater and lasts longer, while there has been no significant impact on native plants.

In Lake Dunmore, since the 2020 ProcellaCOR treatment, divers have spent less time on DASH and a bigger proportion of their time hand-pulling scattered plants, which is less disruptive. Floating fragments have decreased markedly.

Without access to the use of herbicide, would milfoil control have been practical on these lakes? If so, what would be the cost to control milfoil today on these two lakes

without this tool? If association members had to bear the bulk of this cost, would association membership rise or fall? How would the state of Vermont respond to a lake in this situation, with roughly 500 residents facing declining property values and unable to use this public resource? These are difficult questions, illustrating a situation with high risk of instability. These types of risks need to be considered in a rigorous risk assessment when considering reducing access to aquatic herbicide.

Lake Iroquois Association

Lake Iroquois is a 247 acre lake in Chittenden County. It has a public beach and public boat access and is surrounded by four towns – Williston, Hinesburg, Richmond, and St. George. At approximately 10 miles from Burlington and the most highly populated county in the state, it is heavily used.

In 2023, the Greeters inspected over 2800 boats accessing the lake – and the greeters are only on duty Friday through Sunday between Memorial Day and Labor Day.

The Lake Iroquois Association is a relatively young lake association. It was founded in 2007. At its founding the association faced two major problems: high nutrient content with sediment visibly washing into the lake and a large and spreading Eurasian watermilfoil infestation.

The association immediately began an organized effort address these problems:

1. Setting up a greeter program 2007 with the hot water boat washer added in 2017
2. Reduction of phosphorus levels and sediment runoff by:
    a. Tributary monitoring to track sources of pollutants
    b. Creating rain gardens
    c. Replanting streambanks to reduce erosion
    d. Installing catch basins to divert runoff
    e. Outreach and education including publishing a property owners manual
    f. Increasing participation in the Lake Wise program
    g. And creating a website, Facebook page, and email list

These efforts met with notable success by significantly decreasing the phosphorus levels in the lake: https://www.lakeiroquois.org/water/lake-data-maps
By 2022, only 15 years after it was founded the LIA had become only the third lake in the state to reach Lake Wise gold status with 15% of the properties on the lake meeting Lake Wise standards.

However, none of this affected the milfoil problem. In fact, it was growing worse and spreading. In 2014, the LIA undertook a process to study the problem, research options, and develop and implement a plan to reduce and control the milfoil infestation. That process began with a whole lake plant survey in 2014 to quantify the problem. The survey found that over 70 acres out of a 100 acre littoral zone (the area of the lake where aquatic plants can grow) were infested with Eurasian water milfoil.

The board then explored options for control including hand pulling, Diver-Assisted Suction Harvesting (DASH), benthic mats, and herbicide. This part of the process included gathering information from other lakes that were already working on their milfoil infestations and using their experiences to inform the LIA's decision making process. The LIA board felt that it would be wasteful to go down paths that other lakes had already found to be ineffective or prohibitively expensive.

The options that the board looked at were hand pulling, DASH, benthic mats, and herbicide. Hand pulling, since it did not require a permit, was already being done by many people around the lake. However, it was clear that given the size and density of the infestation there was no way that hand pulling was or ever could make a dent and that it was very possibly adding to the spread due to the fragmentation hand pulling causes.

The board then turned to DASH and benthic mats. Both required permits, which were granted in 2016. What the LIA learned about DASH was:

1. it was slow, ½ to 1 acre/week, due to the density of the infestation
2. expensive – up to $10,000/week for one DASH boat
3. could still spread milfoil because of fragmentation
4. disrupted the sediment sending legacy phosphorus into the water column.

Given that the lake at that time had 70 acres of milfoil infestation, much of it extremely dense, it quickly became clear that at 1 acre/week costing some $10,000 each week, there was no chance of ever getting the infestation under control. Given that the season during which DASH can be done is maybe 12 to 15 weeks, this option was untenable.

After that, DASH was used on the lake to clear smaller areas where heavy boat traffic was likely to cause fragmentation, such as near the boat access. In addition, a permit for benthic mats was received and the mats were used in the boat channel to keep it clear. The use of such bottom barriers was limited to small areas and are allowed to be placed only for a limited time period because they kill everything under them – not an ideal way to try to protect the native flora and fauna of the lake. Buoys were also

placed to guide boats away from the milfoil areas and direct them into the center, deeper part of the lake where milfoil does not grow.

