

Regional Eurasian Milfoil Control Plan



**for
King County**

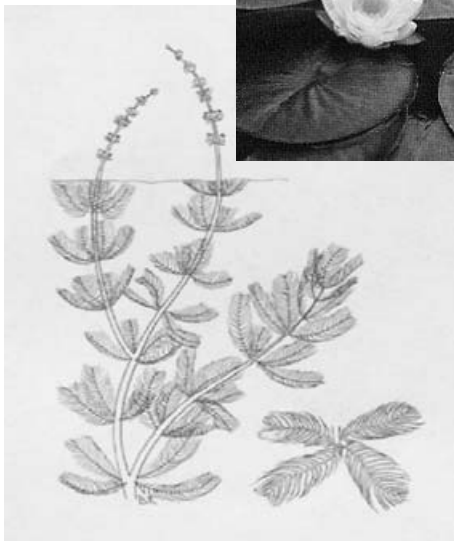
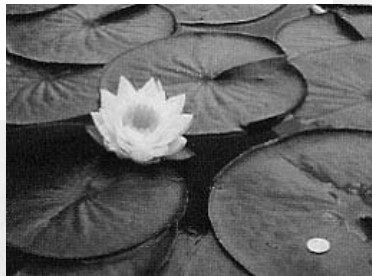
December 2002



King County

Department of Natural Resources and Parks
Water and Land Resources Division

REGIONAL EURASIAN MILFOIL CONTROL PLAN FOR KING COUNTY



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December 2002

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INTRODUCTION

King County is located in Western Washington along the eastern shores of the Puget Sound. A diverse mix of large urban areas, suburban cities, rural areas, farmland, timberland, and alpine wilderness exists within the County. Elevation changes from sea level to nearly 8,000 foot peaks in the Cascade Mountains along the eastern border of the County. The landscape was largely shaped during the last glacial period in North America when glaciers carved the landscape creating many lakes. Most of the lakes are within or in close proximity to urban areas and are under pressure from urbanization. They are also an important recreational and ecological resource to residents of the region. Since the early 1980s, the value of these lakes for use by people, fish, and wildlife has been greatly impacted by the introduction of invasive (noxious) plants, especially Eurasian milfoil (*Myriophyllum spicatum*).

The US Congress Office of Technology Assessment has recognized Eurasian milfoil as a “harmful non-indigenous species.” Eurasian milfoil is also on the State of Washington’s Noxious Weed List. This list includes those plants that are exotic, invasive, and are known to cause detrimental impacts to the state’s resources including the environment. The dense weed beds formed by the plant can be a menace to swimmers and can greatly impede boaters. Extensive Eurasian milfoil beds have also been shown to degrade water quality and aquatic habitat. Dense plant beds absorb sunlight resulting in water temperatures that are elevated, often beyond levels that are safe for trout and salmon species. Dissolved oxygen levels can also be severely depressed under these mats (Frodge et al., 1991). Dense aquatic beds can also affect predator/prey relationships among fish. For example, dense milfoil beds may concentrate young salmon at the outside edges of the plant bed where they are more susceptible to predation. Finally, aquatic plant, invertebrate, and fish species diversity also declines when a monoculture of an exotic like Eurasian milfoil replaces more beneficial native aquatic plants (Madsen et al., 1988).

Eurasian milfoil spreads by fragmentation. Viable fragments break off from the plant and then float to other parts of the lake where they can sink to the bottom and start new plants. Eurasian milfoil often spreads to other waterbodies when plant fragments “hitchhike” on birds, boats, and trailers. Boat trailers are considered the principal carrier of this weed.

PURPOSE AND NEED

Statewide concern over the impacts of Eurasian milfoil and other invasive, non-native plants, resulted in the establishment of the Aquatic Weeds Program at the Washington State Department of Ecology (Ecology). This program is funded through a tax on boat trailers. The money generated is used to fund both planning and implementation efforts for the control of aquatic plants. However, when a noxious weed is widespread within a waterbody an Integrated Aquatic Vegetation Management Plan (IAVMP) must be submitted and approved by Ecology before an application can be submitted for implementation. Because plan development can be expensive, Ecology also offers grant funding up to \$40,000 total project cost to develop integrated plans. The requirements for submittal of an IAVMP are very specific, they include; a problem statement, list of management goals, public involvement, a description and discussion of lake and watershed characteristics, a discussion of beneficial uses, an aquatic plant survey, a discussion and site-specific evaluation of control techniques, and finally an action plan. A long term program for prevention of future aquatic plant problems, cost estimates and a plan for implementing and funding the work set out by the IAVMP are also necessary components for insuring project success.

Since the Aquatic Weeds Program was established, several lakes in King County have produced and implemented plans for control of aquatic plants. One of the problems with the existing lake-by-lake control efforts is that the investment which local groups make in eradicating this weed from their lakes is often threatened by remaining infestations in nearby lakes since the primary mode of spread is by boat trailers. As contaminated lakes are in close proximity to reclaimed lakes, it normally does not take long before a reintroduction occurs.

In 1999, King County recognized the benefits of developing a regional plan that would provide a more efficient and focused approach for combating the spread of Eurasian milfoil. King County applied for and received a grant to develop this “Regional Eurasian milfoil Control Plan”. This document will allow King County to focus their efforts in controlling Eurasian milfoil. It provides basic lake and watershed information, milfoil survey results from 38 King County lakes, and examples of plant control goals for different levels of infestation. It also describes available control strategies that are approved to meet selected goals. This plan can be used to meet a number of the planning elements required for completion of an IAVMP.

