

Ames Lake Integrated Aquatic Vegetation Management Plan



Photo Taken By Tracy Emmanuel

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Survey's done for Ames Lake

Aquatechnex
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Acknowledgement

In creating this document, we researched IAVMP documents from similar lakes in King County. The IAVMP for Cottage Lake was published in January, 2018, and contained information on a number of noxious weeds that also exist at Ames Lake. We applied a lot of the content on fragrant water lily, purple loosestrife, and yellow flag iris from the Cottage Lake document into our own.

For reference, here is the Cottage Lake IAVMP:

<https://www.kingcounty.gov/services/environment/animals-and-plants/noxious-weeds/brochures-reports/reports/Cottage-Lake.aspx>

Section 1 - Executive Summary

Ames Lake is a small 80 acre lake located in Northeast Redmond in unincorporated King County, Washington. The lake has private access, including a community boat ramp operated by the Ames Lake Community Club (ALCC), and is used for boating, fishing, swimming, wildlife viewing, and ecosystem processes.

Over the past several decades aquatic noxious weeds at Ames Lake have greatly increased their distribution and impact. Three species cause the most concern: fragrant water lily, purple loosestrife, and yellow flag iris, all listed as noxious weeds in Washington state. At community meetings Ames Lake residents have voiced concerns over the negative impact of these noxious weeds on swimming, boating, fishing, wildlife habitat value, ecological processes, and connection with wildland areas.

The ALCC has been leading whole-lake scale efforts to reduce fragrant water lily infestations at Ames Lake since 2015. We first followed our own ideas, and hired a team of divers to hand pull lily pads. When this project failed, we did more research and decided to follow the advice of experts. We consider the experts to be entities like King County Noxious Weed Control Program, Washington State Department of Ecology, and other departments and businesses that have decades of experience working with noxious aquatic weeds.

Ames Lake efforts have involved a number of volunteers as well as many hours of research, planning, and even physical labor. Our plans and research have been shared with the community through emails, website posts, newsletters, updates in community meetings, and also educational sessions dedicated to this topic.

Under the guidance of the King County Noxious Weed Control Program, the ALCC decided to put all of this information we have collected over the last 4 years into the form of an Integrated Aquatic Vegetation Management Plan. There are 2 main reasons we are publishing an IAVMP:

1. **To document what has been done.** This document shall be a repository for what has been done to combat fragrant water lily and other noxious weeds at Ames Lake, what has not worked, what has been successful, what challenges we have faced, etc. When existing residents have questions about noxious weeds at Ames Lake, this document will be a valuable resource for them. When new residents and future generations are interested in the history of lily pad efforts, this document will inform them.
2. **To document what we have learned.** Over the years, multiple methods for noxious weed control have been used at Ames Lake. As we have worked on whole-lake scale efforts we have learned a great deal about the noxious weeds in and around Ames Lake. We have also learned many details about various methods of controlling these noxious weeds. We get many questions from residents where someone asks why we don't try a certain method, or where someone thinks they have a new idea that will work. We hope this document will help answer these questions. We hope that any future efforts to control noxious weeds by Ames Lake residents will use this document as a basis for their decisions and not repeat options that we have learned are costly and ineffective.

Section 2 - Problem Statement

Ames Lake supports the well-being of a wide variety of plants, animals and people. Additionally, introductions of several aquatic noxious weeds have influenced the character of this lake. The floating leaf noxious weed fragrant water lily (*Nymphaea odorata*) can be seen covering the majority of the shoreline in the north end of the lake as far back as 1970. These plants have colonized much of the lake's shallow littoral zone. The emergent noxious weed purple loosestrife was first documented at the lake in 2013 and has been found at 15-16 different locations along the lake shore (King County Noxious Weed Control Program, 2019). The emergent noxious weed yellow flag iris (*Iris pseudacorus*) currently occupies much of the lake's shoreline as far back as 1970. At community meetings held on the topic of aquatic weeds at Ames Lake, lake residents have voiced concerns over the impact of the noxious weeds on:

- Swimming – the weeds make it physically difficult to swim and could potentially cause entanglement
- Boating – the weeds impede boat movement and quickly tangle up motorboat props and paddles
- Fishing – the weeds easily snag fishing lines and hooks and prevent shoreline fishing
- Wildlife Habitat Value – the weeds displace native aquatic plants that wildlife are adapted to and favor non-native fish
- Ecological Processes – the weeds disrupt ecological processes

The aquatic vegetation at a lake can positively and negatively affect human and wildlife uses of the waterbody. Aquatic noxious weeds, whether emergent, floating, or submerged, can have an adverse impact on the quality of a lake. An IAVMP is a process framework that aids in the development of strategies that address aquatic noxious weed issues. As stated in *A Citizen's Manual for Developing Integrated Aquatic Vegetation Management Plans* (Gibbons, Gibbons, Jr., & Sytsma, 1994):

“The plan provides a means to make informed decisions for managing aquatic plants that protect human health and the environment. “ An IAVMP contains both background research into the waterbody (see *Waterbody and Watershed Characteristics* section) and consideration of various control strategies for the existing aquatic noxious weeds (see *Management Alternatives* section). Crucial to the success of an IAVMP is active community involvement in the development of the plan. It is also critical that the weed control methods selected are appropriate for both the waterbody and the community.

Section 3 - Management Goals

The overall management goal for this IAVMP is to give homeowners options for controlling aquatic noxious weeds at Ames Lake in a manner that allows sustainable native plant and animal communities to thrive, maintains acceptable water quality conditions, and facilitates recreational opportunities (boating, fishing, and swimming) of the lake.

The following objectives should be pursued to ensure success in meeting this goal:

- Control or eradication of floating and submerged aquatic noxious weeds
- Eradication or control of emergent shoreline noxious weeds
- Maintenance of safe conditions for native fish, wildlife, and people
- Involvement of the Ames Lake Community in planning and implementation of the IAVMP

Section 4 - Public and Community Involvement

Community Commitment

The Ames Lake Community has demonstrated its strong commitment to aquatic weed control issues through the activities of the Ames Lake Community Club. This organization has led and funded several lake-scale aquatic weed control activities at the lake over the past few years.

Community Outreach and Education

The ALCC has been organizing efforts to combat lily pads since 2014. Some residents have reported tackling the lily pads for close to 30 years. An ongoing source of communication has been annual newsletters sent to the community and the annual ALCC meeting itself where information and plans are shared and community questions are heard. The ALCC also has an email registration system where registered owners can receive important updates about ongoing lily pad projects.

For details of community communication, such as emails and meeting minutes, see Appendix 1.

Prior to 2015 -

Individual residents began contacting state agencies and the recommended approved contractors to find options to handle the expanding lily pad mass in front of their lots.

The ALCC and residents sold Lily Pad Rakes custom built by a local welder. This would help encourage residents to cut back their lily pads. See the picture below.



Photo taken by Lisette Johnson



Photo taken by Lisette Johnson

2015 Ames Lake 1st Reported Algae Bloom - The Ames Lake Community Club learned of an algae bloom from a facebook post. The ALCC contacted King County and followed King County's recommendations. The ALCC posted warning signs at the community beach lot. After two additional water sample tests found no harmful algae, the warning signs were removed.

Meeting at Residents House

In May 2015, a group of waterfront property owners put together a meeting with approximately 30 waterfront residents. The meeting was to determine if there was any interest on coming together to take care of the lily pads. There were two options we discussed. The first option was an effort to have the Lilies pulled by divers. This would allow homeowners to take action the upcoming summer. The use of herbicide was also discussed as a possibility. It was suggested by the presenter at this meeting that it was the most affordable option. It was also considered best to have a whole lake approach for controlling the invasive Lilies. It was agreed upon by the majority of the attending homeowners to present the community with pulling the lilies as our first form of action and herbicides as a last resort. The job would require raising funds and hiring a contractor.

2015 Hand-Pulling Project

The ALCC board was presented with the plan to pull lily pads by divers and approve the fundraising to do so. The community beach and other community lots, along with homeowners who wanted their lilies pulled would pay into a fund to cover the expenses.

Pulling started in June. This project failed due to rising costs and the divers not getting all of the lily pad roots as expected. The effort was terminated in July before completion. Community members got together to avoid costs and gathered all the 10 yards of lily pad debris (See pictures below.) Funds were returned to contributing members who did not have lilies pulled.

This led the ALCC to look into a more effective control method. The only option that seemed feasible was to treat with herbicide. In the fall of 2015, the ALCC contacted residents who had contributed as individual property owners, to check interest level in using an herbicide to remove water lilies on their waterfront property. This included the lots at the North end of the lake where lily pad infestations are the worst. Having seen a presentation by Aquatechnex, the focus group agreed we should move ahead and get permits for the 2016 season. The summary was that nobody wants to add herbicide to the lake, but at this point some of the areas were so infested that the group unanimously agreed that they really didn't have any other options. Years and years of fighting them back and using rakes and hand pulling methods were not working. The majority of residents wanted to move forward with Aquatechnex to get a permit.



Photo taken by Lisette Johnson 10 yards of Lily Pads removed from the beach lot.



Photo taken by Lisette Johnson



Photo taken by Lisette Johnson



Photo taken by Andy Carroll after Diver terminated. You can see lily pad growth coming back immediately.

2016 - Herbicide Permit - The ALCC hired Aquatechnex to apply for an herbicide permit for Ames Lake. Residents had the ability to ask questions and submit concerns about the use of herbicide. Department of Ecology answered any and all of the concerns.

2016 - Annual Meeting

At the 2016 ALCC annual meeting, there was a discussion on lily pads, including our failed project to hire divers to hand pull lily pads, and next steps to move forward with Aquatechnex treating lily pads with an herbicide. Travis Fuller, Aquatic Specialist, from Aquatechnex was present to address the community members questions. .

2016 - Organized Volunteer group of residents hand pulled the Community Beach lot

A group of community members strongly objected to the use of herbicide. The ALCC decided to move ahead with treatment only for waterfront lots that have opted in. Those that were opposed to the use of herbicide organized to hand pull lily pads at the community lots a handful of times during the summer of 2016. The group of residents were able to keep the main boat area and swimming paths from the beach lot cleared. They were unable to remove lily pads from the remainder of the beach lot or the other community lots.

2016 - Residents Appeal Permit - In August, residents filed an appeal with the Pollution Control Hearings Board challenging the permit, and requesting a stay be put on the permit until the appeal could be heard. In September the Pollution Control Hearings

Board denied the request to stay the permit, and the residents dropped the appeal. See *appendix 1 for more details.*

1st Treatment applied in the Fall of 2016 - the first treatment reduced the areas of lily pads. You can see in the picture below Aquatechnex cut channels into the large areas of Lily pads.



Photo taken by Andy Carroll after 1st treatment of Lily pads 2016

2017 Annual Newsletter

The 2017 newsletter encouraged residents to attend an upcoming aquatic meeting to learn more about water quality at Ames Lake and options for invasive aquatic plants. The newsletter also informed residents of a vote at the annual meeting that would be used to determine if the community lots would be treated along with other lots that had opted in to the lily pad treatment program. *See more in appendix 1.*

2017 Educational Meeting

In February 2017, the ALCC hosted a lake management educational meeting. We had Ben Peterson, Aquatic Noxious Weed Specialist with King County, Travis Fuller from Aquatechnex, and a senior ecologist from a local company present at the meeting.



Photo taken by Alicia Tremblay

2017 Annual Meeting

In March 2017, at the ALCC annual meeting, the board took an advisory vote of those present to treat the lily pads at community lots B, C, D, and E. The poll concluded that the majority of the community that showed up to the meeting wanted the lots treated. As a result the ALCC board opted in lots B, C, D, and E to the lily pad treatment program moving forwards.

September 2017 The 2nd Reported Algae Bloom

The Ames Lake Community Club learned of an algae bloom from King County. The ALCC followed King County's recommendations. The ALCC posted warning signs at the community beach lot. After two additional water sample tests found no harmful algae, the warning signs were removed. This time around we learned a little more about the algae that was tested.