These efforts, while costly and time consuming, were simply not enough. In fact, things were still worsening. The 2019 plant survey showed that the lake now had 86 acres seriously infested. It also showed an alarming 28% decline in native plant species. (All the Lake Iroquois plant surveys can be found on the LIA website here: https://www.lakeiroquois.org/water/plant-surveys)

This data led to the decision to apply for an herbicide permit. Such a decision was not undertaken lightly. Every effort was made to find a way to protect the aquatic habitat from degradation by this invasive without resorting to the use of a pesticide, but none of the mechanical options were working.

The application that the LIA submitted for the use of ProcellaCOR was nearly 100 pages and included:

- Integrated Five-Year Pest Management Plan
- Background on the lake
- Treatment Plan, including technical details of application process
- Documentation of control activities for EWM
- Plant survey reports
- ProcellaCOR research, technical, and safety information
- Maps: detailed vegetation distribution and planned treatment areas
- Application forms
- Copy of the mail notice of application submission to all properties abutting the lake and one mile downstream which involved gathering names and addresses from the Grand Lists of three towns (St. George has no properties directly abutting the lake)

(The complete application along with other documentation relating to this application can be found on the LIA website here: https://www.lakeiroquois.org/invasives/milfoil-control-efforts)

The activities leading up to and following the submission of the herbicide permit application involved a number of public presentations to the general public, local Selectboards, and the lake community as well as distribution of press releases to local and regional media outlets, email notices to the LIA mailing list, information posted on the LIA Facebook page, and all documents posted on the LIA website.

The permit was finally issued in February of 2021, nearly 1 year after the application was submitted – and 7 years after this milfoil research and control project had begun.

Treatment of 37 acres (permit allowed no more than 40% of the littoral zone to be treated in any one year) took place on June 28, 2021. The results were:

- No viable EWM in treatment area
- Scattered EWM in southern area of lake (hand pulled by LIA members)
- Robust native plant re-growth for most native species within and adjacent to treatment area
- Water lily leaves near treatment area showed some browning on edges immediately after treatment, but recovered by end of season.
- No adverse impact to water quality. Dissolved oxygen levels ranged from 8.3 to 8.6 ppm throughout the water column in the treatment area.
- No adverse impact to aquatic or terrestrial species
- No re-growth of EWM was found in Fall 2021, Spring 2022, or Fall 2022 aquatic plant surveys

The post-treatment aquatic plant surveys show just how quickly native plants rebounded after treatment. (All plant surveys are available on the LIA website here) After treatment, native plants were filling in where the milfoil had been. Some examples are:

- Elodea: 26.9% pre-treatment to 44.6% post-treatment
- Muskgrass: 17.9% pre-treatment to 33.8% post-treatment
- White waterlily: 7.5% pre-treatment to 15.6% post-treatment
- Largeleaf pondweed: 11.9% pre-treatment to 22.1% post-treatment
- Coontail (*Ceratophyllum demersum):* 7.8% pre-treatment to 6.5% post-treatment (Note: Coontail is known to be slightly sensitive to ProcellaCOR. However, by Fall 2022 it had rebounded to 10.1%)

The careful use of ProcellaCOR allowed control of the infestation of invasive milfoil and it allowed native aquatic plant species to quickly rebound. Along with decreasing phosphorus levels, Lake Iroquois is now healthier and in a more balanced and natural state than it has been in many years.

Lake Iroquois before treatment

Lake Iroquois after treatment

In addition, ProcellaCOR was more cost effective. The Iroquois application, including the extra costs of plant surveys, notification mailings, and the hiring of contractors for the application and water testing, cost approximately $1500/acre and the treatment took only about 4 hours to treat 37 acres.

What was experienced at Lake Iroquois is an example of what can easily happen to a lake when an invasive is allowed to spread out of control. It doesn't take long to damage an aquatic ecosystem. The science and the data are clear. The careful and controlled use of ProcellaCOR works and does not cause adverse effects on plants, animals, or humans. It reduces large infestations quickly, avoiding the potential problems caused by hand pulling or DASH such as fragmentation, disruption of the lake bottom, or in the case of benthic mats – killing everything under them.

