



**A Review of Options  
for Suppressing or Managing  
Eurasian Watermilfoil:**

**Greater Sudbury Watershed Alliance  
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## **1.0 Introduction**

The Aquatic Invasive Species Committee (AISC) of the Greater Sudbury Watershed Alliance (GSWA) was awarded a grant of \$1,000 by the Invasive Species Centre in 2022 to provide a summary of references related to the suppression or eradication of Eurasian watermilfoil. The project resulted in:

- a list of references describing work done elsewhere;
- a table of the topics covered in each reference;
- a summary of any personal communications re the topic; and
- a summary of legislation applicable to abatement activities.

Background information about the project, and the products themselves are provided in the Greater Sudbury Watershed Alliance's report: *A Survey of Options for Suppressing or Eliminating Eurasian Watermilfoil*.

This document provides descriptions of five of the options for dealing with Eurasian watermilfoil identified through the AISC's initial project, and includes considerations to help readers identify which option might be best suited to their particular circumstances.

Disclaimer: This document is intended to be used for informational purposes only. It is not intended to advise, endorse or recommend any particular option for suppressing or managing Eurasian watermilfoil. Furthermore, any options listed for suppressing or managing Eurasian watermilfoil may be subject to applicable legislation, regulation and policies in a jurisdiction. The reader should consult the appropriate agency within their jurisdiction if they are considering using a listed option for suppressing and managing Eurasian watermilfoil.

### **1.1 The Project Team**

The members of the Greater Sudbury Watershed Alliance's Aquatic Invasive Species-Eurasian Water Milfoil Committee served as the reviewers who provided the information included in this report: Alex Cieslewicz, Craig Hamilton, Scott Darling, Ruth Debicki, Bill Querney, and Richard Witham. The report was prepared by Ruth Debicki.

## **2.0 Background**

Eurasian watermilfoil is an invasive aquatic species that typically grows in shallow water (between 1 metre and 4 metres deep) but can sometimes grow in water as deep as 10 metres.

Many factors can influence the rate of growth of Eurasian watermilfoil, including the type of substrate present; fluctuating water levels; water temperature and turbidity; available sunlight and nutrients; and algae blooms. For example, a large-scale blue-green algae bloom developed in the Salmon Arm Bay area of Shuswap Lake in British Columbia in mid-July, 2020. The algae bloom effectively reduced the Eurasian watermilfoil growth by blocking light penetration to the plants below and utilizing the available nutrients. This

resulted in no nuisance Eurasian watermilfoil growth in 2020 and minimal regrowth in 2021.

Many individuals, groups, and governments have been using different methods to suppress or control Eurasian watermilfoil from lakes in jurisdictions across North America for decades, with varying levels of success. The Aquatic Invasive Species Committee of the Greater Sudbury Watershed Alliance has compiled information about the references in its report entitled “*A Survey of Options for Suppressing or Eliminating Eurasian Watermilfoil.*”

Based on the information in the references, the Committee has identified several of the most effective existing methods and provided supplemental information in this document to guide decision making when selecting a method to control Eurasian watermilfoil. Note that different local situations may mean that different methods are best suited for suppressing or controlling, depending upon the circumstances.

Three things are clear with regard to suppressing or eliminating Eurasian watermilfoil:

- there is no ‘magic bullet’ or ‘miracle solution’ that can be used in all situations;
- control methods can be very costly if the Eurasian watermilfoil is well established; and
- control work must be undertaken in the long term.

## **2.1 Legal Considerations**

In Ontario, the beds of most waterbodies are provincial Crown land. The Ministry of Natural Resources and Forestry (MNRF) manages these lands under the *Public Lands Act* and Regulations prescribed in O. Reg. 239/13 under the *Public Lands Act*. Guidance about what can and cannot be done without permits is available at from the Government of Ontario website: [Remove Invasive Aquatic Plants](https://www.ontario.ca/page/remove-invasive-aquatic-plants). The URL for the website is <https://www.ontario.ca/page/remove-invasive-aquatic-plants>.

Because of the complexity of the legislation/regulations/policies that may, or may not, apply to any particular option for removing aquatic invasive species, proponents from outside of Ontario are advised to consult with the relevant government officials for guidance related to manual harvesting in their area.

## **3.0 Five Selected Methods**

Details about each of five selected methods, gleaned from the reports identified in the report “*A Survey of Options for Suppressing or Eliminating Eurasian Watermilfoil*” prepared for the Aquatic Invasive Species Committee and from documents acquired more recently are summarized in a series of appendices.

- manual harvesting (Appendix 1);
- benthic mats (Appendix 2);
- mechanical harvesting (Appendix 3);
- diver-assisted suction harvesting (Appendix 4);

- aquatic herbicides (Appendix 5); and
- implications for the City of Greater Sudbury (Appendix 6).

Appendices 1 through 5 are structured in the same way. They begin with a description of what the method is, and information about one or more of the places where it has been used. Background information about each of the methods is then provided, followed by a list of the pros and cons of the method in question. Each appendix is completed by a list of references related to the method and/or its use in suppressing Eurasian watermilfoil.

Appendix 5 includes information about a test using a new aquatic herbicide, ProcellarCor FX, which was recently approved for application in Canada, at a lake north of Penetanguishene. It appears to hold promise as a safe and effective way of suppressing Eurasian watermilfoil.

Appendix 6 provides information specific to the situation of Eurasian watermilfoil within the City of Greater Sudbury.

Documents with information about two other methods, biological (weevils), and dredging are also included in the list of references in the Greater Sudbury Watershed Alliance's report "*A Survey of Options for Suppressing or Eliminating Eurasian Watermilfoil*," but the methods are not discussed further in this report.

#### **4.0 Conclusions**

Conclusions that can be gleaned from the experiences of others over nearly half a century of efforts to suppress or eradicate Eurasian watermilfoil are as follows.

- Identify the presence of Eurasian watermilfoil as soon as possible.
- Map and – where appropriate – mark the areas within the waterbody where the Eurasian watermilfoil occurs.
- Set realistic goals for suppressing or eradicating the invasive plant.
- Take the cost of the options under consideration into account before deciding on a course of action.
- Select the best intervention method for the local circumstances.
- Expect to spend time before starting work, especially if the course of action selected involves consulting with individuals or government.
- Engage local citizens, stewardship groups, and municipal and provincial governments as soon as possible in the planning process to facilitate permitting and – potentially – assist with financing.
- Understand that there is no guarantee that any permits required for the preferred method of suppressing or controlling Eurasian watermilfoil will be granted.
- Entrust the work to professionals where appropriate.
- Do follow-ups to ensure that Eurasian watermilfoil does not re-establish itself or spread.
- Educate those using watercraft about the impact of Eurasian watermilfoil and the ease of spreading it.

- Accept that work to suppress or control Eurasian watermilfoil must be undertaken in the long term. There is no 'magic bullet' or 'miracle solution.'

The details in the Appendices will help illustrate what each method involves, how it is implemented, and where its use is most suited. In some cases, background information gleaned from case histories and a list of references is provided. Finally, the pros and cons of each method are listed.



## Appendix 1: Manual Harvesting of Eurasian Watermilfoil

### What

Eurasian watermilfoil can be cleared manually (hand pulling), by someone who is wading in the water, snorkeling, or reaching into the water from a boat, canoe, paddle board, or other floating device. Strands of milfoil can be grasped by hand and pulled out by the roots. The strands should be “balled” when being pulled out to minimize the risk of fragmentation.



Eurasian watermilfoil can also be cleared manually using cutting tools. A search of the internet will find many of these cutting tools, along with Youtube videos of how to use at least some of them. Several options are described and illustrated below.

The cutting tools that can be used fall into three general categories:

- standard harvesting tools normally used on land;
- specialized tools for cutting aquatic weeds off at the base; and
- tools for pulling aquatic weeds out at the root and conditioning the lake bottom.

Standard harvesting tools normally used on land include Austrian scythes.



Specialized tools for cutting aquatic weeds off at the base include the Weed Razer and Aquatic Weed Eradicator shown below. Both of these tools come with either rope connections so that the tool can be tossed into the lake, and then pulled back to shore along the lake bottom, or with extender handles to lengthen their reach.



Tools for pulling weeds out at the root or conditioning the lake bottom include the Lake Rake and the Aquatic Weed Roller. The Lake Rake comes with an extended handle that can reach up to 3.3 metres. It can pull Eurasian watermilfoil out by the roots. The Aquatic Weed Roller is intended to be used after the Eurasian watermilfoil has been removed. It is worked back and forth across the lake bottom to dislodge the fine silt and organic material preferred by Eurasian watermilfoil from the lakebed, thereby reducing the chances that the weed will re-establish itself there in the future.



### **Where**

In Ontario, residents may remove invasive aquatic plants such as Eurasian watermilfoil manually without a permit if they comply with all of the following rules.

1. They are the waterfront property owner or conducting work on behalf of the property owner.
2. They minimize the removal of native aquatic vegetation (e.g., wild rice).
3. They dispose of the plants/material they remove on dry land to where it cannot re-enter the water.
4. They operate or store any wheeled or tracked equipment (e.g., wagons or wheelbarrows) that they may use while manually clearing Eurasian watermilfoil on dry land, or on a barge or vessel.