Using the information provided on specific lake characteristics and the existing level of infestation by Eurasian milfoil, a problem statement, management goals and applicable control strategies can be selected. Refinement of the Problem Statement and Goals and selection of the preferred Control Strategy through a documented Public Involvement process will need to be done on a lake specific basis before implementation of a plan can begin. These steps will also allow specific lakes or groups of lakes to qualify for implementation grants from Ecology.

SURVEY METHODS.....

Aquatechnex, a consulting firm that specializes in aquatic plant control, conducted the lake surveys. The first step was to develop a list of lakes to survey for this project. A meeting was held with King County staff to select the lakes and discuss the scope of the surveys. The County presented a list of lakes that had public access sites; a subset of these lakes were selected for survey based on available budget and priorities. The budget for field work was capped at approximately \$10,000.00 with a cost per field crew day of approximately \$800.00. The County then developed a prioritized list. Although budget limitations were exceeded, the field crew continued until all 38 of the lakes on the priority list were surveyed. A boat survey method was selected as the most efficient means of conducting the surveys.

The first step in the process was to obtain copies of bathymetric maps for each of the survey lakes. Most of these were available in the Washington Lakes Reconnaissance Data report (Bortelson et al. 1976). Lake Washington and Lake Sammamish are not included in this volume, bathymetry for these two lakes was obtained from Garmen’s (Global Positioning System) GPS mapping software. The bathymetry for each lake was reviewed to determine a probable littoral zone. Since Eurasian Milfoil will grow within the littoral region of each lake, the bathymetry maps helped focus the survey effort for each lake. Aerial images were also obtained. The King County GIS Department provided high resolution aerial imagery in digital format for use on this project. An image of each lake was printed and placed in a survey folder with the corresponding bathymetric map for the lake.

Each of the lakes to be surveyed were highlighted on a map of the County for logistical planning purposes. The size of the lakes and proximity to each other were used to estimate the time necessary to

complete each of these and a daily survey schedule was developed. At that point, the survey teams began field observations and data collection.

Each survey team was equipped with polarized viewing glasses, an underwater viewing tube, snorkel and dive equipment and a differential GPS receiver and data logger. Different sized boats were used depending on the size of the lake, the type of access and the need for electric motors. (King County granted permission to use gas powered vessels on lakes with regulations prohibiting them. Our team utilized electric vessels wherever practical to limit impacts to lake residents).

Prior to each survey effort, the team would develop protocols for the lake or lakes that were scheduled for survey. The bathymetric map was used to define the littoral area that could support Eurasian Milfoil growth and survey coverage was developed based on the amount of area that had to be covered. Some lakes drop off rapidly from the shoreline to deep water habitats. In those cases the littoral area requiring survey would be predicatively narrow. Other lakes might have littoral areas that extend to some distance off shore and additional coverage would be necessary.

On arriving at each lake, surveyors assessed water clarity and the actual extent of the littoral zone. Water clarity plays a role in the depth of the littoral zone and on the ability of the survey team to see aquatic vegetation. This information was utilized to check the assumptions made regarding the littoral zone and to refine the survey as necessary.

The boat team then surveyed all areas of the lake that might support Eurasian Milfoil populations. A Garmin DGPS with topographic maps display was used to plot the location of the vessel and ensure coverage by monitoring the path of the survey craft. When Eurasian Milfoil was discovered, the team would determine the extent of each patch. Single plants were marked as a point with the DGPS equipment. Larger plant communities were mapped as polygons, mapping the outside edge of the plant bed. Field notes and sketch maps were also created by the team to support the GPS data.

At the end of each day, the GPS data was downloaded into mapping software. When work on an individual lake was partially completed, an endpoint was recorded on the paper maps and a waypoint was collected with the Garmin GPS unit to serve as a starting point for the next visit to that location.

Data collected were used to develop maps for each lake in ArcView GIS mapping software. These maps are provided in Appendix A.

LAKE SURVEY RESULTS

Thirty eight lakes in King County were surveyed for the presence of Eurasian milfoil. These 38 water bodies were chosen in a collaborative process with King County staff. They included the major water bodies in the County, and include most of the lakes with a boat ramp or public access site. For other lakes, contact staff at Ecology's Aquatic Weeds Program to request a survey or accurate identification of plants found by citizens. Since lakes can be invaded at any time by milfoil, some of the information in this report may already be out of date.

Survey maps are presented in Appendix A along with information on general lake characteristics, some history of aquatic plant control efforts, and the existing level of infestation at the time of the survey. More detailed information on the characteristics of each lake and its watershed will be required to develop a lake-specific IAVMP. A list of Resources and Contacts is included as Appendix D.

Four levels of infestation have been defined for the purpose of this plan: milfoil free, pioneering colonies present, moderately infested, and heavily infested. Each level of infestation is described below with a list of which of the 38 lakes fell within this category.

MILFOIL FREE

Milfoil free lakes are defined as those for which no milfoil was observed during surveys. These lakes have the potential to be impacted by future introductions due to their location and boat access. Monitoring and preventative activities are appropriate for these lakes. The following 23 lakes in King County are classified as milfoil free as of this inspection.