The aquatic herbicide permitting process in Vermont is one of the strictest in the nation. It is careful, rigorous, and most importantly, based on actual data and scientific evidence. As the Iroquois experience shows, the permits have significant requirements that ensure herbicide use is minimized, and that a fully integrated pesticide management plan is in place and is implemented. With so few tools available to protect our public waters from this damaging invasive, it is important that herbicide remain a viable option to protect the aquatic habitat of the state's public waters.

Salem Lake Preservation Association (SLPA)

Background

The Salem Lakes System is located in Derby and Morgan, Vermont. The system is comprised of two lakes, Big Salem Lake and Little Salem Lake. The State of Vermont recognizes Big Salem and Little Salem as two separate lakes. The SLPA's experience at Big Salem Lake with EWM and ProcellaCOR is the subject of this summary report.

Big Salem is roughly 615 acres and has a shallow, sandy shelf surrounding a majority of the shoreline. The shallow shoreline drops off to depths of up to seventy (70) feet. The littoral zone at Big Salem Lake is roughly 207 acres and supports at least 30 known aquatic plant species.

Effectiveness of ProcellaCOR in Mitigating EWM in Big Salem

- The ProcellaCOR treatment of Big Salem was very effective in mitigating the widespread infestation of Eurasion Water Milfoil.
- Post treatment observations show native aquatic plants are all healthy

History of EWM in Big Salem

In October of 2017 a 50'x50' patch of EWM was discovered in the south end of Big Salem near the State boat access. By 2022 the EWM had grown to engulf nearly all areas (155 acres) of the lake's littoral zone.