5. They only use mechanical devices (e.g., rake, cutter bar, etc.) or their hands to remove plants, and do not dredge the bed of the waterbody.
6. They do not carry out work during fish spawning season or during the time of other critical fish life stages, as set out in the Ministry's In-water Work Timing Window Guidelines (<https://docs.ontario.ca/documents/2579/stdprod-109170.pdf>).

If they cannot meet all of the prescribed rules, or if they want to conduct control or removal activities outside of the timing window guidelines, they will need a work permit. Guidance about this is available at from the Government of Ontario website at Remove Invasive Aquatic Plants (<https://www.ontario.ca/page/remove-invasive-aquatic-plants>).

In the City of Greater Sudbury, and according to the fish species listed on the City of Greater Sudbury's 'Report Cards' for local lakes and the Ministry of Natural Resources and Forestry's timing windows when in-water work is restricted to protect spawning, Eurasian watermilfoil can be cleared from some local lakes between June 15 and September 1, and from other local lakes between July 15 and September 1.

Because of the complexity of the legislation, regulations, and/or policies that may or may not apply to other areas, proponents from outside the City of Greater Sudbury are advised to consult with the relevant government officials for guidance related to manual harvesting in their area.

## **Background**

In the study entitled "A Survey of Options for Suppressing or Eliminating Eurasian Watermilfoil" prepared for the Greater Sudbury Watershed Alliance, thanks to a grant from the Invasive Species Centre, there were 69 references cited that referred to various attempts to suppress or control Eurasian watermilfoil. Of these, 30 made at least some reference to manual harvesting. However, many of those documents simply indicated that manual harvesting was either going to be done, without providing any information about the effectiveness or long-term outcomes of the work. Others indicated that the manual harvesting would be done as part of a diver-assisted suction dredging program, and not as stand-alone initiatives.

Lessons learned from these documents with regard to manual harvesting include the following.

- Anderson, R.C. & Volkmann, K. (2018) noted that care was taken during manual harvesting at Beaver Lake, Wisconsin, to remove the full plant including roots and to collect any fragments. They also noted that regular removal of recurring Eurasian milfoil plants might be needed.
- Cason & Associates (2016) noted during a study of Beaver Lake, Wisconsin, that manually removing Eurasian watermilfoil plants can be an effective method for handling newly found single plants or small isolated beds. They also noted that

hand-pulling is much easier to perform in shallow water than in deep water, where divers are needed.

- The Federation of Ontario Cottagers' Associations (2017) reported that manual control of Eurasian watermilfoil on a small-scale can be accomplished with little specialized training or equipment beyond a rake, but noted that it can promote regrowth of plants by leaving behind root systems, and by leaving behind fragments of the plants. It noted that getting into the water to gently free entire root clusters by hand can reduce plant fragmentation and increase the effectiveness of the manual harvesting.
- The Golden Sands RC&D video released in 2019 illustrated some best practices for removing Eurasian watermilfoil. The Resource Conservation and Development Council, based in Wisconsin, noted that manual removal can be effective, but is not always the most appropriate method. It also noted that it is unrealistic to remove large stands solely by manual methods. It suggested snorkeling as the best method for doing hand-removal of individual plants, and emphasized the importance of removing the roots, minimizing fragmentation by balling up the plants as they are removed, and collecting any fragments that may break off the plants being collected. It also recommended working with a partner who will collect the plants as they are removed, and noted that removing Eurasian watermilfoil is more difficult in autumn because the plants become more brittle then.
- Hamerla, C. & Druckery, C. (2016) provided information that is reiterated in the Golden Sands RC&D video released in 2019, and noted that the density of Eurasian watermilfoil, the depth of the water, the water clarity, the sediment type, and the size of the work party all play a role in determining whether manual methods are suited to clearing Eurasian watermilfoil from a particular site. They also suggest that – for convenience – anyone clearing Eurasian watermilfoil should have a floating basket of some sort with small perforations into which they can deposit the weeds as they harvest them.
- Hamerla, C. & Skawinski, P. (2012) suggested using “pool noodles” and a mesh bag to make a floating basket in which to collect Eurasian watermilfoil as it is harvested.
- Kelting, D. L. & Laxson C.L. (2010) reported on an intensive hand harvesting project that was undertaken to achieve whole-lake control of Eurasian watermilfoil in Upper Saranac Lake, New York. Beginning in 2004, six crews of divers hand harvested the entire littoral zone of Upper Saranac Lake twice each summer for three years, after which the harvesting effort was scaled down to a maintenance program. The Eurasian watermilfoil cover was reduced to rare (<5% cover) for more than 90% of the littoral area, and plant removal decreased from about 16,640 kg in 2004 to 460 kg in 2006. The density of Eurasian watermilfoil at the end of the project was just 4% of the density at the beginning of the

project, but the costs of this effort were very high. They averaged \$351,748 per year during the intensive phase of the project, and \$146,475 per year thereafter during the maintenance period.

- Milot, S. (2018) noted that hand harvesting Eurasian milfoil by pulling it up from the roots can provide good results if staggered over a period of several years. She reported, however, that the initiative at Lac-des-Plages in the Outaouais region of Québec that gave good results, involved 120 volunteers!
- The Minnesota Aquatic Invasive Species Research Center (2022) noted that manual control of Eurasian watermilfoil, whether by hand pulling, raking, or harvesting, is effective at reducing the current abundance of plants and useful for clearing channels or maintaining access. The report noted, however, that these actions will not result in long-term control, and depending upon growing conditions, several removals may be needed each year if the weeds are cut rather than being pulled out by the roots. Hand pulling can be effective in localized areas or for scattered plants, but is labour intensive.
- In their report on Shawnigan Lake, BC., Williams, H., Willmott, T., Wright, I., & Elliot, T. (2018) described work done in other areas and noted that once Eurasian watermilfoil has become established, it is unlikely that it can be eradicated by hand pulling, and ongoing maintenance will be needed after an infestation has been reduced to an acceptable size.

### **Pros of Manually Removing Eurasian Watermilfoil**

The greatest benefits of manually removing Eurasian watermilfoil are that it can be done relatively inexpensively by homeowners in front of their properties, without permits, at specified times of the year.

- No permit permits are needed to remove milfoil manually from in front of their property if they meet all of the conditions prescribed in O. Reg. 239/13 under the *Public Lands Act*.
- There is no limit to the area that can be cleared manually, provided that all of the conditions prescribed in O. Reg. 239/13 under the *Public Lands Act* are met.
- Hand pulling /manual removal in shallow water is relatively cost-effective.
- Hand pulling/manual removal is good when Eurasian watermilfoil first appears.
- Hand pulling can be effective if carried out over several year, if the roots are removed along with the plants and all plant fragments are recovered.
- Hand pulling is selective, and does not affect other, non-invasive plants.

## **Cons of Manually Removing Eurasian Watermilfoil**

The greatest problems with manually removing Eurasian watermilfoil are that it can be time-consuming and not good for established infestations, especially in areas where the water is deep and/or the lake bottom is not smooth.

- Removal activities are limited to times outside of fish spawning. This is generally between mid-June or mid-July and the end of August, depending upon what fish species are found in the lake.
- Hand pulling is not well suited to areas that are too deep for wading or snorkeling, and may require the costly use of divers in deep water.
- Hand pulling can be physically challenging when dealing with very large plants and large, sediment-laden root balls.
- Hand pulling/manual removal is not a good option once the milfoil has established itself and spread.
- It may require several years of hand pulling for the method to be fully effective.
- If the Eurasian watermilfoil is cut, rather than pulled out, it will regrow, possibly even within the same season, and need to be cut again – just like the lawn.
- The specialized tools for cutting aquatic weeds are not suited for lake bottoms that are not smooth because they catch on rocks, sunken logs, etc.
- Removal by cutting is not well suited to areas that are too deep for wading, or too far from shore for the cutting tools to reach.
- The specialized tools for cutting aquatic weeds and conditioning the lakebed can cost hundreds of dollars each.
- Every broken fragment of Eurasian milfoil has the potential to take root and start a new colony of plants. All of the fragments of plants that have been cleared by hand pulling or cutting must be collected and disposed of on shore.