After seeing a photo (see below) of the same kind of algae as was sent in for the water test, here is the response from Chris Knutson Water Quality Planner/Project Manager II with King County Water and Land Resources Division:

"The photo below is definitely benthic algae (probably oscillatoria) and can produce toxins. The other algae you saw may very well be cyanobacteria but I'm thinking Rachael didn't see enough in the bottle to warrant testing. Do you frequently see clumps of that benthic algae around the lake? It is a little bit of an unusual situation to have these little toxic clumps sampled so it becomes a question of management strategy (especially if they are not abundant in the lake). You don't want to have warning signs up all the time but you do want to have people be aware of the potential for toxic algae. I don't think we should submit a sample to the lab until next week. The protocol from Health calls for two

weeks of samples below the guideline so I think we should try again on Monday or Tuesday if you can.”



Additional treatments were applied in the summer/fall of 2017 and 2018 - A total of four more treatments were applied in the summer/fall of 2017 and in the summer/fall of 2018. The treatments significantly reduced the areas of lily pads, which has resulted in reducing the amount of herbicide needed each time as well. Some amount of lily pads return each spring/summer and continued treatment would be required for a few more years to fully eradicate the lily pads in those areas.

2018 Annual Newsletter

The Annual Newsletter is where we educate residents about things they can do to improve the health of their lake (e.g. articles educating the community about washing their boats, checking their septic systems, and much more.)

In May, 2018, the ALCC board decided to work on a IAVMP. **Cynthia Young, Ecologist** with *King County Department of Natural Resources* worked with the Ames Lake Community Club to remove yellow flag iris on the Community lots B,C, and E. King County will maintain for 3 years and make sure the native plants are growing back. They removed carpet that someone put down in the lake and removed all invasive plants. In the picture below, you can see the before and after of one of the lots. This is a good way to showcase to the community what they can do to their own property.



Photo taken by Cindy Young



Photo taken by Cindy Young



Update: King County is on the lake pulling purple loose strife from waterfront properties today. It's a class A noxious weed.

Class A Noxious Weeds are non-native species whose distribution in Washington State is still limited.

- Eradicating existing infestations and preventing new infestations are the highest priority.
- Eradication of all Class A plants is required by law.

July, 2018 - King County and Purple Loosestrife

Ben Peterson with the King County Department of Ecology came out and pulled Purple loosestrife on the lake. The Department of Ecology also sent residents information about purple loosestrife. The ALCC will follow up with homeowners to see if they have removed the noxious weed from their property.

July, 2018 - Residents called Department of Agriculture on Aquatechnex

Residents were concerned about Aquatechnex spraying incorrectly or over spraying. They called the Department of Agriculture to come out and monitor Aquatechnex as they treated the lake. When the Department of Agriculture performed their inspection, they found no problems. See *Appendix 1* for their comments and findings.

Aquatic Meeting January 2019

Ben Peterson Aquatic Noxious Weed Specialist with King County and Rob Zisette Principal Scientist from Hererra came to speak about Ames lake. They focused on noxious weeds, water quality, and other lake organisms. A video of the meeting will be posted later in 2019.



Section 5 - Waterbody and Watershed Characteristics

Human History of Ames Lake

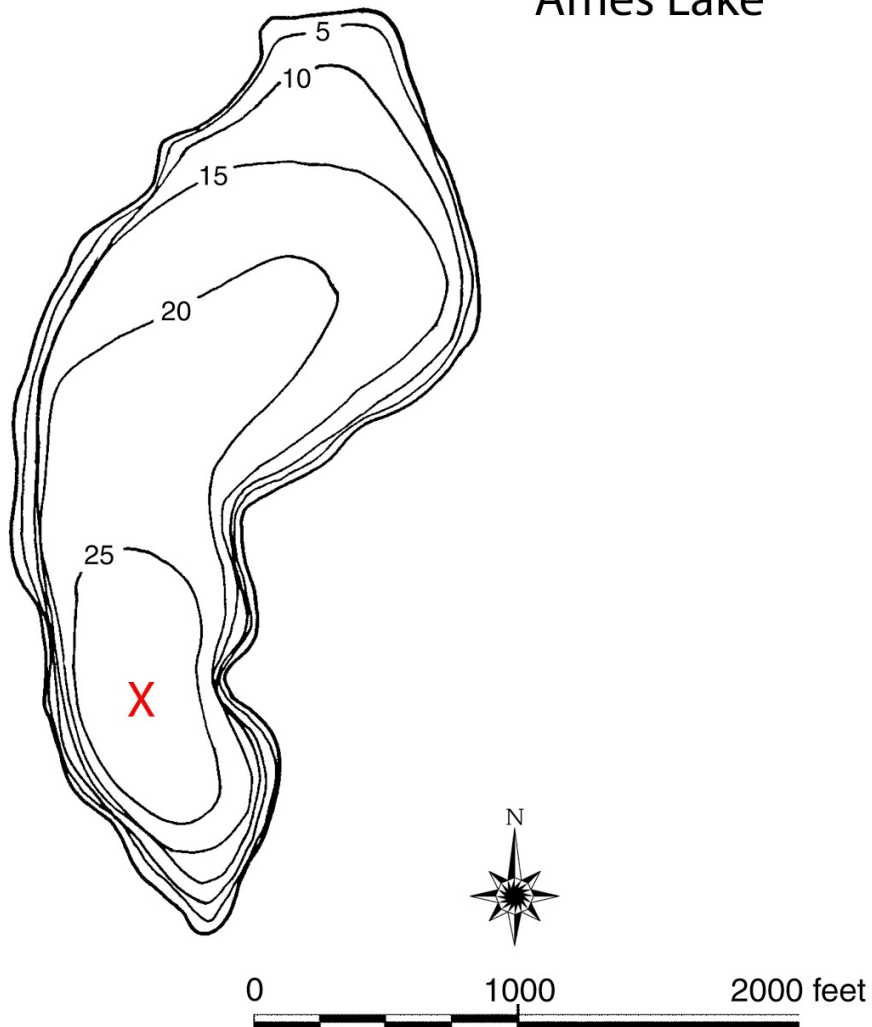
In the late eighteenth/early 1900s the Silver Logging company, which was a partnership between Weyerhaeuser and the Port Blakely Mill Company logged the Carnation/Tolt River/Ames Lake area. In 1941 M.R. Wood and Herman Bittman created the Ames Lake Plat that was registered in 1942. In 1948 lots 61 (lake front), 202, 203 and 204 (non-lakefront across from lot 61) were deeded to the Department of Fish and Game. In 1951 development of these lots began for the purpose of stocking rainbow trout and parking for public access. In 1952 lots 61, 202, 203 and 204 became open to the public for parking and boat launching for fishing access.

Electrical power was brought to Ames Lake in 1954 with telephone service following in 1956. In 1962, through legal proceedings, Ames Lake was classified as a private lake, stocking of trout by the Department of Fish and Game ceased and combustion engines stopped being allowed on the lake. In 1965 public water became available to Ames Lake residences.

Vital Statistics On Ames Lake

| | |
|-------------------|-------------------|
| Watershed Area | 1133 acres |
| Lake surface area | 80 acres |
| Maximum depth | 28 feet |
| Mean depth | 18 feet |
| Public Park | N |
| Boat Ramp | N, no gas engines |

Ames Lake



Small Lake Program with King County

This bathymetric map shows contour lines of equal depth, similar to a topographic map would for mountains and valleys. The red 'X' marks the location where water quality samples are taken.



Small Lake Program with King County

This map shows the area of the watershed relative to the area of the lake. Generally speaking, the larger a watershed is relative to a lake, the greater the influence land use practices on lake water quality.

Birds, Mammals, Reptiles, and Amphibians:

The Steering Committee and Ames Lake Community Board has put together a list of animals that they have seen while living on Ames Lake. We've also asked community members if they had other animals to add to this list.

Birds:

Bald Eagles, Nighthawks, Red-tail Hawk, Goshawk, Osprey, Belted Kingfisher, chickadee, Saw-whet owl, Pygmy owl, Barred owl, Tree Swallows, Pileated Woodpecker, Downy Woodpecker, Flicker's, Goldfinch, Several variety sparrows, Nuthatch, Hummingbirds including the Rufous, Allen's and Anna's, Yellow purple finches, , American Coots, Greeb, BlueHeron, Green Heron, Cormorants, Canada Goose, White fronted goose, Swan, Mallard Ducks, Pin tail duck, Wring neck, Scaup , Golden eye, Whistling ducks, Hooded and Common Mergansers, Red-breasted Merganser, Bufflehead, Ruddy Duck, Common Loon, Ravens, Crows, Stellar Jay, Red-winged Blackbird, Warblers, Cedar Waxwing, American Robin, Flycatcher, Chickadee, Varied Thrush, Vireo, Kinglet, Finch's, Western Tanager, Rufous Towhee, Junco, Sapsuckers, Quail, Doves, cow bird, grosbeaks, kestrels, ruby crowned kinglet, and bushtits.

Reptiles: Turtles, Bull Frogs, Toads, Garter Snakes, Salamanders (Dragon Lizards), Northern Alligator Lizard, and Skinks

Mammals: Beaver, Freshwater Otters, Bobcats, Black Bears, Cougars, Moles, Mule Deer, Rabbits, Coyotes, Young Mink, Rats, Bats, Brown Slugs, Dark Eyed raccoon, Squirrel, Mice,

Spiders: Hobo, yellow sack,

Fish: Big Mouth Bass, Smallmouth bass, Bluegill, Trout, Salmon, Catfish, Rainbow Trout, Cutthroat trout, Perch, Freshwater Mussel, Crayfish, Newts.

Insects: Damselflies, Dragon Flies, painted lady butterflies, Cercropia Moth.

Characterization of Aquatic Plants at Ames Lake

During the 2017 and the 2018 Surveys that Aquatechnex did for us. They found a large number of native plants growing in the lake. Here is a list. For more questions, please see below in their survey. Potamogeton amplifolius, Potamogeton gramineus, Potamogeton pusillus, Elodea canadensis, Najas flexilis, and Fontinalis antipyretica, Chara, Elodea Canadensis, Ribbon Leaf Pondweed, Elodea, and Large Leaf Pondweed, and floating Blatterwort.

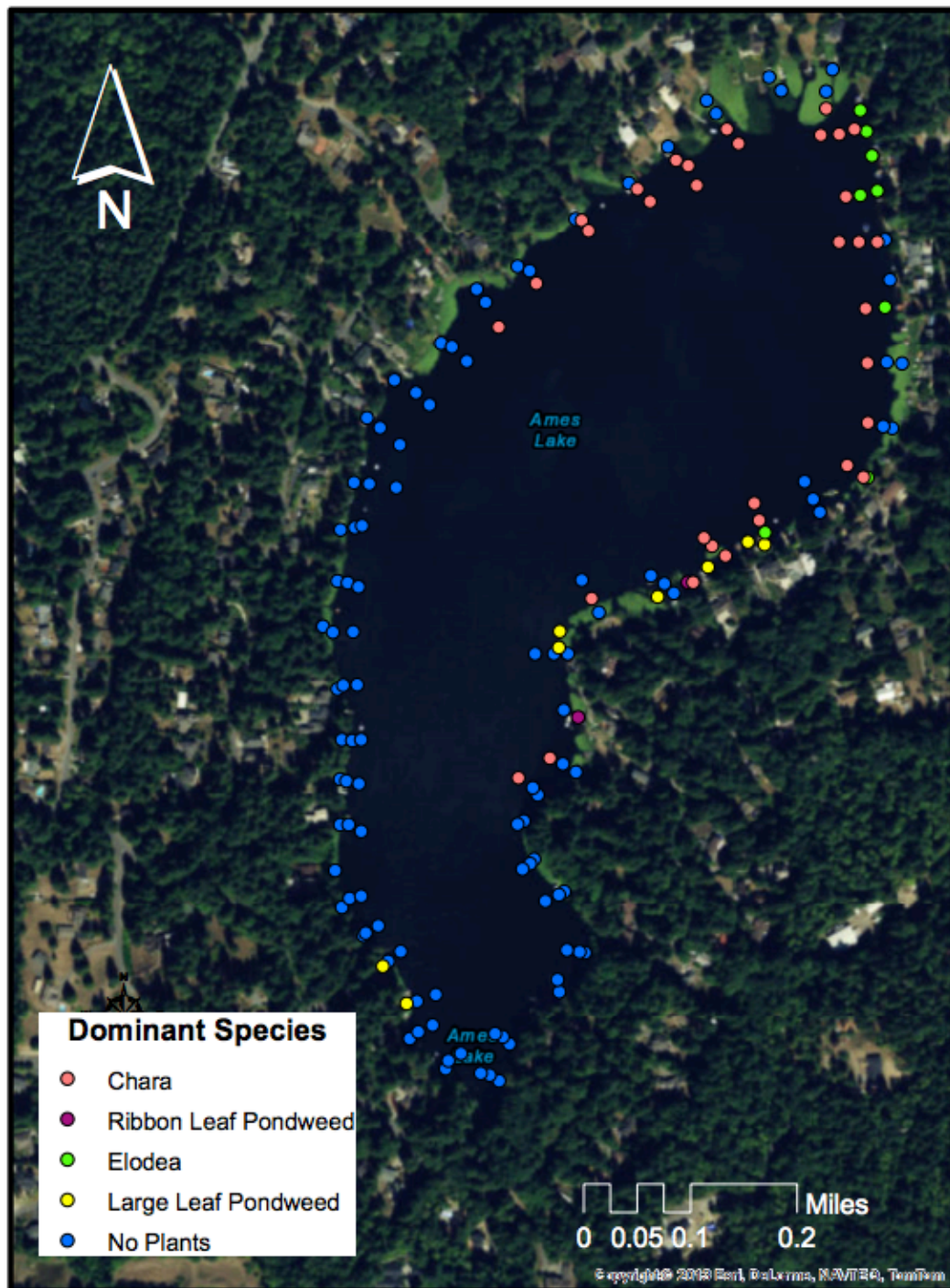
2017 Aquatic Plant Survey Results for Ames Lake

In the past there have been concerns of invasive plants growing in our lake. Residents hired Aquatechnex to do a professional survey of the aquatic plants in Ames Lake with the anticipation of future surveys conducted for the purpose of informing the community of what is growing in our lake and to ease concerns about invasive plants.