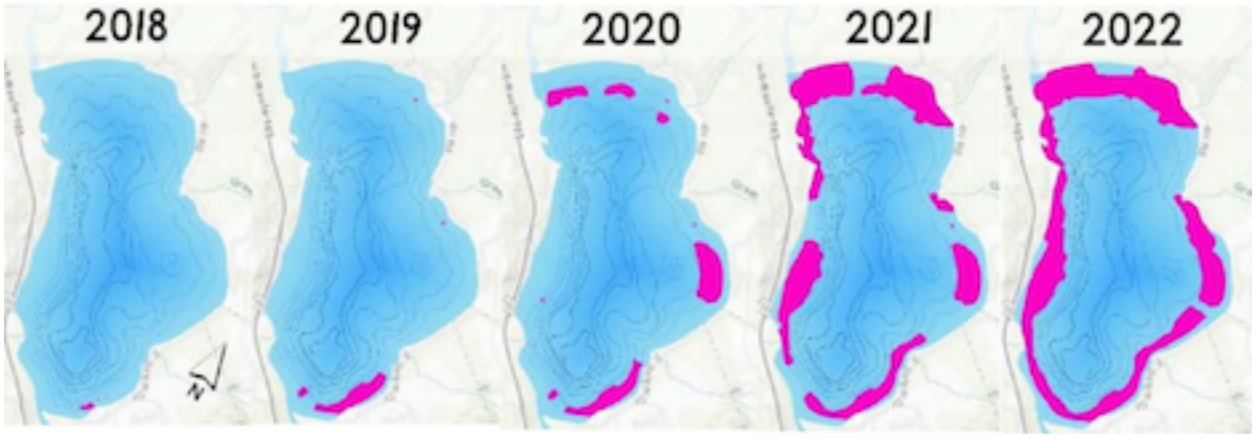
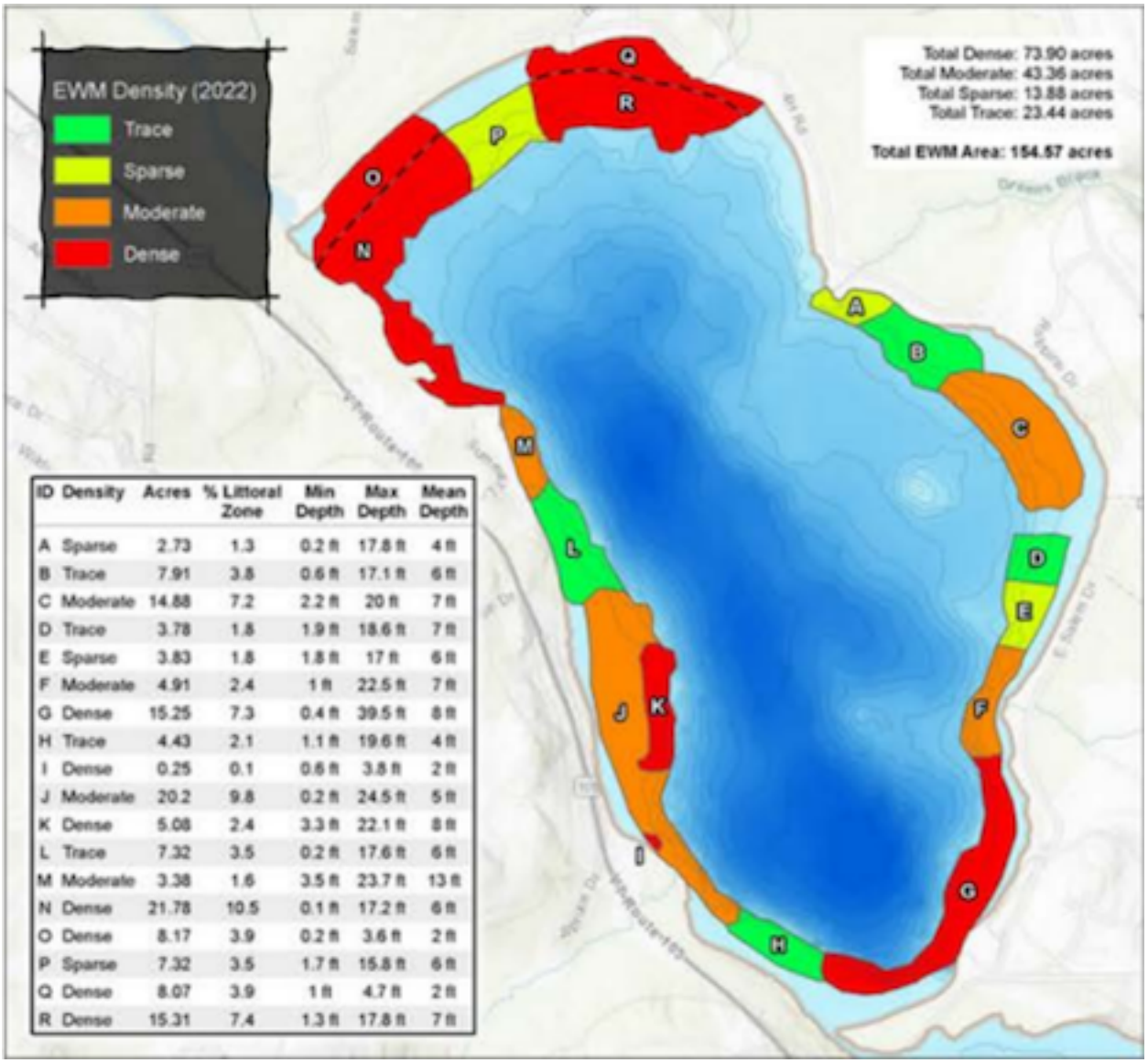


Figure 1 - EWM Progression from 2018 to 2022

Despite SLPA best efforts with Diver Assisted Suction Harvesting (DASH), Bottom Barriers, and Hand Harvesting, EWM continued its exponential growth from 2018 to 2022. This can be seen in Figure 1 (EWM Progression from 2018 to 2022).

2022 Status of EWM in Salem

The 2022 status of EWM in the Lake is shown in Figure 2 EWM Infestation Region Map. This map includes information about the density of each infested region along with acreage, depth and percent of the littoral zone occupied.