## **List of References – Manual Removal**

Anderson, R.C. & Volkmann, K. (2018). *Beaver Lake Eurasian Watermilfoil Manual Removal & General Lake Survey Summer 2018*. Retrieved from [https://img1.wsimg.com/blobby/go/a87d1403-62c4-413d-a756-349962d9282f/downloads/1d2625bm2\\_143202.pdf?ver=1568769469449](https://img1.wsimg.com/blobby/go/a87d1403-62c4-413d-a756-349962d9282f/downloads/1d2625bm2_143202.pdf?ver=1568769469449)

Cason & Associates. (2016). *Results of the August 6, 2015 aquatic plant surveys*. Retrieved from [https://img1.wsimg.com/blobby/go/a87d1403-62c4-413d-a756-349962d9282f/downloads/1cjdt2pba\\_177585.pdf?ver=1618409968320](https://img1.wsimg.com/blobby/go/a87d1403-62c4-413d-a756-349962d9282f/downloads/1cjdt2pba_177585.pdf?ver=1618409968320)

- Farlain Lake Community Association. (2022). *EWM Webinar* [presentation]. Retrieved from <https://farlainlake.ca/wp-content/uploads/FLCA-Webinar-Final-PowerPoint-Presentation-.pdf>
- Federation of Ontario Cottagers' Associations. (2017). *Invasive Species Pilot Project: Site Visit Report*. Retrieved from <http://www.wollastonlakehome.com/resources/Wollaston%20Lake%20Invasive%20Species%20FOCA%20Pilot%20Project.pdf>
- Golden Sands RC&D. (2019). *Hand Removal of Eurasian Watermilfoil* [Video]. Retrieved from [https://youtu.be/n-y\\_3v3VqYI?t=480](https://youtu.be/n-y_3v3VqYI?t=480)
- Government of Ontario (2023) *Remove invasive aquatic plants*. Retrieved from: <https://www.ontario.ca/page/remove-invasive-aquatic-plants>
- Hamerla, C. & Druckery, C. (2016). *Manual Removal of Eurasian Watermilfoil: Tools and Strategies* [Presentation]. Retrieved from [https://www3.uwsp.edu/cnr-ap/UWEXLakes/Documents/programs/convention/2016/WedAMworkshops/ChrisHamerlaChuckDruckery\\_ManualRemovalOfEWMTToolsAndProcedures.pdf](https://www3.uwsp.edu/cnr-ap/UWEXLakes/Documents/programs/convention/2016/WedAMworkshops/ChrisHamerlaChuckDruckery_ManualRemovalOfEWMTToolsAndProcedures.pdf)
- Hamerla, C. & Skawinski, P. (2012). *Eurasian Water Milfoil: Manual Removal*. Retrieved from [https://www.fs.usda.gov/Internet/FSE\\_DOCUMENTS/stelprdb5373240.pdf](https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5373240.pdf)
- Kelting, D. L. & Laxson C.L. (2010). *Cost and effectiveness of hand harvesting to control Eurasian watermilfoil population in Upper Saranac Lake, New York*. *Journal of Aquatic Plant Management*, 48, 1-5. Retrieved from [https://static1.squarespace.com/static/5f99750b9f27037eb4c45662/t/6143a803d047303029d9e770/1631823876423/kelting\\_laxson48.pdf](https://static1.squarespace.com/static/5f99750b9f27037eb4c45662/t/6143a803d047303029d9e770/1631823876423/kelting_laxson48.pdf)
- Milot, S. (2018). *Watermilfoil Control Methods: Updated Knowledge*. Federation des lacs de Val-des-Monts. Retrieved from <https://www.federationdeslacs.ca/upload/userfiles/files/Watermilfoil%20methods.pdf>
- Ministry of Natural Resources and Forestry. (1990) *Public Lands Act, R.S.O. 1990, c. P.43*. Retrieved from <https://www.ontario.ca/laws/statute/90p43>
- Ministry of Natural Resources and Forestry. (2021) *O. Reg. 239/13 under the Public Lands Act*. Retrieved from <https://www.ontario.ca/laws/statute/90p43>
- Minnesota Aquatic Invasive Species Research Center. (2022). *Eurasian watermilfoil control options*. Retrieved from <https://maisrc.umn.edu/ewm-control>

Williams, H., Willmott, T., Wright, I., & Elliot, T. (2018). *Eurasian Water-Milfoil Management Plan for Shawnigan Lake, BC*. Madrone Environmental Services Ltd. Retrieved from [https://www.cvrld.ca/DocumentCenter/View/89788/Shawnigan-Milfoil-Report\\_Final](https://www.cvrld.ca/DocumentCenter/View/89788/Shawnigan-Milfoil-Report_Final)



## Appendix 2: Benthic Barriers

### What

Benthic barriers are pieces of material (film or fabric) that are placed on the bottom of a water body to keep sunlight from reaching the sediment on the lake bottom. The barriers block the sunlight and inhibit photosynthesis, thereby keeping aquatic plants from growing where the barrier is placed.

Most benthic barriers are made of material that is heavier than water, which allows it to settle firmly on the lake's bottom. In most cases, however, additional weight is needed to keep the material in place. Benthic barriers can be placed on top of existing vegetation, and should be put into place in late spring at a time that complies with all local regulations.

Benthic barriers can be made of plastic sheeting, usually black in colour. Black sheeting blocks the sunlight better than clear sheeting. Textiles including jute, coir (coconut fibre) or geotextile can also be used as benthic barriers. Geotextile blankets are very similar to landscape cloth, and are available at many hardware stores.



In most cases, additional weight is needed to keep the benthic barrier material in place. The edges of the barrier can be weighted by stones, or the fabric can be stretched onto weighted frames before being submerged.

### Where

In Ontario, homeowners can install benthic barriers without a permit if they follow the rules listed below.

1. They are the waterfront property owner or conducting work on behalf of the property owner.
2. The area covered by the benthic barrier is no larger than 15 square metres.
3. The work is not done during fish spawning season or during the time of other critical fish life stages, as set out in the Ministry of Natural Resources and Forestry's [In-water Work Timing Window Guidelines](#).

A permit is required from the Ministry of Natural Resources and Forestry if a benthic barrier larger than 15 square metres is going to be installed.

## **Background**

Many Eurasian watermilfoil infestations in front of private property in Ontario are larger than the 15 square metres allowed in Ontario without a permit. Benthic barriers work best when the barrier is in direct contact with the bottom of the water body. They are much less effective where there are stumps, rocks, etc. on the bottom of the water body.

Many Eurasian watermilfoil weed beds in Ontario extend many metres from shore. This means that the weeds may still be spread when they are fragmented by homeowners launching watercraft from their dock or shoreline, even after the homeowners install benthic barriers of up to 15 square metres.

Large swaths of jute burlap mats used in Quebec have had a fairly high success rate in controlling Eurasian watermilfoil, however. For example, Lake Pemichangan in Outououais, Quebec observed a 95% success rate in eradicating Eurasian watermilfoil.

It can be costly to apply benthic mats across large areas. At Lac des Abénaquis in Québec, which is one square kilometre in size, a program that prioritized the most problematic Eurasian watermilfoil beds reduced the surface area of infestations by 95 per cent in just five years. However, the cost to achieve this was more than \$200,000 for each hectare of weed that was eliminated.

The ideal time to install a benthic barrier is at the beginning of the growing season. However, restrictions related to fish spawning mean that barriers may not be installed in some Ontario lakes until at least July 15. When benthic barriers are installed during the peak growing season or late summer, it is advisable – or even necessary – to cut back the existing vegetation before installing the barrier.

## **Pros of Using Benthic Barriers to Suppress Eurasian Watermilfoil**

The greatest benefits of using benthic barriers to suppress Eurasian watermilfoil are that it can be done relatively inexpensively by homeowners in front of their properties at specified times of the year, without permits, and that stray fragments of the weed do not have to be collected.

- Benthic mats are highly effective when it comes to pinpoint accuracy. They can be placed exactly where they are needed.
- Benthic barriers will kill 100% of the weeds they cover.
- Benthic barriers can be used by individual homeowners.
- Benthic barriers can be installed without a permit if they do not exceed 15 square metres in size.
- If the barriers are installed each spring, removed each fall, and maintained well, they can last for years.

- Benthic barriers take less work than hand pulling and various other harvesting techniques.
- There is no need to dispose of the weeds pulled, or to collect all fragments of weeds removed using other methods.
- No chemicals are used.

### **Cons of Using Benthic Barriers to Suppress Eurasian Watermilfoil**

The greatest problems with using benthic barriers to suppress Eurasian watermilfoil manually are that there is a relative low limit to the area that can be covered without a permit, and that the benthic barrier may need maintenance throughout the growing season.

- Most benthic barriers are heavy and need at least two people to install.
- Benthic barriers do not work well in areas where the bottom of the waterbody is not level (e.g., stumps or rocks are present).
- There is a limit to the area of benthic barriers that can be covered without a permit.
- It can be difficult to acquire the required permit.
- Benthic barriers are not effective in areas where plant growth is already well established.
- Benthic barriers may affect the organisms that live in the benthic layer beneath the mat by depleting the oxygen in the water under the barrier, although research done by students at Laurentian University indicated that such impacts were not significant.
- Benthic barriers may need maintenance one to two times per month to ensure that gas bubbles aren't trapped beneath the barrier, and that they have haven't caused the barriers to move. The weights or frame holding the barrier down may have to be lifted to let the gas 'burp.'
- Benthic barriers may also need maintenance to ensure that wave action has not caused silt to build up on top of them. If this happens, Eurasian watermilfoil fragments can root and start growing on top of the mats. This can be prevented by brushing off the silt with a specialized roller or brush.
- Benthic barriers have a high initial cost in comparison to chemicals for treating larger areas.