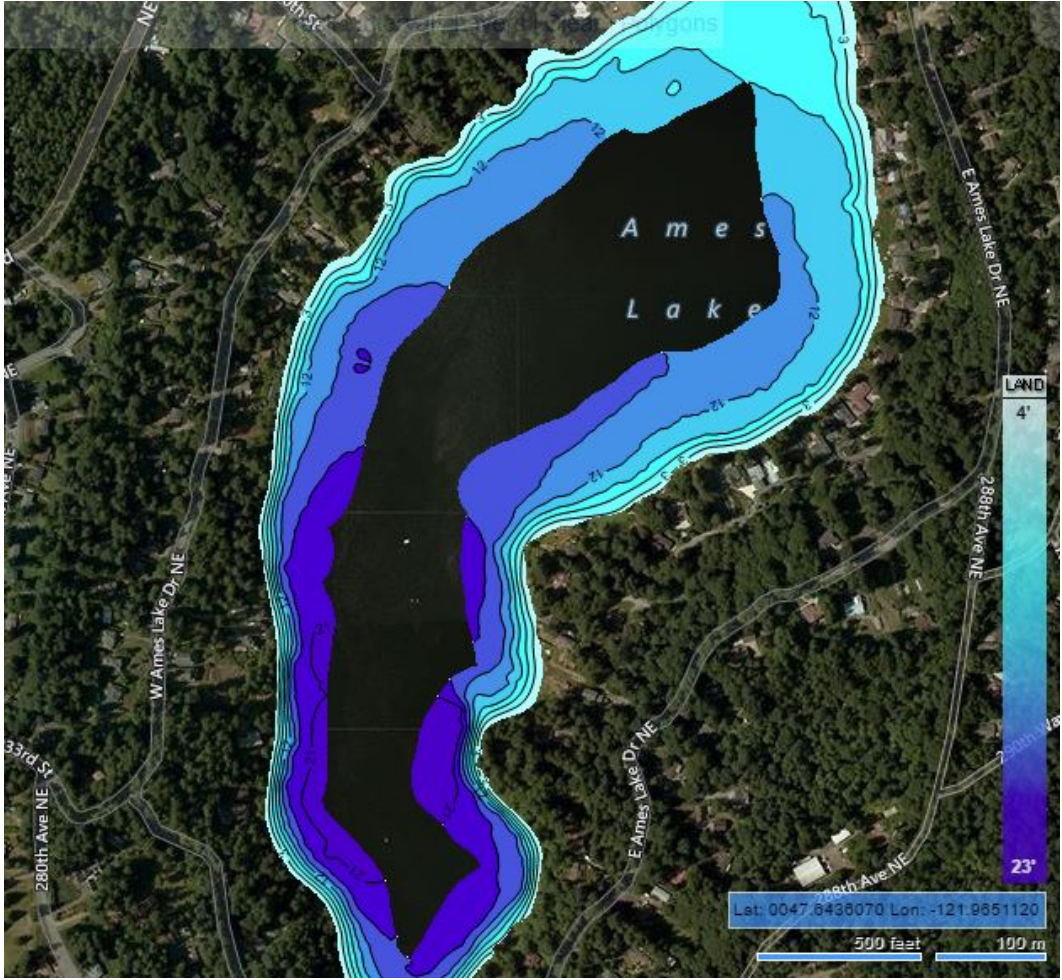
Here is a summary of the results: we found Ribbon Leaf Pondweed, Elodea, and Large Leaf Pondweed. Those three plants are native pondweeds and are commonly found on lakes in the area. We also found a decent amount of Chara which is a form of algae that has structure like a plant and is also very common on lakes in this area. The majority of the points (see diagram 1 below) that we took ended up with no plants and is consistent with the Bathymetry and Biomass data. There were two instances where we spotted a floating Blatterwort plant but did not take a point because it was a floating fragment. Blatterwort is another common plant that is found on lakes in this area.

Below, the Bathymetry map displays depth using different shades to indicate different depths. (Diagram 2) The Biomass data indicates the amount of biomass volume that was present. In diagram 3, the areas of purple are low density area or areas with few plants while the areas with green are moderate density. The areas with red had the highest density of biomass or most plants, but there weren't really any areas of red. Keep in mind these densities are for the submerged plants, not lilies. Lastly, the Survey Map (Diagram 1) shows all of the locations where we took survey points and did rake tosses. At each point we listed what the most common plant or algae was.

Ames Lake 2017



Created by AquaTechnex - Diagram 1



Created by AquaTechnex - Diagram 2



Created by AquaTechnex - Diagram 3

2018 Aquatic Plant Survey Results for Ames Lake Prepared by AquaTechnex, LLC.

Introduction

AquaTechnex has been performing foliar herbicide applications to invasive Fragrant Water Lily at Ames Lake for the past two years. This has led to a significant reduction in this noxious species. By removing dense Fragrant Water Lily stands, an increased area in the lake is opened for beneficial native plant species. These species provide food and habitat for bird and fish species as well as other benefits to the ecosystem. Typically, the Fall is a good time to assess native plant growth because these plants have reached their peak biomass at this point in the year.

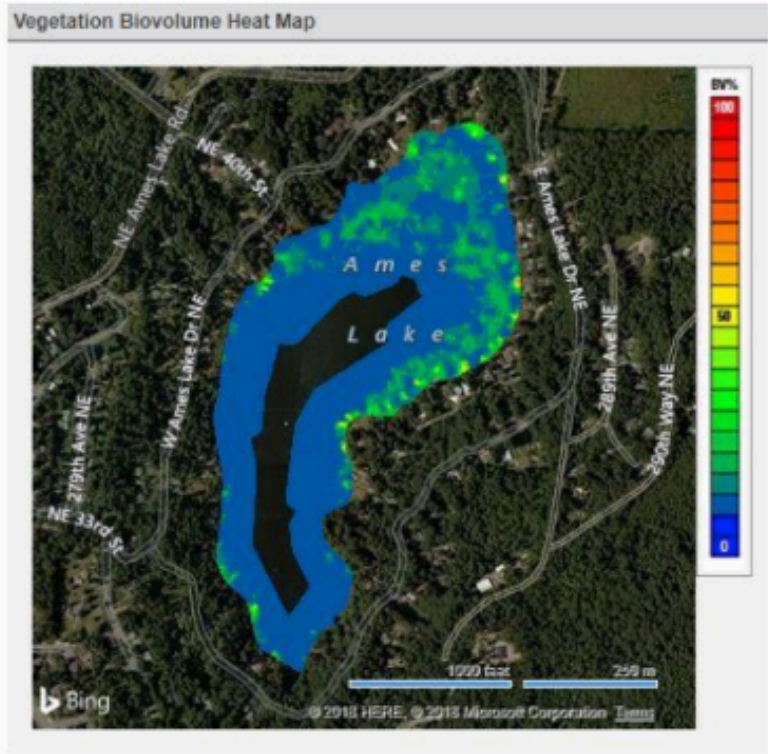
Survey Protocol

AquaTechnex employs several strategies to map native and invasive species. The entire littoral area of the lake is surveyed by boat, with the first pass of the

lake taking the crew around the lake in the shallow, 6 feet deep or less area of the lake. This area is easily checked from the surface for Eurasian Watermilfoil and any other submerged noxious weed species which may have been introduced to the lake. Once this initial pass is completed, the plant community is sampled with a series of rake-tosses to identify plants at given depth ranges throughout the lake. Transects running perpendicular from the shore are traveled and at the 5, 10, and 15 foot depth contours a rake-toss sample is taken. The species collected on the rake as well as the relative density of the species at that point are recorded. (see *Diagram 5 below*) Species present at each point are compiled in a map to show species composition of the lake. In addition to the data points taken, AquaTechnex also uses sonar to scan for plant biomass density in the lake. (see *Diagram 4 below*) This data is processed into a heat map which provides a visual representation of how much of the water column is taken up by plant biomass at any given point on the lake.

October 2018 Survey Results

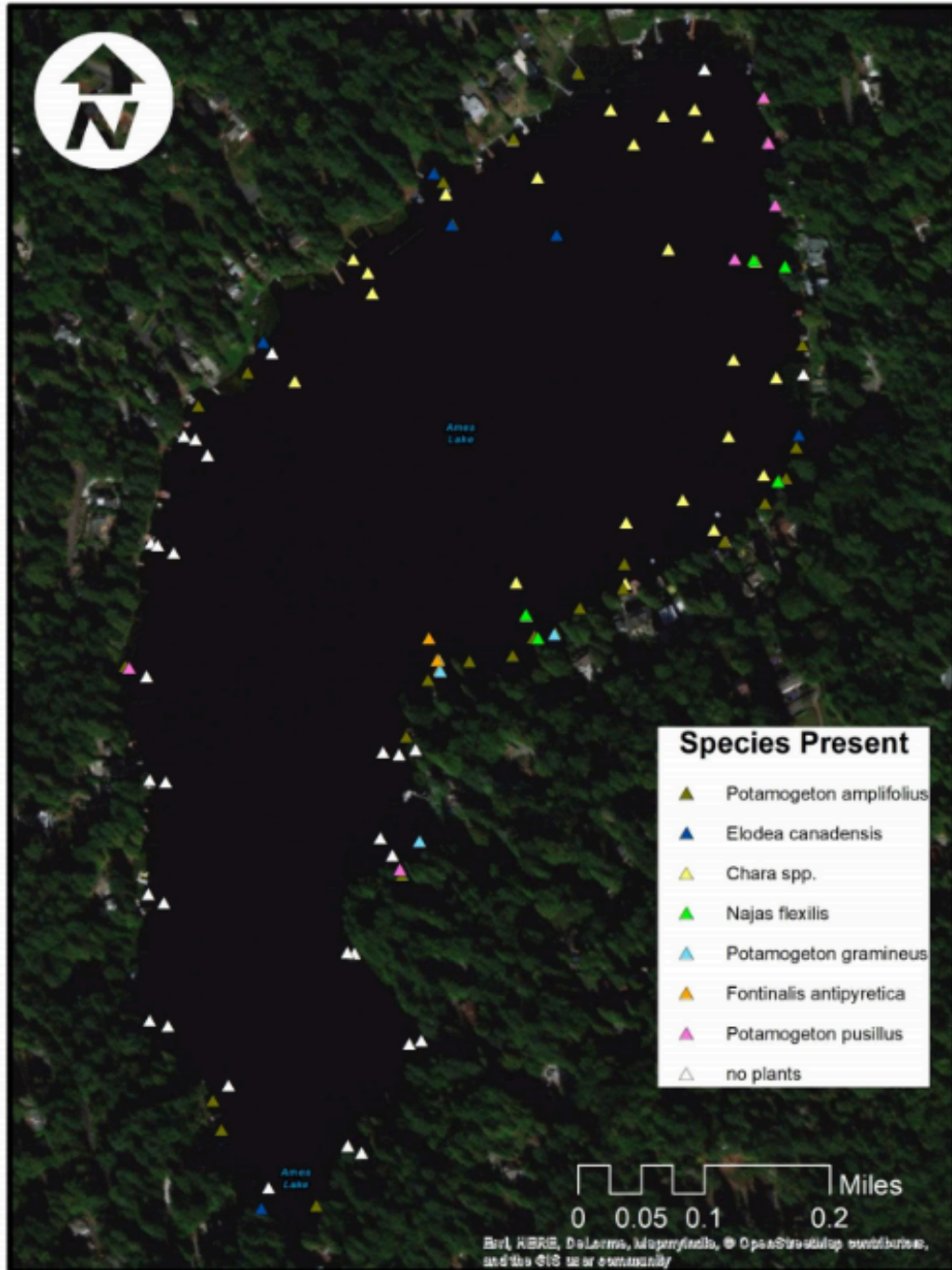
Ames Lake was surveyed on October 24th, 2018 with an AquaTechnex biologist as the primary surveyor as well as a biologist from Herrera Environmental Consultants to provide additional corroboration of the results. No submerged, invasive species such as Eurasian Watermilfoil were found in the lake. A diverse native plant community was present with primarily a sparse to moderate density. Areas over 15 feet of depth were mostly devoid of plants. This is typical as there is insufficient light penetration for plants to grow at these depths. It was also found that little to no submerged plant species grew under dense patches of Fragrant Water Lily that still exist in some areas of the lake. This is similarly due to a lack of light penetration caused by lily pads on the surface of the water. Native plant species found included *Potamogeton amplifolius*, *Potamogeton gramineus*, *Potamogeton pusillus*, *Elodea canadensis*, *Najas flexilis*, and *Fontinalis antipyretica*. There was also a robust *Chara* population in the lake. *Chara* looks like an aquatic plant but is actually a type of macroalgae. Typically, this macroalgae is beneficial and does not inhibit lake use because it usually only grows 20-30 cm high. Overall, it is expected that native plant and macroalgae populations will continue to increase and colonize areas where Fragrant Water Lily has been recently removed. Deeper areas of the lake will likely remain devoid of plant life as most native species can only grow in up to 15 feet of water, depending on clarity. However, we may see more *Chara* or *Elodea Canadensis* growth in these areas as they can be found at slightly greater depths.