ID	Density	Acres	% Littoral Zone	Min Depth	Max Depth	Mean Depth
A	Sparse	2.73	1.3	0.2 ft	17.8 ft	4 ft
B	Trace	7.91	3.8	0.6 ft	17.1 ft	6 ft
C	Moderate	14.88	7.2	2.2 ft	20 ft	7 ft
D	Trace	3.78	1.8	1.9 ft	18.6 ft	7 ft
E	Sparse	3.83	1.8	1.8 ft	17 ft	6 ft
F	Moderate	4.91	2.4	1 ft	22.5 ft	7 ft
G	Dense	15.25	7.3	0.4 ft	39.5 ft	8 ft
H	Trace	4.43	2.1	1.1 ft	19.6 ft	4 ft
I	Dense	0.25	0.1	0.6 ft	3.8 ft	2 ft
J	Moderate	20.2	9.8	0.2 ft	24.5 ft	5 ft
K	Dense	5.08	2.4	3.3 ft	22.1 ft	8 ft
L	Trace	7.32	3.5	0.2 ft	17.6 ft	6 ft
M	Moderate	3.38	1.6	3.5 ft	23.7 ft	13 ft
N	Dense	21.78	10.5	0.1 ft	17.2 ft	6 ft
O	Dense	8.17	3.9	0.2 ft	3.6 ft	2 ft
P	Sparse	7.32	3.5	1.7 ft	15.8 ft	6 ft
Q	Dense	8.07	3.9	1 ft	4.7 ft	2 ft
R	Dense	15.31	7.4	1.3 ft	17.8 ft	7 ft

Figure 2 - EWM Infestation Region Map

2023 ProcellaCOR Treatment of EWM in Salem

SLPA was able to complete all requirements to get a State permit for ProcellaCOR treatment including an extensive long term EWM Mitigation Plan in early 2023. The process to get a ProcellaCOR permit for the lake was long and complicated.

With no opposition from the public, approximately 78 Acres of Big Salem Lake was treated with ProcellaCOR on August 17th 2023.