## List of References – Benthic Barriers

- Andrews, P. (2022). *DFO and MNRF Approval of Jute Mats* [correspondence].
- Anthony, D. (2022). *Chandos Lake Eurasian Watermilfoil Management Project* [correspondence].
- AP Enviro-Conseil. (2019). *Délimitation de herbiers de myriophylle à épi au lac Pemichangan (basin ouest), Outaouais*. Retrieved from [https://pemichangan.org/wp-content/uploads/2021/08/AP-Environ-Conseil-Délimitation-herbiers-myriophylle-a-e\\_pi-Lac-Pemichangan-Août-2019.pdf](https://pemichangan.org/wp-content/uploads/2021/08/AP-Environ-Conseil-Délimitation-herbiers-myriophylle-a-e_pi-Lac-Pemichangan-Août-2019.pdf)
- Big Cedar Lake Stewardship Association. (n.d.). *Healthy Lake Program Approach*. Retrieved from <https://www.bclsa.ca/weevil/>
- Caffrey, J., Millane, M., Evers, S., Moran, H. & Butler, M. (2010). *A novel approach to aquatic weed control and habitat restoration using biodegradable jute matting*. *Aquatic Invasions*, 5(2), 123-129. Retrieved from [https://www.researchgate.net/publication/224833907\\_A\\_novel\\_approach\\_to\\_aquatic\\_weed\\_control\\_and\\_habitat\\_restoration\\_using\\_biodegradable\\_jute\\_matting?enrichId=rgreq-447cfbd8c1e4e718183916ae772fb4ee-XXX&enrichSource=Y292ZXJQYWdIOzlyNDgzMzkwNztBUzo5NzQwMTc1OTA3NjM1NkAxNDAwMjMzNzk3MzM0&el=1\\_x\\_3&esc=publicationCoverPdf](https://www.researchgate.net/publication/224833907_A_novel_approach_to_aquatic_weed_control_and_habitat_restoration_using_biodegradable_jute_matting?enrichId=rgreq-447cfbd8c1e4e718183916ae772fb4ee-XXX&enrichSource=Y292ZXJQYWdIOzlyNDgzMzkwNztBUzo5NzQwMTc1OTA3NjM1NkAxNDAwMjMzNzk3MzM0&el=1_x_3&esc=publicationCoverPdf)
- Chandos Lake Property Owners Association. (n.d.). *Eurasian Watermilfoil Management Project*. Retrieved from <https://clpoa.ca/our-lake/love-chandos-lake/eurasian-watermilfoil-management-project/>
- Cooper, A.L., DeBues, M.J., & Sager, E.P. (2018). *Eurasian watermilfoil management on Big Cedar Lake, Ontario: Progress Report, 2018*. Retrieved from <http://www.bclsa.ca/documents/2019/2018%20Progress%20Report%20-%20Eurasian%20watermilfoil%20management%20-%20Big%20Cedar%20Lake.pdf>
- Cooper, A.L. & Sager, E.P.S. (2018). *Eurasian watermilfoil management on Chandos Lake, Ontario: Progress Report, 2018*. Retrieved from <https://drive.google.com/file/d/17sX2OCNIVQS0-RLJw3r-9OMGq1mtTTvj/view>
- CTV Northern Ontario. (2019, June 26). *Stopping the spread of the 'zombie plant'*. Retrieved from <https://northernontario.ctvnews.ca/mobile/stopping-the-spread-of-the-zombie-plant-1.4483476?cache=yes?clipId=89830>
- Doherty, A. (2019). *Aquatic Vegetation Removal, Farlain Lake, Tiny, ON – Implementation of Measures to Avoid and Mitigate Serious Harm to Fish and Prohibited Effects on Listed Aquatic Species at Risk* [correspondence]. *Fisheries and Oceans Canada*.

- Drag & Spruce Lakes Property Owners Association. (2020). *EWM Working Group Action Plan for 2021*. Retrieved from [https://cewf.typepad.com/EWM\\_Action\\_Plan\\_2021.pdf](https://cewf.typepad.com/EWM_Action_Plan_2021.pdf)
- Drag & Spruce Lakes Property Owners Association. (2021a). *Eurasian Watermilfoil: Using Citizen Science to Combat an Unwelcome Visitor* [presentation]. Retrieved from [https://cewf.typepad.com/DSLPOA\\_EWM\\_PresentationA.pdf](https://cewf.typepad.com/DSLPOA_EWM_PresentationA.pdf)
- Drag & Spruce Lakes Property Owners Association. (2021b). *EWM Update April 1 to June 30, 2021*. Retrieved from [https://cewf.typepad.com/EWM\\_June30\\_2021.pdf](https://cewf.typepad.com/EWM_June30_2021.pdf)
- Drag & Spruce Lakes Property Owners Association. (2022). *The DSLPOA Story against EWM – 2022*. Retrieved from [https://cewf.typepad.com/dive\\_week\\_2022.pdf](https://cewf.typepad.com/dive_week_2022.pdf)
- Farlain Lake Community Association. (n.d.). *Eurasian Watermilfoil – Dealing with the Threat*. Retrieved from <https://farlainlake.ca/our-lake/eurasian-watermilfoil>
- Farlain Lake Community Association. (2018). *Farlain Lake Integrated EWM Management Plan 2019-2021*.
- Farlain Lake Community Association. (2019). *Farlain Lake Eurasian Watermilfoil Management Program – Final Report*.
- Farlain Lake Community Association. (2020). *FOCA Presentation* [presentation].
- Farlain Lake Community Association. (2022). *EWM Webinar* [presentation]. Retrieved from <https://farlainlake.ca/wp-content/uploads/FLCA-Webinar-Final-PowerPoint-Presentation-.pdf>
- Federation of Ontario Cottagers' Associations. (2017). *Invasive Species Pilot Project: Site Visit Report*. Retrieved from <http://www.wollastonlakehome.com/resources/Wollaston%20Lake%20Invasive%20Species%20FOCA%20Pilot%20Project.pdf>
- FLCA EWM Steering Committee. (2020). *2021 Integrated EWM Management Strategy for Farlain Lake*.
- Fraser, B. (2019). *Working to Protect the Long-Term Health and Safety of the Shawnigan Lake Community Watershed and the Drinking Water it Provides* [PowerPoint]. Shawnigan Basin Society. Retrieved from [https://www.shawniganbasinsociety.org/uploads/2/4/3/7/24371226/milfoil\\_ppt\\_1.pdf](https://www.shawniganbasinsociety.org/uploads/2/4/3/7/24371226/milfoil_ppt_1.pdf)

- Gemmill, A. (2019, June 12). *Pilot project to study control method for Eurasian Milfoil on four Sudbury lakes*. CBC News. Retrieved from <https://www.cbc.ca/news/canada/sudbury/pilot-project-sudbury-milfoil-1.5171638>
- Haney, A. (2018). *Invasive Eurasian Watermilfoil Management*. Chandos Lake Property Owners Association. Retrieved from [https://drive.google.com/file/d/1YnyK0c4Mf5jNrMSqnSvZ\\_GxQXqVJqQAc/view](https://drive.google.com/file/d/1YnyK0c4Mf5jNrMSqnSvZ_GxQXqVJqQAc/view)
- Haney, A. (2019). *Eurasian Watermilfoil Management Project Update – Aug. 30, 2019*. Chandos Lake Property Owners Association. Retrieved from [https://drive.google.com/file/d/1yF5G-GaABzmRtcBOGfwbvjQy\\_IF0v4\\_W/view](https://drive.google.com/file/d/1yF5G-GaABzmRtcBOGfwbvjQy_IF0v4_W/view)
- Hofstra, D.E. & Clayton, J.S. (2012). *Assessment of benthic barrier products for submerged aquatic weed control*. Journal of Aquatic Plant Management, 50, 101-105. Retrieved from <https://apms.org/wp-content/uploads/japm-50-02-101.pdf>
- Jack's Lake Association. (n.d.). *Eurasian Milfoil*. Retrieved from <https://www.jackslakeassociation.ca/assets/key%20Documents/Eurasian%20Milfoil.pdf>
- McGregor Lake Association. (2019). *Mise à jour de la cartographie des herbiers de myriophylle à épis du lac McGregor*. Retrieved from <http://lacmcgregorlake.ca/wp-content/uploads/2018/01/Mise-à-jour-Myriophylle-à-épis-Rapport-final-2019.pdf>
- McGregor Lake Association (2019). *Update on Eurasian Watermilfoil at McGregor Lake*. Retrieved from <http://lacmcgregorlake.ca/wp-content/uploads/2018/01/Highlights-Report-on-Milfoil-2019.pdf>
- Michon, G. (2015). *Control of Eurasian Water Milfoil in Lac Pemichangan, Outaouais, Quebec*. [correspondence].
- Milot, S. (2018). *Watermilfoil Control Methods: Updated Knowledge*. Federation des lacs de Val-des-Monts. Retrieved from <https://www.federationdeslacs.ca/upload/userfiles/files/Watermilfoil%20methods.pdf>
- Newroth, P.R. & Soar, R.J. (1986). *Eurasian Watermilfoil Management using Newly Developed technologies*. Lake and Reservoir Management, 2(1), 252-257. Retrieved from <https://doi.org/10.1080/07438148609354638>
- Sager, E., Canning, R., Robertson, E., Martin-Johnson, L. & Mooney, K. (2019). *Aquatic Plant Management on Big Cedar Lake, Ontario. Report on Summer 2019 Activities*. Retrieved from <http://www.bclsa.ca/documents/2020/2019%20Progress%20Report%20-%20Lake%20Program%20management%20-%20Big%20Cedar%20Lake.pdf>