Map of vegetation biovolume showing percent of water column occupied by biomass, with blue being 0% (little to no vegetation) and red being 100% (vegetation growing to water surface). Mapping data taken October 24th, 2018.

Created by AquaTechnex - Diagram 4

Ames Lake Submerged Plant Survey 10-24-2018



Created by AquaTechnex - Diagram 5

Fragrant water lily (*Nymphaea odorata*)

Fragrant water lily (*Nymphaea odorata*) is a perennial floating leaf aquatic noxious weed native to the eastern United States that grows in shallow lakeshore areas. The lily pads re-grow every spring from a large rhizomatous root system in water up to six feet deep.



Fragrant water lily (photo – King County Noxious Weed Control Program)

When uncontrolled, this species tends to form dense monospecific stands that can persist until senescence in the fall (King County Noxious Weed Control Program, 2010a). Mats of these floating leaves prevent wind mixing and extensive areas of low oxygen can develop under the water lily beds in the summer. Dense mats can also increase water temperature, and the warm, shallow stagnant water among them creates mosquito breeding habitat. Water lilies can restrict lakefront access and hinder swimming, boating (binding up props), and other recreational activity. There is speculation that a 2010 drowning at a similar lake in South King County may have occurred, in part, due the presence of the plant (Box, 2010). Fragrant water lily plants may also limit the distribution of the native water lily spatterdock (*Nuphar polysepala*), which occupies the same niche and provides food and habitat for a variety of animals and fish. Water lilies die back in the fall, and the resulting decay uses up dissolved oxygen and adds nutrients to the water, which can contribute to algal growth and related water quality problems.

As smaller patches of fragrant water lily coalesce into large connected mats, recreational activities such as boating, fishing, and swimming becomes more difficult. Even canoes can have great difficulty moving across dense floating mats of fragrant water lily, as well as entanglement with propellers of electric motors.

More information on fragrant water lily can be found in Appendix 5.

Purple Loosestrife (*Lythrum salicaria*)



Purple loosestrife (photo – King County Noxious Weed Control Program)

More information on purple loosestrife can be found in Appendix 5.

Yellow flag iris (*Iris pseudacorus*)

Yellow flag iris (*Iris pseudacorus*), native to Europe and the Mediterranean region, was introduced as a garden ornamental and for erosion control (King County Noxious Weed Control Program, 2009). The yellow flowers are a distinguishing characteristic, but when not in flower it may be confused with cattail (*Typha* sp.) or broad-fruited bur-reed (*Sparganium eurycarpum*).



Yellow flag iris (photo – King County Noxious Weed Control Program)

Yellow flag iris is considered an obligate wetland species (OBL), with a greater than 99 percent probability of occurring in wetlands as opposed to upland areas (Reed, 1988). The plants produce large fruit capsules and corky seeds in the late summer. Yellow flag iris spreads by rhizomes and seeds. Yellow flag iris can spread by rhizome growth to form dense stands that can exclude even the toughest of native wetland species, such as cattail (*Typha latifolia*). In addition to lowering plant diversity, yellow flag iris can also alter hydrologic dynamics through sediment accretion along the shoreline. This species produces prolific seed that can easily be transported downstream and to other parts of the lake shore. Seeds have been found to have 65 percent viability in a germination study (Simon, 2008).

More information on yellow flag iris can be found in Appendix 5.

Responsibility for Noxious Weed Control at Ames Lake

Because it is a regulated noxious weed, state law holds the property owner responsible for controlling any purple Loosestrife growing on their property (King County Noxious Weed Control Program, 2017b). The legal requirement for “control” is “-in a given year, prevent all seed production and dispersal of all propagative plant parts capable of forming new plants” (King County Noxious Weed Control Program, 2017b). Because purple loosestrife can reproduce by both seed and plant fragmentation, control means at a minimum cutting and removing (and disposing in the garbage) flowering stems of purple loosestrife plants before seeds are produced. It also means that cut vegetative purple loosestrife plant parts (stems, roots) cannot be allowed to reproduce (i.e. don't lay cut plant parts on wet ground or throw them in the lake). These “control” activities will prevent further spread (and therefore impact) of the plant at the lake or downstream. Control of the purple loosestrife plants needs to occur annually as long as the plant persists. Details on control and eradication methods are in Section 6.

For the rest of the aquatic noxious weeds at Ames Lake (fragrant water lily, and yellow-flag iris) there is no legal requirement to control them under the state law because they are non-regulated noxious weeds in King County. Ultimately, it is up to the community and individual landowners to proactively control and eradicate these plants to reduce their impact. KCNWCP is able to provide strategic and technical guidance to assist with the control of these plants. Also, while control of non-regulated weeds is not part of the KCNWCP mandate, the program will be able to provide limited on-the-ground weed control activity coordinated with the community.

Section 6 - Management Alternatives

A wide variety of control methods have been developed to address the general problem of aquatic noxious weeds. The suitability of control methods for specific plants, such as yellow flag iris or fragrant water lily, varies widely. All known control options (aquatic herbicide, manual control methods, mechanical control methods, environmental manipulation, and biological control) have been considered and evaluated for each noxious weed species as it relates to the conditions at Ames Lake (Table 5). This matrix separates potential control methods into those that warrant further investigation (either for whole-lake treatment or for small-scale temporary control) and those methods that are not applicable in Ames Lake.

First, a few definitions (King County Noxious Weed Control Program, 2017b):

- Control – in a given year, prevent all seed production and dispersal of propagative parts capable of forming new plants.
- Eradicate – completely eliminate a noxious weed within an area of infestation.

A detailed description of all known control methods, advantages, disadvantages, costs, and suitability at Ames Lake can be found in **Appendix 2 –Control Methods Options**. Table 5 was created from this detailed document. The discussion below describes control methods that warrant further consideration, both at the large scale (whole-lake treatment) or small scale (private property waterfront).

Table 5. Summary of Management Alternatives (page 1)

| broad control method category | Specific method | effectiveness for fragrant water lily | further consideration? | effectiveness for purple loosestrife | further consideration? | effectiveness for yellow flag iris | further consideration? |
|---|--|--|------------------------|--|------------------------|--|------------------------|
| Manual (by hand and hand tools) and Environmental Manipulation Control Methods | Hand pulling | possible in small areas or following whole-lake herbicide treatment | yes* | possible in small areas with loose soil, need to get roots | yes* | not possible | no |
| | hand cutting | possible in small areas, causes fragmentation | yes* | temporary seasonal control, helps prevent spread, won't eradicate | yes* | will only result in temporary control, not eradication | no |
| | bottom barriers/ tarping/ sheet-mulching | can be useful for small areas of waterfronts, not practical for a large area | yes* | for small areas: short term control; or possibly eradication of the plant if left and maintained for several years | yes* | for small areas: short term control; or possibly eradication of the plant if left and maintained for several years | yes* |
| | water level drawdown | not possible | no | not relevant | no | not relevant | no |
| Biological Control Methods | grass carp | not relevant | no | not relevant | no | not relevant | no |
| | other weed-specific biological control insects | none available at this time | no | <i>Galerucella</i> spp. beetles; <i>Hylobius</i> root weevils: feed exclusively on purple loosestrife foliage and roots (respectively), won't eradicate but may reduce density & flowering | yes | none available at this time | no |

Table 5. Summary of Management Alternatives (page 2)

| broad control method category | Specific method | effectiveness for fragrant water lily | further consideration? | effectiveness for purple loosestrife | further consideration? |
|-------------------------------|-----------------|---|------------------------|--|------------------------|
| | Glyphosate | Aquatic formulations can be very effective when applied by a skilled contractor. Can result in dead, floating root mats that may need to be dealt with. | yes | Works well to control plants, timing and spray rates are important for success. Follow-up treatment is necessary | yes |
| | Imazapyr | Aquatic formulations can be very effective when applied by a skilled contractor. Can result in dead, floating root mats that may need to be dealt with. | yes | Works well to control plants, timing and spray rates are important for success. Follow-up treatment is necessary | yes |
| | Imazamox | Potentially a viable control method. Not-yet widespread use. Used at Shadow Lake in 2017 with good results. | yes | Works well to control plants, timing and spray rates are important for success. Follow-up treatment is necessary | yes |
| | Triclopyr | not very effective | no | Works well to control plants, timing and spray rates are important for success. Follow-up treatment is necessary | yes |

Table 5. Summary of Management Alternatives (page 3)

| broad control method category | Specific method | effectiveness for fragrant water lily | further consideration? | effectiveness for purple loosestrife | further consideration? |
|-------------------------------------|-----------------|---|------------------------|--|------------------------|
| Chemical Control (Herbicide) | Glyphosate | Aquatic formulations can be very effective when applied by a skilled contractor. Can result in dead, floating root mats that may need to be dealt with. | yes | Works well to control plants, timing and spray rates are important for success. Follow-up treatment is necessary | yes |
| | Imazapyr | Aquatic formulations can be very effective when applied by a skilled contractor. Can result in dead, floating root mats that may need to be dealt with. | yes | Works well to control plants, timing and spray rates are important for success. Follow-up treatment is necessary | yes |
| | Imazamox | Potentially a viable control method. Not-yet widespread use. Used at Shadow Lake in 2017 with good results. | yes | Works well to control plants, timing and spray rates are important for success. Follow-up treatment is necessary | yes |
| | Triclopyr | not very effective | no | Works well to control plants, timing and spray rates are important for success. Follow-up treatment is necessary | yes |

Fragrant water lily (*Nymphaea odorata*)

For more information on the following fragrant water lily control methods reference Appendix 2 –Control Method Options and Appendix 5 – Fragrant Water Lily Best Management Practices document.

