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-Ben Peterson, King County Noxious Weed Control Program (January, 2018)
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Executive Summary

Over the past several decades aquatic noxious weeds at Cottage Lake have greatly increased their distribution and impact. Four species cause the most concern: Eurasian watermilfoil, fragrant water lily, purple loosestrife, and yellow flag iris, all listed as noxious weeds in Washington state. At public meetings Cottage Lake residents and users 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.

Under the guidance of the King County Noxious Weed Control Program, the Cottage Lake community supported the development of an Integrated Aquatic Vegetation Management Plan (IAVMP) to address these aquatic noxious weed issues. The goal is to arrive at a long-term, affordable, practical plan to manage aquatic plants in a manner that also protects the Cottage Lake human health and environment.

Whole-lake scale aquatic weed control efforts have been occurring since at least 2006 and control efforts by individual land owners have been occurring long before that. The work and community organization by the Friends of Cottage Lake has been critical for this past weed control effort. The purpose of this document is to integrate lake background information, weed control history, a variety of weed control recommendations and community priorities and goals into a comprehensive plan that will be useful in guiding future weed control work.

- This plan is meant to complement prior lake plans for Cottage Lake such as The Cottage Lake Management Plan in 1996 and the Cottage Lake Aquatic Weed Management Fund Grant Final Report in 2010.
- The primary organizing and implementing force behind improving water quality and noxious weed issues at the lake has been, and will likely continue to be, the Friends of Cottage Lake.
Section 2 – Problem Statement

Cottage 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 submerged noxious weed *Eurasian watermilfoil* (*Myriophyllum spicatum*) was first documented at the lake in 2007 (King County, 2010a) and the floating leaf noxious weed *fragrant water lily* (*Nymphaea odorata*) has been documented at the lake since at least 1976 (Metro, 1976). 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 1993 and has been found at 62 locations along the lake shore (King County, 1996b) (King County Noxious Weed Control Program, 2017a). The emergent noxious weed *yellow flag iris* (*Iris pseudacorus*), first documented in 1993, currently occupies much of the lake’s shoreline (King County, 1996b). At public meetings held on the topic of aquatic weeds at Cottage Lake, lake residents and users 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 Integrated Aquatic Vegetation Management Plan (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 Integrated Aquatic Vegetation Management Plan (IAVMP) is to control aquatic noxious weeds at Cottage 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 Cottage Lake Community in planning and implementation of the IAVMP
Section 4 – Public and Community Involvement

Community Commitment
The Cottage Lake Community has demonstrated its strong commitment to aquatic weed control issues through the activities of the Friends of Cottage Lake (http://www.friendsofcottagelake.org/). This organization has led and funded several lake-scale aquatic weed control activities at the lake over the past ten years (for details see the Friends of Cottage Lake website and Section 5).

Steering Committee, Outreach, and Education Process
May 1, 2017: First meeting with Cottage Lake Community (as part of a Friends of Cottage Lake meeting) Ben Peterson, Aquatic Noxious Weed Specialist with the King County Noxious Weed Control Program, introduced the idea of an IAVMP the May 1, 2017 meeting of the Friends of Cottage Lake held at the Woodinville King County Library. There were about 30 people in attendance, all lake residents. Jonathan Morrison, president of the Friends of Cottage Lake, led the evening meeting. Overall, the community was very receptive to the idea of creating an IAVMP for the lake. It was agreed that the IAVMP process would go forward and a planning meeting would be scheduled for early July. Notes from the meeting, and a copy of the meeting invitation are included in Appendix 1.

July 11, 2017 – Steering Committee Meeting
On July 11, 2017, seven Cottage Lake Community members met for an IAVMP planning meeting at the Woodinville King County Library. This meeting would provide guidance for development of the Cottage Lake IAVMP by King County staff. Input was given on weed control history, community priorities, and other details. Several community members provided information to contribute to the document. The meeting agenda, attendance sheet, and notes from the meeting are included in Appendix 1.