Lake Alice	Angle Lake	Beaver Lake (Sammamish R.)
Beaver Lake (Green R.)	Boren Lake	Cottage Lake
Dolloff Lake	Fenwick Lake	Fivemile Lake
Lake Geneva	Lake Jeane	Lake Killarney
Langlois Lake	Lorene Lake	Lucerne Lake
Marcel Lake	Morton Lake	North Lake
Pine Lake	Pipe Lake	Star Lake
Trout Lake	Walker Lake	

Four of these lakes (Pipe, Killarney, Lucerne, and Star) had Eurasian watermilfoil infestations at one time and were treated with fluridone. Another lake (Dolloff) also had a small amount of milfoil at one time. There has been no reported or permitted treatment of this lake (K. Hamel, Pers. Comm.). Also, although Fenwick Lake does not have milfoil, it does have Brazilian waterweed, a different noxious plant.

PIONEERING COLONIES/EARLY INFESTATIONS

The presence of pioneering colonies of Eurasian milfoil indicate that the weed has very recently been introduced to the lake and is not yet distributed widely. It is critical to focus on pioneering infestations as soon as they are discovered. Eurasian milfoil will auto-fragment in the fall. These fragments disperse by both the wind and currents in the lake, rapidly spreading the infestation.

There are a number of ways to define a pioneering infestation. For funding purposes, Ecology generally defines an early infestation as three acres or less of the noxious weed in the lake. However, this is somewhat dependent upon history and lake size. If there is a question about whether or not a lake qualifies as an early infestation, contact Ecology's Aquatic Weeds Program staff to make this determination. The following 5 lakes in King County fell into this category:

Lake Neilson (Holm)	Shady Lake	Steel Lake
Shadow Lake	Lake Wilderness	

Shady Lake was identified as having a high population of milfoil in a survey in 1994 (K. Hamel, Pers. Comm.) and there has been no reported treatment. Lake Wilderness previously had a heavy infestation but was chemically treated and milfoil free until recently. Steel Lake has been treated since this survey and may now be milfoil free.

MODERATE INFESTATION

Lakes with moderate infestations have Eurasian Milfoil colonies in 30 to 60 percent of the littoral zone. The following 3 lakes in King County are classified as moderately infested:

Phantom Lake

Lake Desire

Spring Lake

HEAVY INFESTATION

Lakes that are heavily infested with Eurasian milfoil have dense beds of this plant dominating the littoral zone. Eurasian milfoil generally fills the littoral zone in 5 or 6 years after introduction. The following lakes in King County are classified as heavily infested:

Bass Lake

Lake Meridian

Lake Sawyer

Lake Union

Lake Twelve

Lake Sammamish

Lake Washington

DEVELOPING AN IAVMP.....

The following sections of this plan provide guidance on developing an acceptable IAVMP for controlling milfoil in each of these King County lakes. The information on the existing level of infestation should be used to select from a list of appropriate management goals, and that goal will affect the selection of control strategies. Using the information provided in this report, a local agency or homeowners association should be able to develop an IAVMP appropriate to the level of infestation and recreational activities in a specific lake.

PROBLEM STATEMENT

Numerous King County lakes are infested with Eurasian milfoil, while others are threatened by infestation due to their proximity to infested lakes and boater access. The existing lake-by-lake efforts to control or eliminate this plant are inefficient and expensive. It is beneficial to the County and to lake users to have a regional plan for controlling existing plant populations and the spread of new infestations. The plan must acknowledge that the appropriate strategy for a given lake is dependent upon the level of infestation, specific lake characteristics, and community needs. Therefore, the plan must be flexible enough to allow implementation of a variety of control strategies across a wide variety of situations.

MILFOIL MANAGEMENT GOALS

The management of Eurasian milfoil within the County is the desired outcome of this planning effort. As such, it is critical for the user to understand the types of control that can be achieved, and the tools that are available to manage this invasive weed. There are four basic strategies or goals to consider: prevention, suppression, control and eradication. The decision about which of these is most appropriate for a given lake is dependent upon the lake characteristics and the existing level of infestation.

Prevention

Prevention includes preventing the entry and/or establishment of milfoil colonies. Prevention is the most efficient and least expensive strategy and is appropriate for all lakes where no milfoil currently exists as well as those where milfoil eradication attempts are under way. Prevention involves public education, monitoring, and a plan for rapid action if pioneering colonies are detected.

Prevention can also entail public education and signage at nearby infested lakes to warn boaters about transport of plant fragments to milfoil free environments. A new state law passed in 2002 makes it illegal to transport ANY aquatic plants on boats, boat trailers, and gear. The new law also gives WDFW the authority to declare lakes infested if they contain noxious weeds and exotic animal species.

All lakes in King County should have exotic species prevention programs in place. Unfortunately, it is difficult to motivate lake groups to support a prevention plan since it requires funding for annual monitoring, and people are reluctant to spend money before a problem is apparent.

Suppression and Control

Suppression and control strategies are those that are aimed at reducing the level of impact from plants, but are not intended to eliminate all plants. Generally, suppression refers to reducing the population lake-wide and maintaining it at an acceptable level. Control refers to maintenance of weed free conditions in selected high use areas of a lake. Both can require a mix of control methods.