Hand Pulling and Cutting

The roots of fragrant water lily plants are thick, dense, and intertwined within the lake sediment. Therefore, pulling and cutting would result in the same effect: severing the lily pad and stem from the roots. Hand cutting basically involves using a weed cutter, such as a Weed Razer or WeedShear, to cut the lily pads at their base. The tool is cast out into the littoral zone of the lake where fragrant water lily plants are growing. Then the tool is drug back to shore, cutting the plants at their base. Hand cutting temporarily removes the lily pads and causes them to float in the water column. The roots remain in the lake sediment. This tool is non-selective, meaning it cuts every plant in its path, both noxious weeds and native plants.

Lily pads can also be pulled by hand, although in actuality the ultimate effect on the plant is the same as cutting because the roots remain intact. Hand pulling of lily pads involves wading, snorkeling or reaching from a low boat (especially in areas with a silty lake bottom that make wading impractical) into the littoral zone of the lake and pulling and removing every lily pad. Pulled plants are immediately put in to a mesh bag carried by the puller. The most effective pulling/cutting is done by repeatedly removing the lily pads before they reach the water surface. If lily plants in an area can be diligently controlled (by pulling or cutting) before the leaves reach the water surface, eventually the root system will be starved of its reserved energy. Lily pad removal areas may need to be re-visited and pulled weekly for multiple growing seasons before the plants no longer return. Long-term maintenance is necessary to prevent re-infestation of the plant from nearby uncontrolled areas. This control method is slow and labor-intensive.



Photo: One of the loads of Lily Pads hand pulled by divers at Ames Lake in 2015

Activity appropriate for: Individual property owners. Possibly hand pulling would be appropriate as follow-up to a large-scale whole-lake herbicide treatment for water lily plants.

Activity will lead to: Localized control and eventually eradication of the plant, for example at a property owner's waterfront swimming area. With diligence, the plant can be eliminated from areas where repeated pulling occurs assuming care is taken to get all plants before they reach the water surface.

Permit: a WDFW Aquatic Plants and Fish Booklet (permit) is required for both hand pulling and cutting. See "A note about needed licenses, permits and permissions" at the end of this section.

Mechanical Cutting and Harvesting

For fragrant water lily control on a large scale, a large mechanical harvester can work well. Harvesters are large machines which both cut and collect aquatic plants. Cut plants are removed from the water by a conveyor belt system and stored on the harvester until disposal. Harvesting machines can cut plants in water from two to seven feet deep, but can be hindered by docks and submerged wood. A barge may be stationed near the harvesting site for temporary plant storage or the harvester carries the cut weeds to shore. The shore station equipment is usually a shore conveyor that mates to the harvester and lifts the cut plants into a dump truck. Harvested weeds are disposed of in landfills, used as compost, or in reclaiming spent gravel pits or similar sites. Repeat treatment is needed and harvesting of submerged weeds is usually done two or more times a growing season to achieve enough control to facilitate recreation.

Harvesters do not remove water lily roots so the plants will re-grow. Therefore, harvesting is not recommended unless an entire water body is infested with the weed and the goal is maintenance of open water using a long term mowing schedule. Harvesting is not species specific; in areas where beneficial native aquatic plants are growing among harvested weeds all plants will be harvested.

For fragrant water lily control on a small scale, one strategy that may work in the long term is the repeated use of a small cutting machine (along with a rake to gather the cut plant material). An example of such a machine is the Jenson Lake Mower. The Lake Mower is a battery-powered boat mounted cutter that cuts a four foot wide swath up to three feet below the water surface. If lily pads can be repeatedly cut before they reach the water surface, over time the roots of the plants will deplete their energy reserves and die. Cut lily pads then float to the surface and are raked up using the weed cutters five foot wide rake attachment. This repeated cutting technique would require re-cutting of water lily infested areas at an approximately two week interval throughout the growing season of the plant. The deeper the cut the better because it buys you more time between cutting as well as allows the plant's roots to acquire less energy. This technique would not be a realistic strategy for eradication on the whole-lake scale, but may be appropriate where a waterfront property manager has the time to devote to it. Harvesting is not species specific; in areas where beneficial native aquatic are growing among harvested weeds all plants will be harvested.

Mechanical harvesters and cutters have been ruled out as a whole lake solution for Ames Lake due to the large number logs branches and other submerged wood on the lake bottom.

Activity appropriate for: Individual lakefront property owners or larger areas of lake shore. Land owners will need to buy or borrow the equipment. A small boat and some basic technical know-how regarding use of the machine is also needed.

Activity will lead to: Localized control and eventually eradication of the plant, for example at a property owner's waterfront swimming area. With diligence, the plant can be eliminated from areas where repeated pulling occurs; assuming care is taken to get all plants before they reach the water surface.

Permit: a WDFW Aquatic Plants and Fish Booklet (permit) is required. See "A note about needed licenses, permits and permissions" at the end of this section.

Bottom Barriers

An opaque bottom barrier can be used to suppress water lily growth in small, discrete areas like at a boat launch or around a swimming area. Barriers need to be regularly cleaned because plants will root in the sediment that accumulates on top of them. Barriers control all plants where installed. They can be installed by a homeowner or contractor and cost up to \$1 per square foot. With maintenance, barriers may last up to five years before they need to be replaced. Bottom barriers are not species-specific and will prevent growth of beneficial native aquatic plants as well as noxious weeds. Bottom barriers also may impact benthic organisms. If barrier and anchoring is made of completely biodegradable material it can be left in place. If the barrier is not-

biodegradable then the materials must be removed within two years of installation (according to WDFW requirements).

Activity appropriate for: Individual property owners.

Activity will lead to: Localized eradication of the plant, as long as the barrier is in place and not damaged.

Permit: a WDFW Aquatic Plants and Fish Booklet (permit) is required. See “A note about needed licenses, permits and permissions” at the end of this section. When using this permit for control of aquatic noxious weeds, a waterfront property owner can cover “no more than fifty percent of the length of the applicant’s shoreline”.

Sediment Agitation/Weed Rollers

Weed rolling involves the use of a commercially available, low voltage power unit that drives an up-to-30-foot long roller set on the lake bottom through an adjustable arc of up to 270 degrees. A reversing action built into the drive automatically brings the roller back to complete the cycle. Fins on the rollers detach some plants from the soil, while the rollers force other plants flat, gradually inhibiting growth. Detached plants should be removed from the water with a rake or gathered by hand. Once plants are cleared from the area, the device can be used as little as once per week or less to keep plants from re-colonizing the area. Weed rolling is a suitable way to temporarily control water lily plants in a small discrete area such as a dock end but is not suitable for any larger area. Weed rollers cause an increase in water turbidity each time they operate.

Activity appropriate for: Individual property owners.

Activity will lead to: Localized eradication of the plant, as long as the roller remains operational.

Permit: a WDFW Aquatic Plants and Fish Booklet (permit) is required. See “A note about needed licenses, permits and permissions” at the end of this section. When using this permit for control of aquatic noxious weeds, a waterfront property owner can cover “no more than two thousand five hundred square feet”.

Chemical Control

See Appendix 2 – Control Method Option, Appendix 3 – Toxicity of Aquatic Herbicides, and Appendix 4 – Aquatic Herbicide Labels for details on aquatic herbicide modes of action and toxicity.

Chemical methods used to control fragrant water lily can be very effective and are appropriate for whole-lake treatments. The most reliable and environmentally low toxicity herbicide suitable for water lily control is an aquatic version of glyphosate (see Appendix 4 for herbicide label). This aquatic herbicide must be used with a Washington State Department of Ecology approved aquatic surfactant. Glyphosate is applied directly to the floating leaves through foliar spraying by a licensed aquatic herbicide contractor. Foliar application of imazapyr may also be effective (see Appendix 4 for herbicide label) but glyphosate is generally used as the herbicide is seen as being the most environmentally

friendly of the two. Foliar application of imazamox is another option and alternative to glyphosate. Imazamox is relatively new on the market (first registered with the Environmental Protection Agency in 2008) and rated “practically non-toxic to fish and aquatic invertebrates (Wisconsin DNR, 2012c).

Foliar application of glyphosate or imazamox herbicide reduces the chance that the herbicide will come in contact with and affect non-target plants. The herbicide is not directly applied into the water column. The water lily plants take in the herbicide directly through the lily pads. Both glyphosate and imazamox are most effective when applied to actively growing plants. The herbicide has the advantage of working through translocation whereby the chemical gets moved through the plant and kills the plant to the roots.

Spraying of plants would need to occur twice during the growing season to ensure that no plants were missed. When spraying large patches that are too wide to reach entirely with the stream of herbicide, the applicator’s boat may need to pass through the center of the patch. This path will need to be sprayed at a later time, likely two or more weeks later once the initial effect of the first spraying can be seen on the treated lily pads. It is expected that herbicide treatment would need to occur over a two to three year period. The control effectiveness of fragrant water lily is easy to measure through visual surveys due to the floating leaves.

In the short term following the herbicide application, there is a 24 hour no-swimming advisory for either imazamox or glyphosate. There are no water use restrictions associated with foliar application of glyphosate or imazamox on fragrant water lily pads.

A drawback of using herbicide to control water lily is the potential for “uplifting” of mats of decomposing water lily roots that can form floating islands in the lake after the plants have died. There are several places in Ames Lake with a larger area covered with fragrant water lily where this might occur such as at the north end of the lake. Note that natural decay of fragrant water lily patches can also often create these floating mats. Removal of these mats from the lake is possible using manual or mechanical means (generally involving towing the mats to a take-out point and cutting them up with hand tools or larger machinery). At minimum, a Hydraulic Project Approval (HPA) permit from the Washington Department of Fish and Wildlife will be required to remove the mats. Other permits may also be required.

Activity appropriate for: Large areas of lake shore or whole-lake littoral zone. Because of cost, logistics and permitting, this activity is usually cooperatively done by a group of landowners or the lake community as a whole. Not realistic for individual property owners.

Activity will lead to: Near eradication of the plant, however, re-treatment within the same season as well as in subsequent growing seasons may be necessary for two reasons: 1. some plants may not be fully affected by the treatment, and 2. reproducing plant fragments may be reintroduced into the lake system due to transfer from other lakes by boats and trailers.

Permit: an Aquatic Plant and Algae General Permit (issued by the Washington State Department of Ecology) is required for herbicide use on submerged and floating leaf

aquatic plants. Also, the herbicide applicator is required to have a Pesticide Applicators License with an Aquatic Endorsement (issued by the Washington State Department of Agriculture). If floating mats of water lily roots are removed an HPA and possibly other permits will be required. See “A note about needed licenses, permits and permissions” at the end of this section.

Purple Loosestrife (*Lythrum salicaria*)

For more information on the following purple loosestrife control methods reference Appendix 2 – Control Method Options and Appendix 5– Purple Loosestrife Best Management Practices document. (need to add the purple loosestrife BMP to the appendix)

Hand Pulling and Digging

Purple loosestrife has a moderately deep root system and the roots must be removed entirely to kill the plant. The roots go down six to ten inches so in most situations the plant can be dug up with a shovel. In some situations, especially when the plant is growing in sandy submerged soil/sediment, the plant can be carefully pulled up from the roots by hand. If the entire root is not removed the plant will re-sprout next year. Plants can be dug up any time of the year, however they are easiest to locate when they have leafed-out for the season and are flowering (leaves start to appear mid-spring and flowering occurs from late June into September). Digging plants in standing water will cause a temporary sediment turbidity increase. Soil disturbance will also encourage seed germination of any purple loosestrife seeds in the soil from past years so cleared areas need to be monitored for seedlings.

Any removed pieces of the root or stem should be disposed away from wet sites as they can re-sprout if in contact with wet soil. The best disposal place for flowering plant parts is the trash, not a commercial compost facility or backyard compost pile. Seeds have been found to remain viable for at least 2 to 3 years, so even old flower heads can potentially produce new plants.

Activity appropriate for: Small areas of purple loosestrife infestation. Private landowners may use digging to remove plants from small areas of infestation; however digging all the plants around the lake may be overwhelming.

Activity will lead to: Control or possibly local eradication of the plant. If care is taken to thoroughly remove all root material, and to follow up and remove any emerging seedlings, then the plants could be locally eradicated.

Permit: Normally, in areas where the plant is growing in standing water (“Waters of the State”) a WDFW Aquatic Plants and Fish Booklet (permit) would be required. However, there is a special exemption in the permit for purple loosestrife “*An activity conducted solely to remove or control purple loosestrife and that is performed with hand-held tools or equipment, or equipment carried by you when used, does not require an HPA*”. See “A note about needed licenses, permits and permissions” at the end of this section. In areas where the plant is above the “standing water” elevation level (within unincorporated areas of King County), the King County Critical Areas Ordinance permits

the control of noxious weeds “if removal is undertaken with hand labor, including hand-held mechanical tools” (King County Noxious Weed Control Program, 2014).