- Shaw, D.W.H., Hymanson, Z.P., & Sasaki, T.L. (2016). *Physical Control of Nonindigenous Aquatic Plants in Emerald Bay, Lake Tahoe, CA*. *Invasive Plant Science and Management*, 9, 138–147. Retrieved from [https://www.researchgate.net/publication/300367561\\_Physical\\_Control\\_of\\_Nonindigenous\\_Aquatic\\_Plants\\_in\\_Emerald\\_Bay\\_Lake\\_Tahoe\\_CA](https://www.researchgate.net/publication/300367561_Physical_Control_of_Nonindigenous_Aquatic_Plants_in_Emerald_Bay_Lake_Tahoe_CA)
- Lavoie, C. (2024). *When Fighting Invasive Aquatic Plants, Choose Your Battles*. *The Conversation*, July 31, 2024. Retrieved from [https://theconversation.com/when-fighting-invasive-aquatic-plants-choose-your-battles-232016?utm\\_medium=email&utm\\_campaign=Latest%20from%20The%20Conv](https://theconversation.com/when-fighting-invasive-aquatic-plants-choose-your-battles-232016?utm_medium=email&utm_campaign=Latest%20from%20The%20Conv)
- Trauzzi, D. (2022). *Big Cedar Lake Eurasian Watermilfoil Management Project*. [correspondence].
- Williams, H., Willmott, T., Wright, I., & Elliot, T. (2018). *Eurasian Water-Milfoil Management Plan for Shawnigan Lake, BC*. Madrone Environmental Services Ltd. Retrieved from [https://www.cvrld.ca/DocumentCenter/View/89788/Shawnigan-Milfoil-Report\\_Final](https://www.cvrld.ca/DocumentCenter/View/89788/Shawnigan-Milfoil-Report_Final)
- Wollaston Lake Home and Cottage Association (2021). *Milfoil Action Committee 2021*. Retrieved from <http://www.wollastonlakehome.com/eurasian-milfoil.php>

## Appendix 3: Mechanical Harvesting

### What

A number of mechanical harvester designs that range from simple electronic blades attached to the side of a boat to large barge-type harvesters that gather the weeds onto the vessel after they have been cut have been designed, and are in use in various jurisdictions. The barge-type harvester is preferred due to its ability to gather the cut Eurasian watermilfoil, thereby limiting its further spread.

### Where

In Ontario, permits from the provincial Ministry of Natural Resources and Forestry, and from the federal Department of Fisheries and Oceans are needed to operate a harvester. Permits from the local municipality and Conservation authority may also be needed.

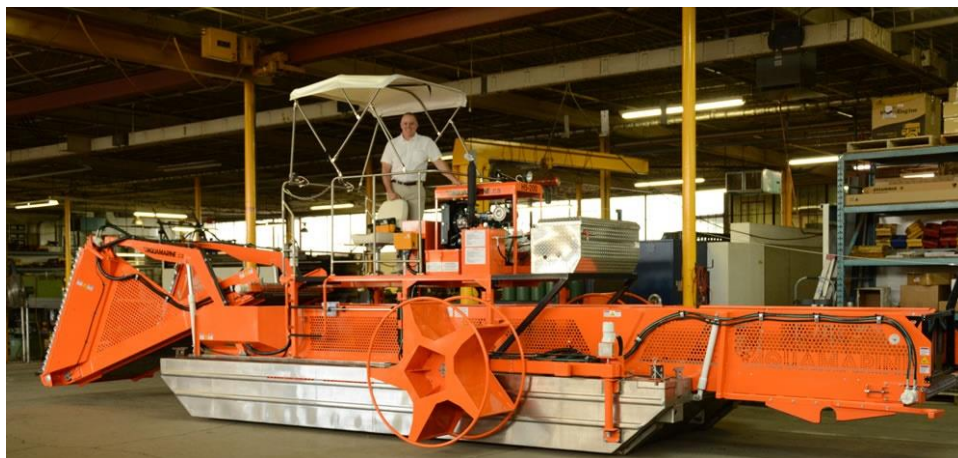
Mechanical harvesters are best suited to large beds of Eurasian watermilfoil where the lake bottom is flat, and – for at least some harvesters – less than 1.25 metres deep.

### Background

Harvesters are large, mechanized floating units that are costly, and require trained operators. They also require storage when they are not in use, as well as a trailer to move them from their storage units to the waterbodies where they are being used.

Information about two commercial varieties of harvesters (the Aquamarine Harvester and the ECO Harvester) will serve to illustrate what they are and how they are used.

The Aquamarine Harvester (<https://www.aquamarine.ca/>) is made in Ontario. Prices for the harvester start at around \$84,000 and rise according to the size of the harvester and the options chosen. The trailer and conveyor systems for the harvester are extra.



- It is operated using a diesel engine that drives paddle wheels on each side of the unit.



- Blades on the front of the barge cut the weed down to a depth of 1.25 metres.
- A conveyor system moves the cuttings to the bulk storage area on the barge.
- This harvester does not remove the whole plant: the roots stay intact meaning that using it is like mowing the lawn. It may have to be done more than once a season.
- The cuttings must be removed from the barge using another conveyor or other extraction method.

The ECO Harvester (<https://lakeweedharvester.com/eco-harvester/>) is manufactured in Minneapolis Minnesota. The harvester is priced at US\$109,499; its transport trailer costs an additional US\$9,499. Taxes and duty would likely have to be paid if such a unit is imported into Canada.



- It is made of aluminum, and powered by a gas Honda engine that drives a paddle wheel on each side of the barge.
- The barge is lightweight, and quite maneuverable.
- A rotating drum (instead of blades) on the front of the barge pulls the weeds out by the roots to a depth of 1.25 metres. The drum easily deflects off of obstacles.
- A conveyor moves the extracted weeds to a storage area on the barge. The conveyor can be repositioned to help remove the weeds at shore.
- The unit can harvest one and a half to two acres an hour once the operator is familiar with the equipment.
- The unit can also be used as a skimmer for things like algae, and for retrieving Eurasian watermilfoil fragments.

There are no commercially available mechanical harvesters in the Sudbury area at present, although at least one such unit is available elsewhere in Ontario. For example, the Wollaston Lake Home and Cottage Association in eastern Ontario rented an Aquamarine harvester from a company in Cobourg called WeedsBGone (<https://weedsbgone.com/pages/weed-harvesting>). The total cost of the rental was \$12,000 for two days. The association was permitted to clear Eurasian watermilfoil from an area of up to 25,000 square metres.

### **Pros of Mechanical Harvesting to Suppress Eurasian Watermilfoil**

The greatest benefits of mechanical harvesting differ according to the design of the unit being used. Large areas can be covered fairly quickly, and in the case of the ECO Harvester, the roots of the plants are removed meaning that repeated or seasonal cutting will not be needed.

- Once the plants are cut or pulled out, boating and other water-based activities will be less likely to cause fragmentation and spreading of the Eurasian watermilfoil.
- Large areas of Eurasian watermilfoil can be harvested relatively quickly.
- It is an environmentally safe means to remove Eurasian watermilfoil.
- If the mechanical harvester removes the roots, the plant will not regrow and ongoing suppression activities will not be needed.

### **Cons of Mechanical Harvesting to Suppress Eurasian Watermilfoil**

The greatest problems with using mechanical harvesting to remove Eurasian watermilfoil are that it is costly and requires a qualified operator for the harvester along with a trailer to transport the unit and a storage area where they can be kept while not in use. In addition, some units are only effective to depths of 1.25 metres.

- The Eurasian watermilfoil beds must be mapped before being harvested, and information including the total square metres of the infestation is required for obtaining quotes for mechanical harvesting programs.
- Waterlines and other underwater obstacles must be identified.
- Mechanical harvesting is expensive, with significant initial capital costs and ongoing operational costs (e.g., fuel, insurance, maintenance, and a qualified operator).
- The available units cut and/or collect Eurasian watermilfoil to a depth of 1.25 metres, while the plant is most common in water up to 3 metres deep and can even be found in water up to 9 metres deep.

- In the case of harvesters that simply cut the Eurasian watermilfoil, the work must be repeated on a regular basis as the plants continue to grow.
- Harvesters can cause fragments of Eurasian watermilfoil to break off as the plants are being harvested. All of the fragments must be collected so that they don't drift away and root elsewhere.
- The harvested weeds must be transported to an approved land-based storage area for composting.
- Permits from the provincial Ministry of Natural Resources and Forestry, federal Department of Fisheries and Oceans, and possibly the local municipality and Conservation authority may be needed.
- Time is needed to plan and get approvals for mechanical harvesting.
- The season for mechanical harvesting is limited because work permits may limit work to the period between July 15<sup>th</sup> and September 1<sup>st</sup>, while Eurasian watermilfoil doesn't normally reach harvesting height until August.
- Prime summer recreation activities could be disrupted by harvesting operations.