For an individual lake, suppression and control strategies may be used simultaneously. Lake Washington provides a good example of where both suppression and control strategies are used. The City of Seattle Parks department has a program of aquatic plant harvesting, diver hand removal, and use of bottom barriers in their swimming beaches to clear beaches each year. Many marinas and community associations around the lake use harvesting or aquatic herbicides to reduce the impact of this weed in the areas of high use. While these local activities have no long lasting impact on lakewide Eurasian milfoil populations, they do maintain open water in high use areas during the summer and protect many beneficial uses.

Suppression and control is a suitable goal for large lakes where milfoil is widespread and there are funding, environmental, or political factors (such as multiple jurisdictions and salmon issues) that make it difficult or impossible to apply eradication methods. Lake Washington and Lake Sammamish both fall into this category.

Eradication

Eradication requires the total elimination of the plant throughout the lake or at least maintaining very low levels of milfoil. There have been a number of successful eradication projects in King County that have been funded and performed under Ecology's Aquatic Weeds Program. The size of the lake and the infestation has a great bearing on the economics of this approach. However, lakes of almost 500 acres in size have been treated in this fashion with good results.

Although eradication is possible, it requires a great deal of financial commitment on the part of the lake group. It requires continual monitoring to detect re-introductions or "missed" plants. Without these efforts eradication is only temporary and plants almost always return within two to three years. Most eradication efforts really result in suppression because of the high probability of re-infestation

from outside the lake. Lake Twelve is an example of an unsuccessful eradication program. For two years after treatment with fluridone it was milfoil free. The third year a few plants were observed and hand removed. However, this monitoring was discontinued and the entire lake is now infested again.

Eradication is a suitable goal for small to medium-sized (up to 350-acres) lakes where lake residents are willing to form self-funding districts to continue with follow-up monitoring and prevention programs. Generally these lakes need to have enough residents to raise comfortably several thousand dollars per year for aquatic plant management. Lakes in Washington have achieved eradication of milfoil by; grass carp stocking (Silver Lake), fluridone treatment (Goss Lake), and hand pulling and bottom barrier installation (Lake Youngs).

PUBLIC INVOLVEMENT

Due to the regional nature of this plan, its development did not include a public involvement effort. However, public involvement will be required before a strategy for control of the milfoil in a specific lake can be selected. Involving the public, affected agencies and other interest groups is critical to the successful completion of a plan and implementation of a control strategy. Even if there is no milfoil present in a lake, a program for prevention and detection will often require volunteer involvement. If milfoil is present and a strategy is selected that requires local funding support or centers on a control mechanism that can be controversial (i.e. chemical treatments), then public involvement is critical for education and to build support for the project.

A public involvement strategy involves contacting people and agencies, conducting well publicized public meetings, and working to keep the community informed. It can also include coordinating volunteer efforts, and other tasks that are specific to individual lake needs. Often the public involvement process begins with development of a steering committee to help carry out these tasks. It is important to involve as many affected parties as possible in these efforts. State, county, and local governments, tribes, private businesses, citizens, and interest groups should be directly contacted.

The public involvement process should be well documented. Meeting announcements, agendas, and meeting minutes should all be tracked and filed. These and sign-in sheets that contain contact information for each of the attendees at meetings and workshops should be retained as evidence of the process followed.

Examples of some of the steps that should be considered when developing a lake specific IAVMP include:

- ◆ Form a Steering Committee comprised of representatives from the lake community and other interested groups or agencies.
- ◆ Identify which steps required for the IAVMP have not been completed, where additional information is required, and who is going to get it.
- ◆ Meet with key people or groups who are likely to be interested in the project or who play an important regulatory role. Invite them to participate on the Steering Committee.
- ◆ Conduct at least two public meetings. The first to discuss this regional plan and describe the control strategies that are approved for use under this plan. This meeting might also be used to

refine goals so they are specific to the lake and to prioritize them. At the second meeting a preferred control strategy would be presented and approved by those present.

- ◆ A newsletter can be advantageous for describing the outcome of these meetings and the direction the group is taking.
- ◆ Ecology recommends that these plans go through the SEPA process. This additional step formalizes the public process.

In addition to these general public involvement steps, additional steps may be required to develop an adequate prevention and detection program. These might include;

- ◆ Training a group of lake residents on aquatic plant identification and survey techniques.
- ◆ Development of an ID “key” for plants currently found in each lake as well as problem exotic plants to aid detection of pioneer infestations.

LAKE AND WATERSHED CHARACTERISTICS

It is important to identify characteristics of the lake and its watershed since this information has a large impact on the selection of control strategies. This information should include things such as primary land use activities (i.e. agriculture, forestry, urban development) and known point or non-point sources of pollution. Key descriptive features of the watershed include: the size and boundaries of the watershed, tributaries, wetlands, and sensitive areas; existing watershed management, monitoring, or enhancement programs; and the presence of rare or endangered plant and animal species, especially ESA listed salmon. Key characteristics of the lake should include the exact location, its size, shape and depth, physical and chemical characteristics, shoreline use, recreational use, history of the lake, outlet control, and significant water rights.

Some lake characteristics may be more important than others depending on the control methods selected. For instance, underwater obstructions may prevent an effective harvesting program from being implemented. As another example, water rights may not be important unless herbicide use is selected. In that case, it is important to determine who uses the water and for what purpose. Once an action plan is selected additional information needs such as these should be identified and addressed. Some of this information may not be available, and the lake steering committee may decide it is important to set up a monitoring program to collect important data. It is also critical to verify the level of infestation in the lake. The survey work for this regional plan was done during the summer of 2001, existing infestations can have progressed and new infestations may have occurred since that time, so updated information will be essential.