Cutting

Repeated mowing or cutting of above ground plant material (leaves and flowers) may keep purple loosestrife contained and will help prevent the spread of the plant. Cutting and removing flower heads (and disposing of them in the garbage) is an allowable method of “control” for this regulated plant (King County Noxious Weed Control Program, 2011). However, the plant will continue to re-sprout from its root annually and there is the possibility that the plant could spread via root fragment due to beaver activity or otherwise. Mowing can be done using a brush cutter or hand tools. Cutting flowerheads is best done as soon as they appear in the season, usually July. It is important to check the area for later blooming flowers every few weeks into September as the plant has a long flowering window and later flowering plants can still produce seed.

Activity appropriate for: Small to large areas of infestation.

Activity will lead to: Temporary control of plants in small to large areas. Cutting techniques (both whole plant and cutting flowers) will not likely lead to eradication of the plant from the area.

Permit: Normally, in areas where the plant is growing in standing water (“Waters of the State”) a WDFW Aquatic Plants and Fish Booklet (permit) would be required. However, there is a special exemption in the permit for purple loosestrife “An activity conducted solely to remove or control purple loosestrife and that is performed with hand-held tools or equipment, or equipment carried by you when used, does not require an HPA”. See “A note about needed licenses, permits and permissions” at the end of this section. In areas where the plant is above the “standing water” elevation level (within unincorporated areas of King County), the King County Critical Areas Ordinance permits the control of noxious weeds “if removal is undertaken with hand labor, including hand-held mechanical tools” (King County Noxious Weed Control Program, 2014).

Tarping

Small patches can be covered with a heavy plastic tarp weighted at the edges for several years. The tarp needs to extend well beyond the edges of the infestation and be periodically checked to ensure that plants are not growing up around the tarp. Other materials (heavy plastic, landscape cloth) are not as effective. It is recommended tarps are kept in place for two growing seasons.

Activity appropriate for: Small areas of iris infestation. Private landowners may use tarping to suppress small areas of purple loosestrife.

Activity will lead to: Control or possibly local eradication of the plant if care is taken to ensure the tarp is secure and in place for several years.

Permit: In areas where the plant is growing in standing water (“waters of the State”) a WDFW Aquatic Plants and Fish Booklet (permit) is required See “A note about needed

licenses, permits and permissions” at the end of this section. In areas where the plant is above the “standing water” elevation level (within unincorporated areas of King County), the King County Critical Areas Ordinance permits the control of noxious weeds (King County Noxious Weed Control Program, 2014).

Biological Control

Biological control (biocontrol) is the use of an organism (often an insect) from a weed’s native range to control the plant. The insects are rigorously studied by the United States Department of Agriculture Animal and Plant Health Inspection Service (USDA APHIS) before being allowed to be released in the wild (U.S. Department of Agriculture, 2018). Biological control agents approved for use on purple loosestrife in Washington State will only feed on purple loosestrife in the State and are confirmed to not feed on other plants species.

The two major insects used for biocontrol of purple loosestrife are *Galerucella* spp. beetles (which feed of the plants vegetation) and *Hylobius transversovittatus* root weevils (which feed on the plants roots). Even in the most ideal situations, these insects alone will not eradicate a purple loosestrife infestation but they the weeds population density and number of flowering plants. They are best used in dense, contiguous, inaccessible infestations of purple loosestrife and getting to a point where the insects are controlling the plants to the maximum of their ability can take six years or longer. It is best used in conjunction with other control methods such as cutting flower heads.

However, the purple loosestrife infestation at Ames Lake is more scattered in small patches.

Activity appropriate for: large areas of un-controlled purple loosestrife plants. Insects could be released at the lake but will not lead to eradication.

Activity will lead to: partial control of the plant and eventually eradication if used as a starting point for other control options such as herbicide.

Permit: Sourcing and regulation of biocontrol release is done by the Washington State University Extension Biocontrol Program <http://extension.wsu.edu/impact-reports/biocontrol-of-noxious-weeds/>

Chemical Control

See Appendix 2 – Control Method Option, Appendix 3 – Toxicity of Aquatic Herbicides, and Appendix 4 – Aquatic Herbicide Labels for details on aquatic herbicide modes of action and toxicity.

Long term control and eventual eradication of large infestations of purple loosestrife plants is possible with careful use of aquatic-approved, systemic herbicides. The application of herbicide to the emergent purple loosestrife is best conducted by manual spot applications. An experienced and licensed aquatic herbicide applicator can selectively target individual emergent weed species and limit collateral damage to other species to a minimum. Control of purple loosestrife is most effectively achieved using

either a selective herbicide such as of triclopyr TEA or non-selective glyphosate, imazapyr, and imazamox. (see Appendix 4 for herbicide label). Selective herbicides also have the advantage of not harming monocot plants (cattails, grasses, sedges, etc.). Triclopyr-TEA is often used to control purple loosestrife plants. The herbicide is fairly quick acting and can be sprayed on plants that are just starting to flower without the need to remove flower heads. However, to be effective the applicator needs to get good coverage of the plant (i.e. spray all the entire leaf area). If the plant is sprayed when flowers are further along, such as August and September, then flower heads should be removed before spraying (see suggestion below).

Use of slower acting non-selective herbicide is most effective when the plant is actively growing. Herbicide application before flowering is the most effective; however individual purple loosestrife plants can be very difficult to spot before the magenta-colored flowers appear when growing among the common shoreline plants cattails and reed canarygrass. If glyphosate, imazapyr, or imazamox are applied later in the season when plants are flowering, plants should first be clipped of flowers before spraying. This work is often done best in groups of two, with one person locating plants, clipping and bagging the flowers and the other person following behind and spraying the plants.

These aquatic herbicides must be used with a Washington State Department of Ecology approved aquatic surfactant and can only be applied by someone with a pesticide license from the Washington State Department of Agriculture who has an aquatic endorsement on their license. Consult KCNWCP or the herbicide label for recommendations on herbicide and surfactant rates. Since the emergent noxious weed infestations at Ames Lake are still confined largely to the shoreline, it should be relatively simple for the applicator to avoid significant collateral damage and preserve landscape plants and the native plant community.

Treatment of purple loosestrife will likely have to occur twice during the growing season in order to ensure that plants were not missed as the vegetative part of the plants can be hard to spot among other vegetation. In sensitive areas or areas prone to erosion, careful spot-spraying will create fewer disturbances than manual or mechanical control. For several years following treatment, areas should be monitored for new plants germinating from the seed bank. In some cases several years of treatment may be necessary.

Activity appropriate for: Small to large areas of infestation.

Activity will lead to: Control and, with follow-up treatments, eradication of the plant. 90-100 percent control in the first year of treatment can be expected. Follow-up treatment will likely be required for several years and it is best to alternate which herbicide is used to prevent promoting a herbicide-resistant population.

Permit: an Aquatic Noxious Weed Management General Permit (issued by the Washington State Department of Ecology and managed by the Washington State Department of Agriculture) is required for herbicide use on emergent, riparian, and shoreline listed noxious weeds. Also, the herbicide applicator is required to have a Pesticide Applicators License with an Aquatic Endorsement (issued by the Washington State Department of Agriculture). See “A note about needed licenses, permits and permissions” at the end of this section.

Yellow flag iris (*Iris pseudacorus*)

For more information on the following yellow flag iris control methods reference Appendix 2 – Control Method Options and Appendix 5 – Yellow Flag Iris Best Management Practices document.

Hand Pulling and Digging

Yellow flag iris has an extensive root system and plants must be dug up, taking care to remove the entire rhizome. The rhizome is tough and may require heavier tools, such as pickaxes or Pulaskis. If the entire rhizome is not removed, more plants will be produced. The location should be watched and new leaves will show locations of any missed sections of rhizome. By continuing to remove the rhizome, one can eradicate a small patch. For plants emergent in standing water for the entire growing season, cutting all leaves and stems off below the waterline can result in good control. This method is most effective if the plants are cut before flowering. Digging plants in standing water will cause a temporary sediment turbidity increase.

Any removed pieces of rhizome should be disposed away from wet sites. Composting is not recommended for these plants in any home compost system, because rhizomes can continue growing even after three months without water. When removing manually, care should be taken to protect the skin, as resins in the leaves and rhizomes can cause irritation.

Activity appropriate for: Very small areas of iris infestation. Private landowners may use digging to remove plants from small areas of infestation; however, any area more than a few square feet may prove too much work as the roots are extensive and tough.

Activity will lead to: Control or possibly local eradication of the plant. If care is taken to thoroughly remove all root material, then the iris could be locally eradicated.

Permit: In areas where the plant is growing in standing water (“Waters of the State”) a WDFW Aquatic Plants and Fish Booklet (permit) is required. See “A note about needed licenses, permits and permissions” at the end of this section. In areas where the plant is above the “standing water” elevation level (within unincorporated areas of King County), the King County Critical Areas Ordinance permits the control of noxious weeds “if removal is undertaken with hand labor, including hand-held mechanical tools” (King County Noxious Weed Control Program, 2014).

Cutting

Repeated mowing or cutting of above ground plant material (leaves and flowers) may keep yellow flag iris contained and can potentially kill it by depleting the energy in the rhizomes after several years of intensive mowing. Mowing can be done using a brush cutter or hand tools. Deadheading (cutting off) flowers and seed will prevent further spread of the plant via seed. When growing in standing water, cutting of the plant leaves below the water level in the spring may result in reduced stem density (Simon, 2008). However, the plant can also slowly spread laterally via rhizomes and can reproduce via rhizome fragment, so cutting methods will not likely lead to plant eradication.

Activity appropriate for: Small to large areas of infestation.

Activity will lead to: Temporary control of plants in small to large areas. Cutting techniques (both whole plant and deadheading) will not likely lead to eradication of the plant from the area.

Permit: In areas where the plant is growing in standing water (“Waters of the State”) a WDFW Aquatic Plants and Fish Booklet (permit) is required. See “A note about needed licenses, permits and permissions” at the end of this section. In areas where the plant is above the “standing water” elevation level (within unincorporated areas of King County), the King County Critical Areas Ordinance permits the control of noxious weeds “if removal is undertaken with hand labor, including hand-held mechanical tools” (King County Noxious Weed Control Program, 2014).

Tarping

Small patches can be covered with a heavy plastic tarp weighted at the edges for several years. The tarp needs to extend well beyond the edges of the infestation and be periodically checked to ensure that plants are not growing up around the tarp. Other materials (plastic, landscape cloth) are not as effective. It is recommended tarps are kept in place for two growing seasons (Simon, 2008).

Activity appropriate for: Small areas of iris infestation. Private landowners may use tarping to suppress small areas of yellow flag iris.

Activity will lead to: Control or possibly local eradication of the plant if care is taken to ensure the tarp is secure and in place for several years.

Permit: In areas where the plant is growing in standing water (“waters of the State”) a WDFW Aquatic Plants and Fish Booklet (permit) is required. See “A note about needed licenses, permits and permissions” at the end of this section. In areas where the plant is above the “standing water” elevation level (within unincorporated areas of King County), the King County Critical Areas Ordinance permits the control of noxious weeds (King County Noxious Weed Control Program, 2014).

Chemical Control

See Appendix 2 – Control Method Option, Appendix 3 – Toxicity of Aquatic Herbicides, and Appendix 4 – Aquatic Herbicide Labels for details on aquatic herbicide modes of action and toxicity.

Long term control and eventual eradication of yellow flag iris plants is possible with careful use of aquatic-approved, systemic herbicides. Since yellow flag iris is a monocot, herbicides that are selective for broadleaf plants such as 2,4-D or triclopyr are not effective. However, nonselective herbicides will injure or kill any plant they contact (both monocots and dicots), so special care must be taken when using these chemicals. The two non-selective, aquatic approved herbicides commonly used for yellow flag iris control are glyphosate and imazapyr.

Glyphosate is the most frequently used chemical for controlling yellow flag iris. It is applied to actively growing plants in late spring or early summer and should be applied directly to foliage, or applied immediately to freshly cut leaf and stem surfaces. It is important to avoid spraying non-target plants because glyphosate is non-selective. Foliar application of glyphosate at a rate of 5 to 8 percent, along with an aquatic-approved surfactant is recommended (Tu, 2003) (Tyron, 2006) (Simon, 2008) (King County Noxious Weed Control Program, 2009). Glyphosate is not known to have residual soil activity.