#### **List of References – Mechanical Harvesters**

Aquamarine: The Ecological Way of Thinking (2023). The Aquamarine H5-200 Aquatic Weed Harvester. Retrieved from <https://www.aquamarine.ca/>

Shoretch Industries (2023). The Eco-Harvester Lake Weed Puller and Skimmer. Retrieved from <https://lakeweederharvester.com/eco-harvester/>

Weedsbgone (2023). Aquatic Weed Harvesting. Retrieved from <https://weedsbgone.com/pages/weed-harvesting>

Wollaston Lake Home and Cottage Association (2021). Milfoil Action Committee 2021. Retrieved from <http://www.wollastonlakehome.com/eurasian-milfoil.php>

Williams, H., Willmott, T., Wright, I., & Elliot, T. (2018). Eurasian Water-Milfoil Management Plan for Shawnigan Lake, BC. Madrone Environmental Services Ltd. Retrieved from [https://www.cvrtd.ca/DocumentCenter/View/89788/Shawnigan-MilfoilReport\\_Final](https://www.cvrtd.ca/DocumentCenter/View/89788/Shawnigan-MilfoilReport_Final)

## **Appendix 4: Diver-Assisted Suction Harvesting (DASH)**

### **What**

Diver-Assisted Suction Harvesting (DASH), involves the manual harvesting of the invasive weed from the lake bottom by a diver, and suctioning the complete plant, including the root-ball and stem, to the surface via a hose and pump device.

Once the DASH process brings the invasive weed to the surface, the water is filtered out before it is returned to the lake to keep fragments of the weed from re-entering the water. The weed is collected and transported to a land-based disposal site.

### **Where**

In Ontario, permits from the provincial Ministry of Natural Resources and Forestry, and from the federal Department of Fisheries and Oceans are needed for DASH operations. Permits from the local municipality and Conservation authority may also be needed.

Diver-assisted suction harvesting is best suited to large beds of Eurasian watermilfoil. Its use is not dependent upon water depths, or the type of substrate in the water body.

### **Background**

The DASH hoses and pumping device are contained on a barge that floats over the affected areas while the diver, typically equipped in scuba gear, removes the weeds below.

Suction harvesting is best incorporated into an Aquatic Plant Management plan where a benthic barrier is deployed to cover the harvested area following plant extraction via DASH. Suction harvesting is not considered dredging, because the plants are selectively removed by hand. Any removal of sediment is incidental to the plant harvesting.

DASH was used at Beecher, Thunder, and Little Newton lakes in Wisconsin. A pontoon boat was retrofitted for a staging platform, and a filtration system was added to manage the harvested Eurasian watermilfoil. It cost US\$15,000 to retrofit the pontoon boat (which was purchased used), and add the motor, pump, hoses, and filtration system. The dive equipment, including a wireless communication system to connect from the boat to the diver cost an additional US\$6,600.



The area to be harvested was identified beforehand using GPS coordinates and

buoys. Factors affecting the harvest efficiency included:

- the sediment type;
- the depth of the water;
- the time of the year; and
- the age and density of the plants.

Given the outcomes, the project managers concluded that DASH should be part of a comprehensive Aquatic Plant Management plan, especially where it is going to be followed up by installation of benthic barriers.

DASH was also used to control Eurasian watermilfoil in Lake George and Upper Saranac Lake (110 and 19 square kilometres, respectively), in New York State. At Upper Saranac Lake, where work began in 2004, more than 22 tonnes of the plant were removed in the first three years. The initial intensive work was followed by maintenance control, which for several years has resulted in a minimal summer harvest. Overall, however, this work has cost more than US\$2 million.

DASH was also used at Farlain Lake in Ontario. It was supported by funding from the Ontario Trillium Foundation.

### **Pros of DASH to Suppress Eurasian Watermilfoil**

The greatest benefits of using diver-assisted suction harvesting to remove Eurasian watermilfoil are that it removes the plants by the roots, and can be done regardless of water depth.

- The plants are completely removed, not just cut back, and do not have to be trimmed on an ongoing basis.
- Large areas of Eurasian watermilfoil can be harvested relatively quickly.
- It is an environmentally safe means to remove Eurasian watermilfoil.
- It is selective, so will not result in removal of other native aquatic plants.

### **Cons of DASH to Suppress Eurasian Watermilfoil**

The greatest problems with using diver-assisted suction harvesting to remove Eurasian watermilfoil are its limited operating season, and its cost.

- The Eurasian watermilfoil beds must be mapped before being harvested, and information including the total square metres of the infestation is required for obtaining quotes for DASH programs.
- Permits from the provincial Ministry of Natural Resources and Forestry, and federal Department of Fisheries and Oceans are needed.
- There is a high capital cost for the custom-fitted barge and trailer.

- There are ongoing costs of storing and maintenance of the barge and trailer.
- There are costs for professional divers and operators.
- It can be difficult to keep the barge in position relative to the diver, especially if it is windy.

### **List of References – Diver-Assisted Suction Harvesting**

Lavoie, C. (2024). *When Fighting Invasive Aquatic Plants, Choose Your Battles*. The Conversation, July 31, 2024. Retrieved from [https://theconversation.com/when-fighting-invasive-aquatic-plants-choose-your-battles-232016?utm\\_medium=email&utm\\_campaign=Latest%20from%20The%20Conv](https://theconversation.com/when-fighting-invasive-aquatic-plants-choose-your-battles-232016?utm_medium=email&utm_campaign=Latest%20from%20The%20Conv)

Lake, N. (2016). *Diver Assisted Suction Harvesting*. Wisconsin Lakes Convention. Retrieved from [https://www3.uwsp.edu/cnr-ap/UWEXLakes/Documents/programs/convention/2016/WedAMworkshops/ChuckDruckery\\_DiverAssistedSuctionHarvesting.pdf](https://www3.uwsp.edu/cnr-ap/UWEXLakes/Documents/programs/convention/2016/WedAMworkshops/ChuckDruckery_DiverAssistedSuctionHarvesting.pdf)

Farlain Lake Community Association. (n.d.). *Eurasian Watermilfoil – Dealing with the Threat*. Retrieved from <https://farlainlake.ca/our-lake/eurasian-watermilfoil>

## Appendix 5: Aquatic Herbicides

### **What**

Aquatic herbicides are used to control unwanted algae and weeds in water bodies, particularly lakes, rivers, and wetlands. These herbicides are different from those applied to land (for example on crops and industrial sites) to control weeds, although there are cases where one compound is used for both purposes.

Aquatic herbicides include Sonar (fluridone), Rodeo (glyphosate), Aquicide (diquat); and Aquathol (endothall), among many others. They are most often used to kill invasive plant species and reduce algal blooms that threaten the health of aquatic ecosystems. Only certain chemicals are approved for use as aquatic herbicides.

When weeds or algae become overgrown, they create too much shade and kill many of the species growing below them. This makes it difficult for aquatic animals to find food. Overgrowth also makes swimming, fishing, or other recreational activities difficult or even impossible.

Aquatic herbicides can be applied directly to nuisance plants and algae or dispersed through an entire water body. They come in many forms, including soluble crystals or powders, concentrates, or emulsifiers. Permits are required based on variables like the type of water body, the species to be controlled, and the amount of herbicide to be used. In addition, the person applying the aquatic herbicide may have to be certified.

While some herbicides kill the target species within days, others require multiple weeks of use to be effective. During and surrounding the application period, irrigation, swimming, and other water contact may be restricted, depending on the herbicide used.

### **Where**

In Ontario, permits from the federal Department of Fisheries and Oceans and from the provincial Ministry of Natural Resources and Forestry are needed for the use of aquatic herbicides. Permits from the local municipality and Conservation authority may also be needed.

Aquatic herbicides are best suited to large beds of Eurasian watermilfoil. Their use is not dependent upon water depths, or the type of substrate in the water body.

### **Background**

Apart from on-line research, most of what the Aquatic Invasive Species Committee learned about herbicide use initially come mainly from Jessica Damaren's report for the committee entitled "A Survey of Options for Suppressing or Eliminating Eurasian Watermilfoil." However, of the more than 80 references or sources Jessica cites, only a few relate to aquatic herbicides.