Appendix A contains information of the level of Eurasian milfoil infestation, survey results, and maps of the 14 lakes which contained the invasive plant in the 2001 survey. This information provides the starting point for describing lake and watershed characteristics. King County and Ecology staff are an excellent source for more detailed information. Appendix D contains a list of resources for obtaining additional information. If the lake group wants to qualify for Aquatic Weeds grant funding, their site-specific plan must be approved by Ecology and must meet minimum requirements. These requirements can be reviewed at the following website:

<http://www.ecy.wa.gov/programs/wq/plants/grants/appendixc.html>

CONTROL OPTIONS

Control options fall under three categories; Physical and Mechanical Controls, Biological Controls, and Chemical Controls. A general description of the differences between these follows. Detailed description of all aquatic plant control tools approved for use in Washington State are described in Appendix B. Detailed information on permitting requirements is provided in Appendix C.

PHYSICAL/MECHANICAL CONTROL METHODS

Mechanical control programs for aquatic weeds, Eurasian milfoil in particular, have been in place for years. Mechanical controls include aquatic plant harvesting, rotoation, weed rolling, and diver dredging. All require handling and transport of removed plant materials. Physical controls include lake level drawdown and the use of bottom barriers. There are also many hand removal methods that fall into this category. These are methods used on small areas around homes, docks, beaches, etc. that can be physical or mechanical and range from handmade rakes to the use of bottom barriers.

There are many things to consider when selecting between one or more of the control options. Some require transport and disposal of plant material, some create plant fragments that will cause the infestation to spread, some are not appropriate for use in lakes with salmon, etc. Information on the issues and limitations associated with each option, are described in detail on Ecology's Aquatic Weeds website: <http://www.ecy.wa.gov/programs/wq/links/plants.html>

BIOLOGICAL

There are only a few biological control agents that have been identified, and some of these are still in the research phase. Biological control agents include fish, insects, and fungal pathogens. The only common form of biological control for submerged aquatic weeds is the White Amur, more commonly known as "grass carp". This fish is native to the Amur River in Northern China and consumes aquatic vegetation as its main source of food.

CHEMICAL

Chemical control technologies are a widely used method of aquatic plant management in the United States. The Environmental Protection Agency (EPA) is responsible for approving pesticides and setting use restrictions. If the EPA finds that there is a potential for impact or injury when the material is applied, a use restriction is applied to decrease the potential for impact. The most common water use restrictions involve the use of the treated water for irrigation, since these are herbicides that can also affect terrestrial plants. In other cases, the use of treated water for human consumption might be limited for a short time until the herbicide dissipates or is broken down.

Aquatic herbicides can be divided into two types: contact and systemic. Generally, contact herbicides work rapidly, but affect only the exposed part of the plant, while systemic herbicides require more time to take effect, but affect the entire plant including roots.

Contact Herbicides

Contact herbicides are fast acting but affect only the parts of the weed contacted; that is, it destroys the vegetative part of the plant but does not kill the roots. Contact herbicides generally will not translocate

through the plant and control the root systems. Contact herbicides can be useful for removing and killing the portions of the plant in the water column that would fragment and spread. This can be an effective method for targeting pioneering colonies to keep them from spreading while a more permanent solution is found. They are most commonly used as part of a long term maintenance program, as a means of managing and removing vegetation in high use areas. Use of contact herbicides requires careful monitoring of plant recovery and ongoing treatment. There is one contact herbicide (Aquathol®) that is routinely used for the management of Eurasian milfoil.

Another contact herbicide possibly available in the future for control of Eurasian milfoil is Reward®. This product has a shorter irrigation restriction than Aquathol® (up to 72 hours as compared to 7 to 21 days for Aquathol®). As it too is a contact herbicide, it is most useful in the role of controlling vegetation in high use areas and preventing spread by plant fragments. It is not yet approved for use in Washington State but is expected to be approved in 2003.

Systemic Herbicides

Systemic herbicides are more commonly used to target Eurasian milfoil because they are often more species selective and also will translocate to the roots, thus controlling the entire plant. Since some systemic herbicides are relatively selective, they can be used to remove Eurasian milfoil from a lake with minimum affect on other plants. Since they kill the entire plant, they provide a long period of control or even eradication. They are appropriate for use at all levels of control; suppression, control, and eradication and for all levels of infestation. However, treatment area size and the volume of water being treated are important determinants in selecting among them and will greatly affect the treatment costs.

Differences to consider in comparing between systemic herbicides include: how fast it works, whether it is selective for milfoil or affects all plants, whether it can be used for spot treatments, and associated water use restrictions. Ecology's Aquatic Weeds Program website contains detailed descriptions of these considerations (<http://www.ecy.wa.gov/programs/wq/links/plants.html>).

Environmental and human health impacts of these herbicides were evaluated in a recent EIS and risk assessment by Ecology. This document can be reviewed at the following website:
<http://www.ecy.wa.gov/programs/wq/pesticides/seis/index.html>

DEVELOPING A COST ESTIMATE

The following matrix is provided to assist with developing milfoil control cost estimates and to aid with identifying other cost elements that may be associated with these projects. This is provided as a general guideline. There may be other cost considerations that are specific to a lake project, and there is a great deal of variation and subjectivity about monitoring requirements and prevention programs. For example, a long term prevention and detection program is always recommended. It is highly recommended (essential) in cases where a high degree of suppression or eradication is the goal. Either way, the costs will vary widely depending upon the extent of the program and available volunteer labor.