Imazapyr applied at 1 to 1.5 percent solutions in the fall results in good control. Imazapyr sprayed in the spring, or a combination of imazapyr (1 percent) and glyphosate (2.5 percent) sprayed in fall both result in good control, but are slightly less effective than imazapyr alone (Simon, 2008). Note that imazapyr has been shown to have some residual soil activity, so care should be taken to avoid spraying in the root zone of desirable plants, and the treated area should not be replanted for several months after application.

Activity appropriate for: Small to large areas of infestation.

Activity will lead to: Control and, with follow-up treatments, eradication of the plant. 80 to 90 percent control in the first year of treatment can be expected. Follow-up treatment will likely be required for several years.

Permit: an Aquatic Noxious Weed Management General Permit (issued by the Washington State Department of Ecology and managed by the Washington State Department of Agriculture) is required for herbicide use on emergent, riparian, and shoreline listed noxious weeds. Also, the herbicide applicator is required to have a Pesticide Applicators License with an Aquatic Endorsement (issued by the Washington State Department of Agriculture). See “A note about needed licenses, permits and permissions” at the end of this section.

Integrated Pest Management

The preferred approach for weed control is Integrated Pest Management (IPM). IPM involves selecting from a range of possible control methods to match the management requirements of each specific site. The goal is to maximize effective control and to minimize negative environmental, economic and social impacts. IPM uses a multifaceted and adaptive approach. Control methods are selected that reflect the available time, funding, and labor of the participants, the land use goals, and the values of the community and landowners. Management of noxious weed problems will require dedication over a number of years, and should allow for flexibility in methods as appropriate.

A Note about Needed Permits, Licenses, and Permissions

When working on vegetation control in and near water and in wet areas, there are a number of permits and licenses that ensure weed control work is done in a way that has minimal to no impact on the environment. More information can be found in the document Noxious Weeds Regulatory Guidelines BMP in Appendix 5.

Manual, Mechanical, and Other Forms of Physical Plant Control

The Aquatic Plants and Fish Booklet (Permit) issued by the Washington Department of Fish and Wildlife (Washington Department of Fish and Wildlife, 2015)

- The Pamphlet permit can be acquired and printed from this web site: http://wdfw.wa.gov/licensing/aquatic_plant_removal/ or copies can be requested by calling (360) 902-2200
- This permit covers activities that occur in “Waters of the State” including areas of standing water on the lake shore.
- Plant control activities vary depending if the plant is an “aquatic noxious weed” (on the state noxious weed list) or an “aquatic beneficial plant” (all native and nonnative aquatic plants except those on the state noxious weed list). Read and follow the permit carefully.
- This permit is not necessary for purple loosestrife control (via hand digging or pulling) as there is a specific exemption for manual control of that plant.
- The allowable work window listed in the permit for Ames Lake is July 16 to September 30. All work outside this time period requires an individual HPA permit.
- The permit is very specific about what weed control situations it allows, what situations required an HPA permit (see below) and what activities do not pertain
- The permit does not regulate the use of grass carp or herbicide, which are regulated by other WDFW rules and the WA State Dept. of Ecology respectively.

Formal Hydraulic Project Approval Permit (HPA)

- This permit covers all other activities, including weed control work, that happen in “Waters of the State” and are not allowed under the Aquatic Plants and Fish Pamphlet permit.
- Details of when a formal HPA is needed are in the Aquatic Plants and Fish Pamphlet permit.
- An HPA permit can be applied for online at: <http://wdfw.wa.gov/licensing/hpa/> ; as of January 2018 it free to apply for the permit, it takes ~ 45 days to process

King County Critical Areas Ordinance (for manual control in areas where the plants are not in “Waters of the State”)

- Details of the ordinance are in Appendix 5 – “Noxious Weed Control Regulatory Guidelines BMP”
- Other municipalities may have more stringent rules about working in Critical Areas.

Aquatic Herbicide Use

Licenses – Pesticide Applicators License with an Aquatic Endorsement (issued by the Washington State Department of Agriculture).

- Two tests (approximately 60 questions, multiple choice), \$25 testing fee, and \$33 annual license fee are required. It takes about two weeks to get the license if the test is passed. Without re-certification credits, the license is good for five years.
- WSDA pesticide licensing website: <http://agr.wa.gov/PestFert/LicensingEd/Licensing.aspx>
- A license is not necessary for a private landowner using the injection method to control knotweed on their own property.

Permits

Aquatic Noxious Weed Management General Permit (ANWMGP)

- Issued by the Washington State Department of Ecology and managed by the Washington State Department of Agriculture
- For emergent plants (state listed noxious weeds only)
- Free permit, takes approximately one month to receive. Apply online: http://www.ecy.wa.gov/programs/wq/pesticides/final_pesticide_permits/noxious/noxious_index.html (see the “how to apply...” link on the right side of the screen)
- Public notification (letters and/or signs) are needed and the permit involves record keeping of herbicide use and reporting back to WSDA
- Each permit has its own list of Ecology permitted herbicides and surfactants

Aquatic Plant and Algae Management General Permit (APAMGP)

- Issued by the Washington State Department of Ecology
- Required for herbicide use on submerged and floating leaf aquatic plants (and for native plants/non noxious weeds in any aquatic situation)
- Permit costs about \$450/year and takes approximately 2 months or more to receive
- Apply online: <https://ecology.wa.gov/Regulations-Permits/Permits-certifications/Aquatic-pesticide-permits/Aquatic-plant-algae-management>
- Public notification is required (newspapers, signs, letters)
- Record keeping and potentially water quality testing are required
- Each permit has its own list of Ecology permitted herbicides and surfactants

Section 7 - Integrated Treatment Plan

An integrated treatment plan is the overarching strategy put forward to comprehensively address noxious weed issues at Ames Lake. The integrated management approach involves considering weed control alternatives with regard to the following (as adapted from Gibbons, 1994):

- The extent of the problem plants
- The scale, intensity, and timing of the treatment
- The effectiveness against the target plants
- Duration of control (short term vs. long term)
- Human health concerns related to treatment activities or no-action
- Environmental impacts of treatments and mitigation if needed
- Program costs, both initial treatment(s) and long-term maintenance
- Permit requirement (Washington Department of Fish and Wildlife, Washington State Department of Ecology, local, landowner permission)

When control activities are evaluated while thinking about these factors, control techniques appropriate for the waterbody and community can be selected. Along with the benefits of each activity, careful consideration should be given to the cost of activities (both monetary and environmental).

Fragrant water lily (*Nymphaea odorata*)

Control of fragrant water lily requires persistence and thoroughness. The ultimate strategy for all fragrant water lily control activities is to kill the roots of the plants. Manual control methods achieve this by removing lily pads so frequently and thoroughly that the plant is not able to photosynthesize.

Eventually the roots will be depleted of their energy storage and they will die. Systemic herbicide acts in a similar way when it translocates down to the roots and eventually kills the plants.

Short Term Action

Persistent hand pulling/cutting is probably the most straightforward method that waterfront property owners can do to control lily pads in front of their property. If the lily pads are pulled or severed repeatedly before the leaves reach the water surface then there is a good chance that significant progress will be made in starving the roots of the plant. It may take two to three years of repeated cutting in an area every week or so during the growing season to completely starve the roots, but it will work. The roots of fragrant water lily plants are generally too large and intertwined with the lake bottom to be pulled or dug up. Also, digging up the roots will likely cause the roots to fragment, which will readily re-grow. The only permit required for hand pulling is the Aquatic Plants and Fish Pamphlet (HPA) permit available for free from the Washington Department of Fish and Wildlife.

If the lily pads are cut only occasionally and the returning lily pads are allowed to surface, then it is unlikely the roots will be starved. However, even only occasional cutting of plants can greatly reduce the coverage and impact of the plants in localized areas.

Cutting and pulling can be done by hand (either swimming or from a boat), by using a hand-operated weed cutter such as a Weed Razer or WeedShear from shore (and gathering up the cut lily pads), or by using a boat-attached machine such as the Jenson Lake Mower and rake. Cut lily pads can be composted inland or composted at an off-site commercial green waste facility.

Lake-wide Control Strategy

A lake-wide control strategy for controlling fragrant water lily depends on support and cooperation from a large number of lake community members. Success also depends on a funding commitment, not only for initial treatment but also the annual follow-up maintenance that is necessary to keep the lake from reverting back to pre-treatment conditions.

Year 1

Careful mapping of fragrant water lily plant distribution is recommended before treatment. This can be done using detailed aerial photos taken during the summer growing season. This mapping can also be done using a small, maneuverable boat, such as a canoe, and an accurate GPS unit.

Large-scale fragrant water lily control is most efficiently done using the systemic, **aquatic herbicide glyphosate or imazamox**. The herbicide is mixed with an aquatic surfactant (to help the herbicide adhere to and penetrate the lily pad surface) and a water-safe dye (which helps the herbicide contractor know where they have applied the product). The herbicide is mixed in a tank and sprayed from a boat on the surface of the lily pads. One treatment of all the lily plants at the lake will take about one day. Some large patches of lily pads will have to be treated in two stages as there will be an approximately 20 feet wide swath of plants that are not able to be sprayed because of wash over from the boat. These strips of un-sprayed plants will need to be treated two to three weeks after the initial treatment. It will take about two weeks for sprayed plants to start showing symptoms of the treatment. There is no irrigation water use restrictions associated with a glyphosate or imazamox application to fragrant water lily and are no swimming or fishing restrictions associated with a glyphosate or imazamox application to fragrant water lily.

It should be noted that although herbicide treatment will control most plants that are sprayed, there will likely be a number of scattered lily pads that had not surfaced at the time of treatment. Those plants will continue to grow unless their roots are not connected to roots of plants that were treated. It is recommended to plan on **two rounds of herbicide spraying, approximately six to eight weeks apart** to make sure all plants are treated.

Year 2 to 3

Follow-up herbicide application treatments will likely be needed for two years after the initial treatment. These year two and year three treatments will target increasingly more

sparse patches of lily pads. However, the cost for applying the herbicide will be approximately the same as the initial treatment cost because the extent of the plants will be similar and most of the cost is labor, not herbicide.

Alternatively, if the initial year of herbicide treatment is very successful, meaning very few lily pads return the second year, then it may be possible to do **follow-up control by cutting**. This strategy will require careful record management and mapping to make sure all areas of the lake where plants might come back up are checked and lily pads are pulled/cut before they reach the surface.

Long-term management

Every time a fragrant water lily leaf is allowed to reach the surface and photosynthesize, the plant roots accumulate energy and vigor. Even in areas where lily pads have been repeatedly pulled or sprayed, if a new leaf pops up and is allowed to photosynthesize you are in effect starting to undo the work that has been done to kill the roots. For that reason, resources (time to hand pull and/or money for herbicide applications) should be set aside to prevent the system reverting to dense areas of fragrant water lily. Unlike milfoil, it is less likely that new water lily plants will be introduced via boat or trailer, although it could happen. More likely is a situation where residual plants are allowed to continue to grow and eventually they begin increasing their distribution at the lake to pre-control levels.

The beautiful blossoms of the fragrant water lily produce seeds which are spread throughout the water via currents and birds that eat them. From the time a bloom emerges it takes about three days for them to be pollinated and become seed viable. Each blossom can generate hundreds of seeds that then can become plants. The blossoms stem will begin to coil up and draw the flower back under the surface of the water once it has been pollinated, where the seeds grow and are released to find their new life. It can take several years for these seeds to produce plants that make it to the water surface.

Purple loosestrife (*Lythrum salicaria*)

Control of purple loosestrife requires persistence and thoroughness. The ultimate strategy for all loosestrife control activities is to kill the roots of the plants and prevent re-establishment. Manual control methods achieve this by digging up and removing the entire root and removing flowering/seeding plant parts. Systemic herbicide acts in a similar way when it translocates down to the roots and eventually kills the plants.