- *Frontiers in Plant Science* (Marko 2018) reported on a study comparing the effectiveness of weevils with two herbicides – Fluridone and 2,4-H (Aqua-Kleen20) in suppressing Eurasian watermilfoil. Fluridone shuts down photosynthesis. Weevils allow fragmentation so the spread of the invasive weed is still possible. The report notes “Both herbicides showed mixed results”. Plants can grow back when herbicides are used, so the growth of native vegetation needs to be promoted.
- B. Sexton (2022) reported that residents around Jack Lake near Apsley ON used the aquatic herbicide Reward, whose main ingredient is Diquat, to kill Eurasian watermilfoil in the lake. This led to division among cottagers. There was distrust of the approval provided by the Ontario Ministry of Environment, Conservation and Parks because Diquat has been banned in United Kingdom and the European Union. The Reward was effective at first but did not kill the roots of the plants, so the application must be repeated annually. Reward also kills native plants.
- V. Simkovik (2020) reported that Reward aquatic herbicide was only the only product approved for use in Ontario as of 2020. Permits are required before any herbicide is used in Ontario. Reward affects all aquatic plants, not just Eurasian watermilfoil. After Reward is sprayed, humans are to avoid the area for consumption or recreational use for 5 days.
- The *Sudbury Star* (2024) reported that an application to use Diquat to suppress Eurasian watermilfoil in Long Lake is under consideration, and that it has previously been approved for use in the lake. Diquat has negative effects on aquatic vertebrates and invertebrates and is banned in the United Kingdom and the European Union.
- Williams (2018) reported that three aquatic herbicides were tried in Lake Okanagan in British Columbia: Diquat; 2,4-HD; and Paraquat. Their use was discontinued in 1978 due to public pressure. Shawnigan Lake, a drinking water source for a nearby village subsequently decided not to pursue herbicides as a control method for Eurasian watermilfoil.

After the research for Jessica Damaren’s report entitled ‘*A Survey of Options for Suppressing or Eliminating Eurasian Watermilfoil*’ was completed, Health Canada’s Pest Management Regulatory Agency approved ProcellaCOR FX, a new aquatic herbicide, for use in Canada.

- ProcellaCOR was developed as an aquatic herbicide in 2010. It was subject to dozens of peer-reviewed scientific studies for several years, leading up to its ultimate approval by the US Environmental Protection Agency in 2018. The active ingredient of ProcellaCOR, florpyrauxifen-benzyl, has been used worldwide for several years as an herbicide on food crops such as rice.



- Further tests were done to determine its effectiveness between 2019 and 2021, and it is now approved for use in every US state except Alaska, as well as in the European Union.
- ProcellaCOR FX (the Canadian brand name) was approved by Health Canada's Pest Management Regulatory Agency (PMRA) for use in Canada on May 16, 2023.
- Most ProcellaCOR research emanates from the United States and Europe. Numerous reports about research on the effects of ProcellaCOR, and on its use as an aquatic herbicide have appeared in the literature in the past year. Some of them are cited in the list of references below.
- ProcellaCOR is considered safe for humans. It has been used in more than 200 lakes in the United States since it was approved, and no harmful impacts on non-targeted plants have been observed.
- In addition to the research undertaken by the EPA and the PMRA, more than 15 American state departments of environmental protection, ecology, natural resources, health, environmental protection, fish and wildlife, and agriculture; over six universities; two aquatic plant management associations; the US Army Corp of Engineers; the Queensland, Australia Department of Agriculture and Fisheries; and the European Food Safety Authority have undertaken research on ProcellaCOR as it relates to human health, fish, animals, birds, invertebrates, and the overall aquatic ecosystem.
- None of these independent studies have shown ProcellaCOR to have an adverse impact on human health, fish and wildlife, or non-targeted aquatic plants if applied by certified pesticide applicators.
- Swimming and fishing following application are permissible under the American and Canadian regulations.
- Prohibitions on using treated water for non-agricultural irrigation immediately after ProcellaCOR is applied appear to relate to its negative effect on at least some broad-leaf terrestrial plants. Although these prohibitions can be several days to several weeks long where ProcellaCOR has been intensively applied to large areas, they can be as short as half a day for more normal applications.
- Concerns have been expressed that non-listed constituents of ProcellaCOR, which make up 94.3% of the product, may pose risks. However, the U.S. Environmental Protection Agency, which approved ProcellaCOR for use in the U.S., maintains a list of inert ingredients approved for use in pesticide products. The Agency would have considered the non-listed constituents in ProcellaCOR in its review.

- Concerns have been expressed that the application of ProcellaCOR would make lake water unsafe for domestic use and consumption. No maximum allowable drinking water concentrations were established by either the American or the Canadian regulators, while the State of Vermont established a drinking water health advisory for the active ingredient in ProcellaCOR that is more than 60 times higher than the highest use amount allowed on the U.S. Environmental Protection Agency label.
- Concerns have also been expressed that although the active ingredients in ProcellaCOR may not pose health risks to humans, flora, or fauna, the products of its degradation may do so. However, the U.S. Environmental Protection Agency assesses the breakdown products of pesticides as part of its scientific evaluation process before making a decision on whether to approve a product.
- The Canadian Department of Fisheries and Oceans approved an application made by the Farlain Lake Community Association to use ProcellaCOR FX in its 2023 Eurasian watermilfoil management plan, and the Ontario Ministry of Environment, Conservation and Parks issued a pesticide permit for the plan in August 2023.
- As no Canadian licensed pesticide applicator has been certified to apply ProcellaCOR FX, the Farlain Lake Community Association engaged the American company SOLitude Lake Management to apply ProcellaCOR FX to the lake's 15 verified Eurasian watermilfoil sites.
- An area of 4,000 m<sup>2</sup> of the lake (the 2% of the lake's surface area that contained Eurasian watermilfoil) was treated on September 6, 2023. The herbicide was typically applied at a dosage of 6-10 parts per billion (ppb) of its active ingredient florpyrauxifen-benzyl. This is equivalent to 2.7 ml (approximately 0.5 teaspoon) of herbicide in a swimming pool containing 40,000 litres (approximately 8,800 Imperial gallons) of water, although a dosage of 10-20 ppb was used for very small spot infestations in the lake.
- A follow-up assessment was done on October 4, 2023. The assessment determined that the Eurasian watermilfoil in the areas treated with ProcellaCOR FX had died or was in the process of dying. It also determined that native plants were healthy and unaffected by the ProcellaCOR FX. The results of the test exceeded the association's expectations.
- The Farlain Lake Community Association recommended that before deciding on any control method for Eurasian watermilfoil, the infestations should be mapped to determine their location, size, and density, and to assess the percentage/mix of the invasive species versus native plants within the bed. This will help planners identify the best treatment method for the local circumstances, while keeping costs down.

- The Farlain Lake Community Association admits there will always be those who question or oppose government use of aquatic pesticides, so education and transparency and patience are important.

### **Pros of Aquatic Herbicides to Suppress Eurasian Watermilfoil**

- The application can be done quickly, although there may be an extended period following application of some aquatic herbicides when the water cannot be used.
- Although not inexpensive, it is less costly than other methods of suppressing Eurasian watermilfoil such as mechanical harvesting or diver-assisted suction dredging.
- No custom watercraft are needed to apply the herbicide.
- It is best for thick infestations of Eurasian watermilfoil.
- ProcellaCOR FX, an option that does not appear to have the negative side effects of some other aquatic herbicides, has been approved for use in Canada.

### **Cons of Aquatic Herbicides to Suppress Eurasian Watermilfoil**

- The Eurasian watermilfoil beds must be mapped before being treated, in part because information about the total square metres of the infestation is required for obtaining quotes for aquatic herbicide programs.
- Permits must be acquired before aquatic herbicides can be used.
- Some aquatic herbicides may be harmful to humans., and consumption or use of water may be restricted for an extended period of time after certain aquatic herbicides are applied.
- The interests of any individuals using the water bodies in question for domestic purposes must be taken into consideration.
- Some members of the public may oppose the use of aquatic herbicides on principle.
- Aquatic herbicides are not well suited to areas where the growth of Eurasian watermilfoil is sparse.
- Common aquatic herbicides in use in Canada prior to 2023 kill the plants, but not the roots, so the plants will grow back meaning that the herbicide will have to be applied annually.

- Some aquatic herbicides kill native plants and benthic invertebrates, in addition to Eurasian watermilfoil.
- Diquat, the active ingredient in the herbicide Reward, which has been used in Ontario in some places to counteract Eurasian watermilfoil, has been banned in the United Kingdom and European Union (EU) since 2019.
- Diquat does not work effectively in deeper water.
- The use of herbicides in lakes used as a drinking water source may be problematic, depending upon the herbicide. The risk of human harm far outweighs any benefit from the removal of aquatic plants
- Aquatic herbicides can be costly.
- Specially trained technicians are generally needed to apply the aquatic herbicide.