Matrix 1. Developing cost estimates for implementing Eurasian milfoil control strategies.	Per Acre Cost	# of Treatments per Year	Permitting	Other Considerations	Monitoring &/or Diver Surveys⁽⁹⁾	Prevention Program
Physical/Mechanical Methods						
Bottom Barrier	17,424 ⁽¹⁾	1	(5)	No	RQ ⁽¹⁰⁾	RQ
Harvesting	800	2-3	(5)	Disposal		RQ
Rotovation	1,800	1	(5)	Disposal		RQ
Diver Dredging	(2)	1-2	(5)	Disposal	RQ	HR
Drawdown	Variable	1				RQ
Biological Methods						
Grass Carp	50-200 ⁽³⁾	NA	\$24 ⁽⁶⁾	Screens	HR	R
Chemical Methods						
Contact Herbicides (Aquathol® & Reward®)	250-550	1-2	(7)	(8)		RQ
Systemic Herbicides (Aquakleen®, Navigate®)	650	1-2	(7)		RQ	HR
Systemic Herbicides (DMA*4VM®)	500-700	1-2	(7)		RQ	HR
Systemic Herbicides (Sonar PR®)	1,100	2-3	(7)		RQ	HR
Systemic Herbicides (Sonar AS®)	750 ⁽⁴⁾	2-3	(7)		RQ	HR

- (1) Based on an estimate of \$0.40 per square foot installed (\$0.20 per square foot material costs).
- (2) Costs highly variable depending upon plant density. Estimate \$160 per hour for a diver team performing removal work.
- (3) The cost will vary according to the stocking density and shipping method.
- (4) This assumes a whole lake treatment.
- (5) HPA required by WDFW. May require assistance from a professional. Appendix C summarizes permitting requirements.
- (6) Although the permit application is easy to fill out, the development of an appropriate stocking density may require assistance from a professional.
- (7) All herbicides must be applied by a licensed applicator. Typically the applicator applies for the permit and thus there is no direct cost to the lake homeowners. Appendix C summarizes permit requirements.
- (8) Estimate \$100 per hour for a diver team that is doing only survey work.
- (9) May involve temporary disruption of other uses.
- (10) Periodic checks for gas build-up under the barriers.

RQ: Required
HR: Highly Recommended

SELECTING A CONTROL STRATEGY

The following matrix provides a summary of the available techniques for control of Eurasian milfoil and their general appropriateness for use in meeting different control strategies at different levels of infestation. Please note that the matrix is a guidance tool. As described in other sections of this report, many lake specific factors need to be considered that would make some of the approved control methods inappropriate for a given lake and vice versa. For example, harvesting is approved for moderate levels of infestation because it can be used to suppress populations. However, it is likely to result in the spread of the infestation and accelerate movement from a moderately infested to heavily infested lake. So, it would probably only be used if no other alternative was feasible. Similarly, diver

dredging is listed as approved for use in heavy infestations. While diver dredging could be used to control a heavy infestation, the cost would likely be prohibitive, so it is unlikely to be the best choice for that situation.

Matrix 2. Eurasian milfoil control strategies approved for use in meeting different management goals for various levels of infestation.	Suppression	Control	Eradication	Pioneering	Moderate/Patchy Infestations	Heavy Infestation
Physical/Mechanical Methods						
Bottom Barrier		✓	✓	Yes	Yes	Yes
Harvesting	✓	✓		No	Yes	Yes
Rotovation	✓	✓		No	Yes	Yes
Diver Dredging	✓	✓	✓	Yes	Yes	Yes
Drawdown	✓			No	Yes	Yes
Biological Methods						
Grass Carp	✓		✓	No	Yes	Yes
Chemical Methods						
Contact Herbicides (Aquathol® & Reward®)	✓	✓		No	Yes	Yes
Systemic Herbicides (Aquakleen®, Navigate®, Sonar®, DMA*4VM®)	✓	✓	✓	Yes	Yes	Yes

LONG TERM PROGRAMS

No matter which strategy is selected for control of milfoil, there will always be potential for re-introduction. There are also other non-native, highly invasive plants of concern. These include Parrotfeather (*Myriophyllum aquaticum*), Brazilian Waterweed (*Egeria densa*), Hydrilla (*Hydrilla verticillata*), Fanwort (*Cabomba caroliniana*), and Water Hyacinth (*Eichhornia crassipes*). A long term program is nearly always required to protect lakes from future invasions, and the focus of such a program must be prevention and detection. Ecology recently published an excellent manual for identifying these and other aquatic plants. A copy of this publication “An Aquatic Plant Identification Manual for Washington’s Freshwater Plants” can be obtained through the following website: <http://wws2.wa.gov/prt/printwa/wsprt/default.asp>. This manual is also available on-line at: <http://www.ecy.wa.gov/programs/wq/plants/plantid2/index.html>.