Short Term Action

Waterfront property owners can **dig up purple loosestrife plants**, roots and all. The plant material can be composted inland (somewhere where the roots can't touch the soil) or bagged up and disposed of in the trash. In the Aquatic Plants and Fish Pamphlet (HPA) permit there is a special exemption in the permit for purple loosestrife "An activity conducted solely to remove or control purple loosestrife and that is performed with hand-held tools or equipment, or equipment carried by you when used, does not require an HPA". It should be noted that most places where purple loosestrife growing are considered to be a "wet site" and homeowners are not allowed to apply the over-the-

counter formulations of herbicide that are readily available. See more about herbicide in the “Lake-wide control strategy” section below.

Hand digging of purple loosestrife plants is an option for smaller areas of waterfront infestations or once a large population has been diminished through herbicide treatment. However, it is likely not a feasible option for a lakeshore-wide infestation as left root parts can sprout new plants.

Short of digging up entire plants, one control activity that should be done by almost any landowner is **removing (and disposing of) the flowers** of the plants. This will prevent further spread to un-infested areas of the lake shore by the floating seeds. These plant parts should be disposed of in the garbage, not yard waste.

Lake-wide Control Strategy

A lake-wide control strategy for controlling purple loosestrife depends on support and cooperation from a large number of lake community members. Success also depends on a funding commitment, not only for initial treatment but also for the annual follow-up maintenance that would be necessary to keep the lake shore from reverting back to pre-treatment conditions. The current level of purple loosestrife infestation at Ames Lake is manageable through hand digging techniques. If the current infestation is not kept in check and the extent of the infestation spreads, then the only realistic way to eradicate the plant from the lake shore would be to use a systemic aquatic herbicide. Permission would need to be obtained by all waterfront property owners to control the plants. Any landowner not giving permission for control would not have their loosestrife plants sprayed.

Year 1

A pre-treatment survey of purple loosestrife should occur in late July or early August. This survey would be done at a time when the majority of the plants are flowering to ensure that none are missed. The survey could be conducted by King County staff or private contractor from a small boat and all plants would be mapped.

Initial control of purple loosestrife plants can be accomplished efficiently using a systemic, aquatic herbicide (see Section 6 – Purple Loosestrife – Chemical Control). If treatment is done early during the flowering time (mid-late July) then treatment can be done using triclopyr TEA without the need to remove flower heads. If treatment is done using the slower acting glyphosate, imazapyr, or imazamox (or using triclopyr TEA in August or early September), then the flower heads should be first removed before the plant vegetation is sprayed (see Section 6 – Purple Loosestrife – Chemical Control). The herbicide applicator should use a “spot spraying” technique, being careful to only spray the targeted plants with a backpack or hand held sprayer. The applicator will need to be licensed and have the required application permits (see Section 6 – Purple Loosestrife – Chemical Control).

In late August/early September the entire lake shore should be surveyed again for purple loosestrife to determine the thoroughness of the herbicide treatment. The location of persisting plants should be mapped and noted to make sure they are controlled during the first round of herbicide treatment the following year.

As necessary, a second spot treatment of purple loosestrife using herbicide should be scheduled after the follow-up survey. Concurrently, hand removal of any remaining purple loosestrife flowers or seed heads should be done by mid-September.

Long-term management

A long-term management strategy would involve checking on treated plants in subsequent years and retreating with herbicide as necessary to eradicate all infestations of the plant. As areas are cleared, seeds are likely to germinate and the area may be re-infested if follow up monitoring and control are not done.

Purple loosestrife control in years two, three, and four would use a combination of herbicide treatment and hand pulling follow-up. Pre-treatment surveys of purple loosestrife should occur in late July or early August. The survey could be conducted by King County staff or a contractor from a small boat with all plants being mapped.

Spot herbicide treatment of persisting purple loosestrife plants could then be conducted by a contractor or trained, licensed community volunteers in late-July to mid-August. Two to three weeks after treatment the entire lake shore should be surveyed again for purple loosestrife to determine the thoroughness of the herbicide treatment.

Based on the September survey and mapping, hand removal of any remaining purple loosestrife flowers or seed heads could be conducted by community volunteers or individual property owners by mid-September.

Yellow flag iris (*Iris pseudacorus*)

Control of yellow flag iris requires persistence and thoroughness. The ultimate strategy for all iris control activities is to kill the roots of the plants. Manual control methods achieve this by digging up and removing the entire root. Systemic herbicide acts in a similar way when it translocates down to the roots and eventually kills the plants.

Short Term Action

Waterfront property owners can **dig up iris plants**, roots and all. The plant material can be composted inland (somewhere where the roots can't touch the soil) or composted at an off-site commercial green waste facility. If plants are growing in standing water the only permit required for digging is the Aquatic Plants and Fish Pamphlet (HPA) permit available for free from the Washington Department of Fish and Wildlife. If plants are in areas that are drier than standing water (i.e. wet soil) then no permit is required in unincorporated King County. It should be noted that anywhere yellow flag iris plants are growing is considered to be a "wet site". Application of over-the-counter formulations of herbicide that are readily available from hardware and lawn and garden stores is not allowed in these wet sites. See more about herbicide in the "Lake-wide control strategy" section below.

Hand digging of iris roots is an option for smaller areas of waterfront infestations. However, it is likely not a feasible option at some of the larger infestations around the lake.

Short of digging up entire plants, one control activity that can be done by almost any landowner is **removing (and disposing of) the flowers and seed pods** of the plants. This will prevent further spread to uninfested areas of the lake shore by the floating seeds. These plant parts should be bagged up and disposed of in the trash.

Lake-wide Control Strategy

A lake-wide control strategy for controlling yellow flag iris depends on support and cooperation from a large number of lake community members. Success also depends on a funding commitment, not only for initial treatment but also for the annual follow-up maintenance that would be necessary to keep the lake shore from reverting back to pre-treatment conditions. Due to the size of some of the infestations of iris around the lake, the only realistic way to eradicate the plant from the lake shore would be to use a systemic aquatic herbicide. Permission would need to be obtained by all waterfront property owners to control the plants. Any landowner not giving permission for control would not have their iris sprayed.

Year 1

Ideally all iris plants at the lake would be treated with the systemic aquatic herbicide glyphosate, imazapyr, or imazamox and an aquatic surfactant. The herbicide treatment would be done using a foliar spray from a backpack sprayer. Concurrent with the herbicide treatment, all plants would be mapped using an accurate GPS unit. The herbicide application would take one to two days in the late spring/early summer (May-June) or fall (September). The effect of the herbicide treatment may take several weeks to become evident on treated plants. This initial treatment work could be conducted by a hired contractor or licensed and trained community members. Using the herbicide control method, approximately 75 percent control can be expected in the first year.

Long-term management

A long-term management strategy would involve checking on treated plants in subsequent years and retreating with herbicide as necessary to eradicate all infestations of the plant. It would be realistic for several interested lake volunteers to get a Washington State Department of Agriculture Pesticide Applicators License with an Aquatic endorsement. This license, along with an Aquatic Noxious Weed NPDES permit would allow volunteers to apply herbicide on the property of landowners who gave them permission to treat iris plants. See A note about needed permits, licenses, and permission at the end of section 6 for details about these permits and licenses. KCNWCP staff could then provide further training on herbicide mixing and application techniques.

It would be realistic for volunteers to make their way around the lake once or twice per year doing spot treatments of any returning iris plants. Eventually there would likely be very little or no yellow flag iris at the lake. Because the plant mostly spreads by water and animals moving plant fragments, if all the plants on the lake are controlled, then there is a good chance control efforts would be fairly long-lasting and only plant/seed fragments entering the lake from upstream would be an issue.

Section 8 - Plan Elements, Costs, and Funding

Costs of the Plan

Lily Pad Funding

All funding for the Lily Pads removal will come from donations that have been marked as Lily Pad Fund. This is put into Ames Lake Community Club funds.

Permit Yearly Costs approximately \$618

Each Treatment is approximately \$2,000

We would treat 2-3 times a year, depending on the company's schedule.

1st Survey of Ames Lake: \$1,100

2nd Survey of Ames Lake: \$1,500 plus \$600 for a company to oversee it.

We would do approximately 2-3 treatments a year.

As of fall of 2018 we have raised for herbicide treatment \$15,854

Hand Pulling from divers \$10,000

Total spent \$25,854 Including the Hand Pulling Effert.

Yellow Flag Iris

We have worked with **Cynthia Young, Ecologist** *King County Department of Natural Resources* to remove invasive yellow flag iris from the community lots and replace with native plants. King County has approved a grant that includes having King County personnel plant and hand pull the yellow flag iris for 3 years.

Sources of Funding

Ames Lake Habitat Improvements: We are working with Cindy Young, King County Department of Natural Resources, to hand remove the yellow flag iris at our community lots. This is to educate residents what they can do in helping to eradicate the yellow flag iris. This is also to help Salmon as they need patches of exposed sand and gravel for spawning. The yellow flag iris covers the shoreline and doesn't leave the salmon any place to spawn.

Long Term Sustainability

The long term sustainability of this project is dependent on the commitment of the Ames Lake community of residents to follow-up on the initial weed control and the ability of the staff of the King County Noxious Weed Control Program to communicate weed control techniques, strategies and priorities. It is recommended that no treatment regimens be committed to before long-term sustainable resources, both financial and community commitment, are secured. Failure to do so will likely result in a poor investment of time and money and a return to the pre-treatment conditions at the lake. However, if the community members are committed, long-term management of aquatic weeds at Ames Lake can be achieved.

Section 9 - Monitoring, Evaluation, and Implementation

Monitoring

Yearly surveying and monitoring of emergent, floating and submerged aquatic noxious weeds should be conducted at Ames Lake. These surveys would help guide noxious weed control efforts and provide a year-to-year baseline for progress towards weed eradication. Surveys of purple loosestrife should be done annually by King County staff via canoe, usually in late July. Surveys of water lily and iris can be done by volunteers and/or hired contractors with the assistance of King County staff as needed. During the surveys, mapping of the aquatic noxious weeds would be done using aerial photos and/or GPS data loggers. Data collected by King County would then be transferred to GIS.

Evaluation of the Plan

The effectiveness of the plan should be evaluated yearly by King County staff and other members of the Implementation Committee (see below). Adaptive changes should be made as needed. Year-to-year comparisons of the monitoring data should be used to evaluate trends in specific target species abundance and distribution. The results of these comparisons should guide control efforts and may result in a change in future control strategies. Success of the plan should be measured by the reduction of the target noxious weed species.

Implementation

This plan can be implemented as a whole or selectively. The separate weed species can be targeted individually.

Formal implementation of the plan could occur as follows:

Convene a Project Implementation Committee. This group would likely consist of Ames Lake residents as well as, potentially, someone from the King County Noxious Weed Control Program. This important committee would guide how the plan is implemented. If lakefront residents become frustrated with controlling noxious weeds at their property they can form a project implementation committee to follow the recommendations in this document.

Identify Funding Sources. Sources of funding are discussed in Section 9.

Select an Herbicide Contractor and/or Train and License Residents. An applicator should be selected for treatment of each of the target weeds outlined in the IAVMP. The treatments could be done either “in-house” by experienced King County employees or by a licensed contractor. Contractors should be hired according to the King County process (if the funding is being administered by King County). Alternatively, some or all of the

weed species can be controlled by lake residents and volunteers as part of a whole-lake weed control strategy. Just like County staff or private contractors, they would need to get the required licenses and permits as outlined in Section 6. Seek the advice of experts at the King County Noxious Weed Control Program or Washington State Department of Ecology.

Application of Herbicide. Application of herbicides should be completed as prescribed in the IAVMP and agreed upon by the community, unless consultation with the community, Ecology and/or the applicator leads to defensible changes in the plan.

Public Education and Communication. The residents of Ames Lake should be notified about upcoming herbicide applications as determined by the herbicide application permits, the results of yearly monitoring efforts, and any major changes made to the plan via public notification letters or email. Much of this communication should be done by active members of the Ames Lake community who are involved with the Implementation Committee. The Committee should take into account public feedback when making decisions about the plan.

Monitoring Surveys. Surveys should be done yearly by King County staff with the help of Ames Lake residents. Surveys should be conducted at the same time each year in order to get a comparable measure of the plants' distribution and density.

Long-Term Monitoring and Maintenance. Long-term monitoring and maintenance should be the responsibility of the Ames Lake community after the satisfactory completion of the implementation plan. Because none of the noxious weeds that are part of this plan are regulated in King County (required to be controlled by the land owner) the King County Noxious Weed Control Program has no authority or obligation to long-term maintenance of the control work.