### **List of References – Aquatic Herbicides**

Adirondack Explorer (2024) *An environmental duel: Lake George to face herbicide treatment amidst debate about safety, use*. Retrieved from <https://www.adirondackexplorer.org/stories/lake-george-procellacor-herbicide-debate>

European Food Safety Authority et al (2018) *Peer review of the pesticide risk assessment of the active substance flupyrauxifen (variant assessed flupyrauxifen-benzyl)* EFSA Journal, August 6, 2018, retrieved from <https://efsa.onlinelibrary.wiley.com/doi/full/10.2903/j.efsa.2018.5378>

Frost, Z. (2022) *Battle over use of herbicide vs milfoil on Lake George*. Chronicle. Retrieved from <https://www.glensfallschronicle.com/battle-over-use-of-herbicide-vs-milfoil-on-lake-george/>

Farlain Lake Community Association (2023) *ProcellaCOR FX – Questions and Answers*. Retrieved from <https://farlainlake.ca/wp-content/uploads/ProcellaCOR-Q-and-A-August-24-2023.pdf>

Farlain Lake Community Association (2023) *Farlain Lake 2023 EWM Management Year End Report*. Retrieved from <https://farlainlake.ca/wp-content/uploads/FLCA-2023-EWM-Management-Year-End-Report-Final.pdf>

Farlain Lake Community Association (2023). *ProcellaCOR FX Questions and Answers*. Retrieved from <https://farlainlake.ca/wp-content/uploads/ProcellaCOR-Q-and-A-August-24-2023.pdf>

Government of Canada Pest Management Regulatory Agency (2022) *Summary of consultation document on the proposed registration decision for Florpyrauxifen-benzyl* (includes ProcellaCOR). Retrieved from <https://www.canada.ca/en/health-canada/services/consumer-product-safety/pesticides-pest-management/public/consultations/proposed-registration-decisions/2022/florpyrauxifen-benzyl/document.html>

Government of Canada Pest Management Regulatory Agency (2023) Registration Decision RD2023-08, Florpyrauxifen-benzyl, Milestone NXT Herbicide, Restore NXT Herbicide, GF-3206 Herbicide, GF-3301 Aquatic Herbicide, and ProcellaCOR FX Herbicide. Retrieved from <https://www.canada.ca/en/health-canada/services/consumer-product-safety/reports-publications/pesticides-pest-management/decisions-updates/registration-decision/2023/florpyrauxifen-benzyl.html>

Government of Massachusetts (undated) *ProcellaCOR® Herbicide Product Summary and Use Restrictions*. Retrieved from <https://www.mass.gov/doc/procellacor/download>

Hall, H., et al (2024) *PFAS in Pesticides – Interim Report to the Legislature (of Minnesota)*. Retrieved from <https://www.lrl.mn.gov/docs/2024/mandated/240221.pdf>

Health Canada (2022) *Guidelines for Drinking Water Quality in Canada – Diquat*. Retrieved from <https://www.canada.ca/content/dam/hc-sc/documents/services/publications/healthy-living/guidelines-canadian-drinking-water-quality-guideline-technical-document-diquat/guidelines-canadian-drinking-water-quality-guideline-technical-document-diquat-2022.pdf>

Heilman, M. (2018) *ProcellaCOR Aquatic Herbicide: Game-changing Technology for Aquatic Plant Management*. SePro. Retrieved from <https://corpslakes.erc.dren.mil/employees/learning/webinars/18Apr25-ProcellaCOR.pdf>

Lake George (New York) Park Commission (2022) *ProcellaCOR FAQ*. Retrieved from <https://lqpc.ny.gov/system/files/documents/2022/04/procellacor-faq.pdf>

Marko, M.D. & White, J.C. (2018) *Direct Comparison of Herbicidal or Biological Treatment on *Myriophyllum spicatum* Control and Biochemistry*. *Frontiers in Plant Science*, 9(1814). Retrieved from <https://www.frontiersin.org/articles/10.3389/fpls.2018.01814/full>

Paradox Lake Association (2022). *Paradox Lake ProcellaCOR Treatment Frequently Asked Questions*. Retrieved from <https://paradox-lake.com/procellacor-faq>

- SePRO (undated) *Specimen label for ProcellaCOR*. Retrieved from [https://www.sepro.com/Documents/ProcellaCOR\\_Specimen-Label.pdf](https://www.sepro.com/Documents/ProcellaCOR_Specimen-Label.pdf)
- Sexton, B. (2022) *What's the Best Way to Combat Eurasian Watermilfoil? Opinions are Divided*. Outdoor Canada. Retrieved from <https://www.outdoorcanada.ca/whats-the-best-way-to-combat-eurasian-watermilfoil-opinions-are-divided/>
- Simkovic, Vicki. (2020) *Eurasian Water-Milfoil (Myriophyllum spicatum): Best Management Practices in Ontario*. Ontario Invasive Plant Council, Peterborough, ON. Retrieved from [https://www.ontarioinvasiveplants.ca/wp-content/uploads/2021/01/Eurasian-Water-Milfoil\\_Edn1.0\\_March2020.pdf](https://www.ontarioinvasiveplants.ca/wp-content/uploads/2021/01/Eurasian-Water-Milfoil_Edn1.0_March2020.pdf)
- The Sudbury Star (2024) UPDATE: *Proposed herbicide spraying alarms Long Lake residents*. Retrieved from <https://www.thesudburystar.com/news/local-news/proposed-herbicide-spraying-alarms-long-lake-residents>
- United States Environmental Protection Agency (2018) *Notice of Pesticide Registration February 27, 2018*, Retrieved from [https://www3.epa.gov/pesticides/chem\\_search/ppls/067690-00079-20180227.pdf](https://www3.epa.gov/pesticides/chem_search/ppls/067690-00079-20180227.pdf)
- Vermont Department of Health (2020). *Aquatic Nuisance Control Permits, ProcellaCOR*. Retrieved from <https://lgpc.ny.gov/system/files/documents/2022/03/vermont-procellacor-review-2020.pdf>
- Vermont Pesticides & Poisons Action Network (2023). *Citizen's Guide to Procellacor-EC*. Retrieved from <https://legislature.vermont.gov/Documents/2024/WorkGroups/House%20Environment/Bills/H.31/Witness%20Documents/H.31~Sylvia%20Knight~Citizen's%20Guide%20to%20ProcellaCOR-EC~3-17-2023.pdf>
- Vose, S. (2020) *State of Vermont Department of Health – Memorandum to the Vermont Department of Environmental Conservation*. Retrieved from <https://lgpc.ny.gov/system/files/documents/2022/03/vermont-procellacor-review-2020.pdf>
- Williams, H., Willmott, T., Wright, I., & Elliot, T. (2018) *Eurasian Water-Milfoil Management Plan for Shawnigan Lake, BC*. Madrone Environmental Services Ltd. Retrieved from [https://www.cvr.ca/DocumentCenter/View/89788/Shawnigan-Milfoil-Report\\_Final](https://www.cvr.ca/DocumentCenter/View/89788/Shawnigan-Milfoil-Report_Final)

## **Appendix 6: Eurasian Watermilfoil within the City of Greater Sudbury**

There are 18 documented lakes in the City of Greater Sudbury that are infested with Eurasian watermilfoil. This number will undoubtedly climb. Some of the infestations cover large areas.

Most Eurasian watermilfoil infestations affect homeowners' use and enjoyment of their waterfront properties. In addition, Eurasian watermilfoil infestations have been shown to diminish the values of waterfront properties by 13% in one study in Wisconsin, by 19% in a study in Washington state, and by 20%-40% in another study in New Hampshire. If accounted for in assessments of properties within the City of Greater Sudbury (also called "The City of Lakes") it will undoubtedly have a negative impact on the municipal tax base as well as the values of the homeowners' properties.

At present, the best – and probably most cost-effective – option for dealing with the situation in the City of Greater Sudbury would be to use mechanical harvesting and/or diver-assisted suction harvesting.

The preference with regard to mechanical harvesters would be for units that remove the roots along with the plants, since they would help minimize regrowth and help native plants and marine life re-establish. Since they are only effective to water depths of 1.25 metres, however, harvesters that cut the plants would be needed for areas where the water is deeper.

A new option would be the use of the aquatic herbicide ProcellaCOR FX. It was approved for use in Canada in May 2023, and was later approved by both the federal Department of Fishers and Oceans, and the provincial ministry of Environment, Conservation and Parks for use in an Ontario lake in 2023. The results of this pilot project appear to have been very successful.

The company that produces the herbicide sets the price of application – approximately \$6,000 per hectare. However, the calculation of hectares includes just the areas of the Eurasian watermilfoil beds where the herbicide is being applied, not the whole lake. It also includes three years of follow-up visits and reapplication, if necessary. A Sudbury resident has been working to become certified to apply the product.

Unfortunately, initiatives using harvesters, diver-assisted suction dredging, and the newly approved aquatic herbicide are too costly for individuals or lake stewardship groups to undertake. In addition, public opposition to any of these options may have to be overcome through information and education programs.

Partnerships with the private sector and First Nations, as well as the City of Greater Sudbury, may be options to pursue.

## List of References – Eurasian Watermilfoil with the City of Greater Sudbury

- Goodenberger, J.S. and Klaiber, H.A. (2016) *Evading invasives: How Eurasian watermilfoil affects the development of lake properties*. *Ecological Economics*, Vol. 127, pp173-184. Retrieved from <https://www.sciencedirect.com/science/article/abs/pii/S0921800916302257>
- Olden, J.D. and Tamayo, M. (2014) *Incentivizing the Public to Support Invasive Species Management: Eurasian Milfoil Reduces Lakefront Property Values*. *PLOS ONE*. Retrieved from <https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0110458>
- Zhang, C., and K. J. Boyle. (2010) *The effect of an aquatic invasive species (Eurasian watermilfoil) on lakefront property values*. *Ecological Economics* Vol. 70 pp394–404 Retrieved from <https://www.sciencedirect.com/science/article/abs/pii/S0921800910003708?via%3Dihub>