INVASIVE PLANT PREVENTION AND DETECTION PROGRAM

To be effective this program should include both a source control component (a plan for keeping the plants out of the lake) and a detection program. The objective of source control is to prevent non-native submerged plants from entering the lake. Public boat launches represent an area where there is a high potential for introduction of invasive plants. At a minimum, a sign warning of exotic plant introductions should be posted at boat launches with specific instructions on how to clean boats and trailers to prevent the spread of plant fragments. Although most King County area lakes already have a milfoil control sign, it is recommended that a larger sign be placed near the entrance to the launch that requests boaters to stop well away from the water and check their boat and trailer for plant

fragments before launching. Lake residents should also receive informative brochures on an annual basis, reminding them of plant invasion problems and the importance of keeping their own equipment free of plants. It is also recommended that the lake community institute a public information campaign for opening day of the fishing season and a few other key weekends. Simply having volunteers hand out brochures for a few hours and help with boat and trailer checks will emphasize the importance of the effort and remind boaters of their responsibility to check equipment.

Early detection is the next step to protect against infestations. While an infestation is still relatively small, there are options for control that are less expensive and less controversial than whole-lake treatment. Effective early detection requires both a trained group of lake volunteers who are responsible for periodic patrol of the lake and periodic diver surveys to assess the existing plant community. The main purpose of these surveys is to search for Eurasian milfoil and any other exotic plants, noting location, abundance, and spread. Small pockets of plants can be handpulled immediately. If the area infested is too large to control by handpulling, or if after two follow-up dives the exotic is still found, another strategy may be needed for its removal or control. The long term control plan for each lake should include development of a contingency fund to allow immediate control of new infestations of invasive aquatic plants, if necessary permits can be obtained.

Additional diver surveys, bottom barrier installation, and herbicide treatments may be contingency elements to overall aquatic plant control plans. Since these costs would only accrue in the event of another infestation by Eurasian Watermilfoil or another exotic plant, the costs may be covered through an “early infestation grant” by Ecology.

PLANT CONTROL ADVISORY COMMITTEE

Proper implementation of the described plan may rely upon formation of a Plant Control Advisory Committee. This committee would have the following responsibilities:

- ◆ Review annual plant survey information (collected by volunteers and professionals) and track potential problem areas.
- ◆ Insure permit requirements are met.
- ◆ Review submerged exotic plant problems and determine the appropriate control strategy and urgency of control needed.
- ◆ Recruit and direct volunteers for annual surveys.
- ◆ Select and hire contractors when necessary for tasks such as providing training, spraying, diving, etc.
- ◆ Oversee implementation activities such as herbicide applications.
- ◆ Provide information and newsletters to lake residents and perform as spokesperson for answering questions on plant control problems and long-term implementation of this plan.
- ◆ Conduct annual evaluations to determine if implementation activities are meeting plan goals and make recommendations for activities in the next year.

The King County Water and Land Resource Division’s Lake Stewardship Program and King County’s Noxious Weed Control Board are an excellent resource for technical assistance and noxious weed

identification training. The Lake Stewardship program also offers speakers on lake-related topics and can tailor programs to the community needs.

FUNDING.....

SHORT TERM FUNDING

As detailed in previous sections, implementation of a milfoil control strategy and other elements of a complete IAVMP for a lake can be costly. There are a number of mechanisms for acquiring funds to carry out these efforts. The State's Aquatic Weed Management Fund (AWMF) is a main source of funding. As described below, funding can be obtained to either complete development of an aquatic plant control plan (IAVMP) or to implement a plan that is already approved under the program. This regional plan serves as the planning document for many elements required to meet the AWMF program IAVMP planning needs. However, certain elements such as site-specific lake and watershed characteristics, public involvement, selection of control strategies, and development of cost estimates must still be accomplished on a lake specific basis. These steps could be completed under a "planning grant."

The AWMF has a yearly funding cycle for general aquatic weed management projects. (Funds are also available for early infestation projects. These funds are available year-round, but only as funding is available and on a first come first served basis.) There is a competitive process for awarding these grant funds that begins with a written application. The annual application period begins October 1 and closes on or about November 1 of each year. Workshops are held before or during the application period to explain the application process and general program requirements. Workshops are generally held in Lacey and Spokane. Grant applications are evaluated according to established criteria. Application guidelines, criteria and other information about this program are detailed on Ecology's Aquatic Plants and Lakes website, under Aquatic Weed Grants (Appendix D).

Limits have been set on the size of grants that are available.

- ◆ The maximum grant amount for aquatic weed management grants is \$75,000. With the local match requirement of 25 percent, this equates to a project cost of \$100,000.
- ◆ Planning grants are limited to \$30,000. With the local match requirement, this equates to a project cost of \$40,000.
- ◆ The maximum grant amount for early infestation grants is \$50,000.

A public body (for example, a local agency such as King County or the City of Redmond) must sponsor the grant application and ultimately be responsible to meeting grant requirements. These public entities are also required to provide matching funds for AWMF grants. The percentage of match varies according to project type: General aquatic plant projects will be funded at 75 percent state share and 25 percent local share. Pilot projects and early infestation projects will be funded at 87.5 percent state share and 12.5 percent local share.

Limits have also been set on the amount of funds available to each public body (e.g., King County) during each funding cycle. The ceiling amount per public body is \$75,000 for general aquatic weed management projects and \$75,000 for early infestation projects. Ultimately these projects will fail unless lake groups form some sort of self taxing district to carry on with monitoring and other long term efforts.

The WaterWorks grant program funds projects that improve water quality and water-dependent habitat in King County and South Snohomish County. Grants up to \$50,000 can be applied to restore or protect lakes, including the eradication or control of noxious weeds such as milfoil and purple loosestrife. Projects must meet the following criteria: 1) address water quality/habitat issues or problems, 2) involve community stewards and educate the public, 3) form partnerships, 4) leverage resources, and 5) provide assurance of their legacy.