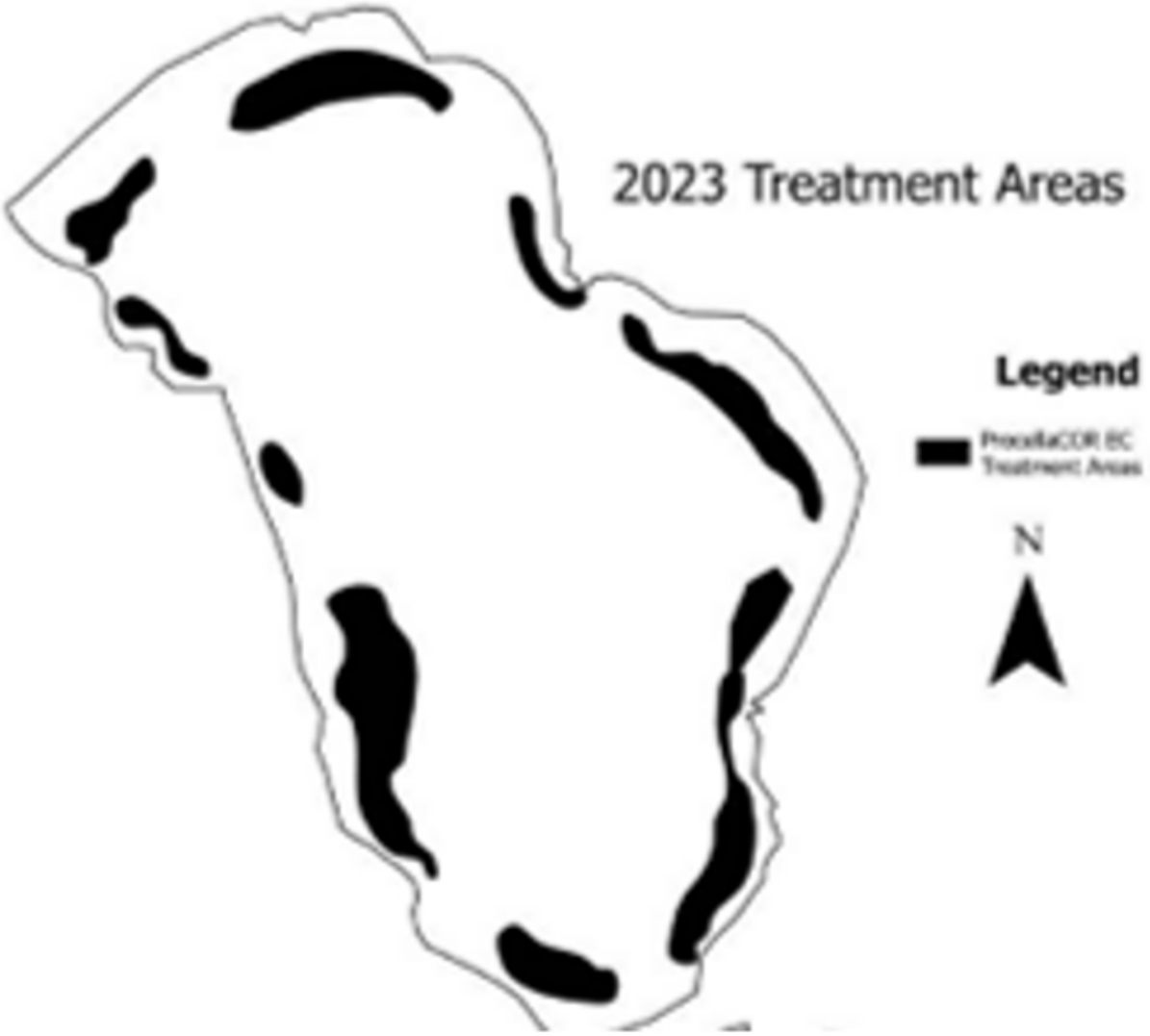


Figure 3 - ProcellaCOR treatment Map

The mandated 48 hour post treatment water sample results showed that ProcellaCOR was undetectable.

2023 Post Treatment ProcellaCOR Treatment Observations in BIG Salem

In the initial days after treatment observations from volunteer inspectors and property owners around the lake were good. EWM plants looked wilted and a darker green or black in color. After 3-4 weeks, dead and decaying EWM plants could be seen on the bottom of the lake. Two months after ProcellaCOR treatment 155 acres EWM has been virtually removed from the lake.

From initial observation ProcellaCOR has proven to be far more efficacious than all other mitigation methods used to date (hand pulling, bottom barriers, and DASH – Diver Assisted Suction Harvesting).

SLPA is looking forward to post treatment Comprehensive Plant Survey results from Arrowwood Environmental.

Figure 4 - Post ProcellaCOR Treatment Infestation Map

After the 78 acre ProcellaCOR treatment, Plant Survey and Volunteer Searches found one remaining EWM Patch. This can be seen in Figure 4 (Post ProcellaCOR treatment infestation Map). The EWM patch is ~ 0.06 sparse acres. Volunteer Hand Harvesting was used to manage fragmentation in this remaining EWM patch.

Costs and the Decision to treat with ProcellaCOR

The decision to go with ProcellaCOR was based in part on an EWM Mitigation cost table SLPA developed, over years of experience.

ProcellaCOR was determined to be 3-4 times less expensive in moderate & dense abundance than all other methods. This can be seen in the following figure (Figure 5. Estimated EWM Treatment Costs).

Estimated EWM Treatment cost per acre per year

Rank	Infestation Abundance	Biomass estimation (g/sqr m)	Biomass estimation (Lbs/Acre)	DASH Low Cost per acre per year	DASH High Cost per Acre per year	ProcellaCor Cost per acre per year	Bottom Barrier Cost per acre per Year including pre-treatment Low DASH costs	Hand Harvesting Low Cost per acre per Year	Hand Harvesting High Cost per acre per Year
0	No Plants	0	0	$0	$0	$1,200	$12,400	$0	$0
1	Trace	.0001 - 2.000	0 - 17.9	$350	$1,400	$1,200	$12,750	$0	$54
2	Sparse	2.001 - 140.000	17.9 - 1249.8	$1,400	$2,333	$1,200	$13,800	$54	$3,749
3	Moderate	140.001 - 230.000	1249.8 - 2053.2	$2,333	$3,500	$1,200	$14,733	$3,749	$6,160
4	Dense	230.001 - 450.000	2053.2 - 4017.2	$3,500	$7,000	$1,200	$15,900	$6,160	$12,052
4	Dense (Vertical Wall)	Greater than 450.000	Greater than 4017.2	$7,000	$9,333	$1,200	$19,400	$12,052	$16,068

Figure 5 - Estimated EWM Treatment Costs

Summary and Conclusion

- The ProcellaCOR treatment demonstrated that it is very effective, safe, and cost effective in mitigating the widespread infestation of EWM.
- The process to get a ProcellaCOR permit for the lake was long and complicated.
- Post treatment observations show native aquatic plants are all healthy.