Proposals up to \$5,000 can be submitted anytime. Proposals above \$5,000 can be submitted in March or in August and are evaluated competitively. Incentive points are awarded if proposals address lake issues. Applicants must either be incorporated or be sponsored by an incorporated organization or local government.

For more information, an application and deadlines, please visit the WaterWorks website at <http://dnr.metrokc.gov/wlr/waterres/wsf/wsfinfo.htm> or call Ken Pritchard at (206) 296 8265.

LONG TERM FUNDING

The AWMF is only appropriate for use for development of IAVMP's and initial implementation. Funds for expensive control strategies or long term monitoring will need to be acquired through other mechanisms.

Lake Management Districts

The most common method used is a local taxing district, often called a "Lake Management District." This allows lake property owners to develop a method of taxing themselves and other lake users to collect funds for various lake management activities. Information about this can be obtained from the King County Lakes Stewardship Program and from the following website:
<http://www.leg.wa.gov/RCW/index.cfm?fuseaction=chapterdigest&chapter=36.61>

Lake groups that have formed lake management districts include: Long Lake, Thurston County; Campbell-Erie Lakes, Skagit County; Loon Lake, Stevens County; and Lake Wilderness and Beaver Lake in King County. Groups in King County at Lakes Cottage, Sawyer, and Desire are in the process of forming taxing districts.

Water and Sewer Districts

Water and Sewer Districts are self-taxing districts whose funds can also be used to manage lake problems.

Lake groups that have formed Water and Sewer Districts include: Liberty Lake, Spokane County, Clear Lake, Pierce County, and Sacheen Lake, Pend Oreille County.

Homeowners Associations

A few lake groups have homeowner associations that assess themselves for lake management activities. Lake Limerick in Mason County is an example of such a lake.

Lake Associations

These typically do not have taxing or assessment functions, but they are the first step in getting organized as a functioning lake group and may have the structure to provide some start-up revenues.

Future Funding

Most lake groups are unhappy at being expected to pay the costs of noxious weed removal. However, very little funding for exotic plant removal is available from the state. A few years ago, the state legislature formed a bipartisan Lake Health Committee to look into lake issues, including funding. The conclusion of this committee was that the legislature should make laws which make it easier for lake groups to form self-funding districts. Although increased funding was discussed, there was no move to develop new state funding sources or to increase existing funds. Unfortunately, it is still up to each lake group to take the initiative to remove exotic plants from their lake, no matter what merit their arguments may have.

CONCLUSIONS AND RECOMMENDATIONS

Eurasian milfoil is a major problem in Washington State and is present in important water resources located in King County. In 2001, the majority of the smaller lakes in the County were milfoil free. In some cases the plant had not yet spread to those water bodies. In other cases, government and the lake shore residents have banded together to eradicate the populations. Because so many lakes are currently free of milfoil, prevention and early detection is critical to success of a long term regional control plan. An outreach program should be developed to train lake volunteers on simple survey techniques and plant identification. A more formal survey program should be considered to insure surveys are completed near the boat ramps of all 27 non-infested lakes each summer. Catching this plant early is the key to less expensive control.

Where possible, eradication efforts should be implemented to treat impacted lakes. Where this is not possible, boat ramp sites should be checked for the presence of Eurasian milfoil plants and fragments. These should be removed from the immediate area of the boat ramp using chemical methods or diver operations. Discussions with Ecology should be undertaken to determine the extent to which this type of preventative activity could be funded under the Aquatic Weed Program.

The lakes identified here with early infestations should be a high priority for local planning. These lakes along with Spring Lake, should be targeted for immediate action and control. (Spring Lake is included because it is very near Shady Lake as well as close to a number of other milfoil free lakes, where extensive amounts of money have been spent on eradication.) Steel Lake has recently been treated under an Early Infestation grant provided to the City of Federal Way.

Eradication of Eurasian milfoil has been accomplished in Washington State using herbicides, grass carp, and, diver removal technologies. Ideally, every infested water body in King County would be treated in order to restore native aquatic plant communities. However the larger the lake, the more cost prohibitive this approach becomes. Some lakes that fall within the range of potential affordability are Lake Meridian, Phantom Lake, Lake Sawyer and Lake Twelve. Each of these lakes would be eligible for funding under the Ecology's Freshwater Weed Fund criteria, although priority would be given to those that have not previously received funding. These lakes are among the more heavily utilized water bodies in the state. They are also in close proximity to lakes where Ecology and local groups have funded successful eradication efforts. Those efforts are threatened by the presence of this weed in other lakes.

Lakes Washington and Sammamish pose a problem because of the high cost of treating such large infestations. These lakes will continue to be a source of Eurasian milfoil in the area, maintenance to

protect beneficial uses may be a realistic goal for these lakes. At a minimum, all boat access ramps should be surveyed and treated to suppress Eurasian milfoil.

This report is focused on Eurasian milfoil because it is the most prevalent noxious aquatic weed in the state. There are other invasive aquatic species in King County waters that should not be neglected. Brazilian Waterweed has been known to be present in Lake Fenwick for a number of years and is also present in Lake Washington. Hydrilla is present in Pipe and Lucerne Lakes. To insure early detection of other infestations of this plant, homeowners and other groups should conduct monitoring.

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