Observations by volunteer diver Ed Wells on Big Salem Lake

These comments and observations are provided by someone actively involved in attempts to control Eurasian Water Milfoil (EWM) at Big Salem Lake in Derby from 2019-2022. I presently serve as the lake association's VP and manage the Greeter Program at the state boat access. As summer cabin owners using lake water for domestic uses and occasionally consuming fish, we have keen interest in the safe use of herbicides.

Brief history: EWM was first discovered in Salem Lake in 2017 by a contractor doing an annual lake survey for invasives. A 50'x50' patch was discovered near the boat access on the east shore and was removed by suction harvesting (DASH) in late October 2018. All thought it was under control. To our surprise, in 2019, I discovered a patch of EWM similar in size to the original while in-water surveying with snorkel and mask just 1-200 yards north of the initial discovery. By 2020-2021 EWM was beginning to show up over a mile away to the northwest. Hundreds of hours in planning and mitigation efforts by volunteers and a professional diver yielded minimal gains. It needs to be said that I nor any other volunteer had previous experience managing aquatic invasives. Mistakes were made early on and guidance was sought from numerous private and state sources.

By 2021 I began suggesting to lake peers and other stakeholders that a more powerful tool was needed at Salem. Stakeholders were polled on the herbicide question and information about ProcellaCOR disseminated. Consultants green lighted our use of this herbicide as the lake has over 200 acres of robust littoral area (plant growing), in a Mesotrophic-rated lake.

In 2022 and 2023 we were a net "exporter" of EWM; boats leaving Salem Lake had over 12 times the amount of EWM on them as boats attempting to launch from other lakes and ponds, according to DEC Survey 123 data generated by our Greeters.

What I've learned so far and suggestions:

- Lakes with abundant native aquatic plant life makes searching for and effectively removing invasive EWM by hand or DASH very challenging. At times a diver is unable to spot EWM just two feet away in dense pondweed infiltrated by EWM. Salem hosts 30 different native plants, seven of which are the dominant pondweeds.
- Water visibility becomes clouded when EWM plants and roots are extracted from the sediment making it difficult to capture plant fragments. Even our very experienced diver could not prevent creating fragments, especially when hand pulling large numbers of plants. Large quantities of fragments were released on at least two occasions. Extracting plant-forming roots from the sediment is a vital step and one can never be sure all have been removed.
- Not all fragments can be removed by boat. From personal observations, fragments in the water column tend to drift off or settle in the immediate area. Madsen et al. (1997) found that 46% of EWM plant fragments form new plants.
- DASH (suction harvesting) also produces fragments.
- Bottom barriers work well in some EWM infestations but less so in dense EWM patches that first need to be harvested.

- A 40% yearly limit on “cumulative surface area of permitted chemical and non-chemical control projects” (VT DEC’s Permitting Aquatic Herbicide Projects in Vermont, October 2022) seems overly restrictive (and less cost effective) at lakes where native aquatic plants still dominate.
- A rapid response to a new AIS infestation is critical.
- Unregulated boat and recreational activity (of all kinds) greatly interferes with EWM mitigation efforts. Jet skis and other impeller driven craft are notorious at Salem Lake for spreading and creating plant fragments. Other watercraft are also culpable when not used carefully in infected areas.
- Vermont does not have enough skilled (and affordable) divers/contractors. Competition with other lakes for diver time can result in less timely lake maintenance.
- The vagaries of Vermont weather compounded by a warmer climate greatly increases the challenge. Lower, warmer water increases plant growth and risk of fragmentation by lake users. Salem’s EWM growth soared during drought years 2020-2022. See graph at https://droughtmonitor.unl.edu/DmData/TimeSeries.aspx.
- There is a limit to what volunteers can do. Only one VT lake is known to have eradicated EWM without using herbicides.
- We could use more technical support from all state departments. DEC staff are very helpful but their time seems stretched thin.
- One lake neighbor who was thinking of selling his camp because of the milfoil problem is very happy with the results of the ProcellaCOR treatment, as are many others.

In summary, gaining control of an aggressive invasive such as EWM at Salem Lake required an equally aggressive response. Even an experienced contractor found mitigating this plant very difficult using only mechanical means. Salem’s lake association concluded that herbicide use is the most cost-effective approach to managing its EWM problem.