Public Sentiment about Proposed Weed Control Methods
Through the years of weed control at the lake and during this planning process, people involved with the lake, as residents and regular volunteers, have voiced their support or concern over various proposed control methods. Some have expressed their concern about the use of any aquatic herbicides at the lake. Others are “OK” with foliar spray herbicide use (such as on yellow flag iris or fragrant water lily) but are concerned about the use of in-water herbicide treatments to control Eurasian watermilfoil.

Concern was raised regarding the effects that removal of large areas of fragrant water lily control would have on bass, which are known to use the plant for cover. Bass are introduced non-native fish but are popular with anglers. There is concern that removal of fragrant water lily plants would negatively affect bass fishing at the lake.

Other possible impacts related to choice of control method include the potential for hand pulling of milfoil to cause a temporary, localized increase in water turbidity/cloudiness. Also, certain control methods (such as using a weed rake, mechanical weed cutter, bottom barriers, and weed rollers) that are used for water lily and milfoil control often remove both native plants and the targeted noxious weed. Even in areas where the submersed and floating-leaf weeds are growing densely, there are often native aquatic plants in the immediate area that are affected by physical control methods. There has been some concern expressed about these side effects of physical control methods.
Whatever control methods are used, it is important that they are done with full knowledge of the positive and potentially negative effects associated with them. One of the purposes of this IAVMP is to disseminate that information to the lake community.
Section 5 – Waterbody and Watershed Characteristics

Watershed Characteristics

Location and Size of Watershed
Cottage Lake lies in an unincorporated area of northern King County, about 15 miles northeast of downtown Seattle and about 3 miles east of Woodinville (Figure 1). State resource agencies frequently use a system of Water Resource Inventory Areas (WRIA) to refer to the state’s major watershed basins. Cottage Lake is located in WRIA 8, which refers to the Cedar-Sammamish watershed and includes Lake Washington and Lake Sammamish, the Cedar and Sammamish Rivers, and many other smaller creeks and small lakes which drain into this basin. A map of the WRIA 8 can be found at http://www.govlink.org/watersheds/8/map.aspx.
The Cottage Lake sub-basin constitutes 4,328 acres (20 percent) of the Bear Creek basin (KCGIS Center, 2017a). The Cottage Lake sub-basin receives a mean annual rainfall of 46 inches (U.S. Department of Agriculture, 2002). The elevation of Cottage Lake is 231 feet (U.S. Geological Survey, 1970). The Cottage Lake watershed receives drainage from the landscape to the west, north and east, the highest point being 620 feet at the north tip of the sub-basin (U.S. Geological Survey, 1970).

Streams and Wetlands in the Watershed
Cottage Lake was likely formed during the retreat of glaciers approximately 15,000 years ago. The basin-type geography of the lake and the porous glacial till substrate of the area has resulted in the formation of several types of wetlands in the watershed (Figure 2) (U.S. Fish and Wildlife Service, 2015).
Figure 2. Cottage Lake Watershed Map (water bodies, wetlands, and roads)
Within the Cottage Lake watershed there are several other waterbodies and wetland features (Figure 2). Crystal Lake (54 acres) lies about two miles upstream of Daniels creek in Snohomish County. North of Crystal Lake there is a 125 acre wetland that includes bog vegetation and soil. Other wetlands and smaller ponds lay further upstream. Several wetland areas flank Daniels creek as it flows from Crystal Lake to Cottage Lake. From the northeast, the 2.7-mile origin of Cottage Lake Creek flows into Cottage Lake at Cottage Lake Park (figure 2). Wetland surrounding and west of Cottage Lake have a wetland rating of “Class 1 wetland” due to their size and diversity of habitat (King County, 1991).

The Cottage Lake watershed consists primarily of two types of well-drained upland soils: “loam” (and variants of) soil (89 percent) and “loamy sand” soil (4 percent) (U.S. Department of Agriculture, 2017). Adjacent to both Cottage Lake and Crystal Lake there are wetland “muck” (wetland) soils (2 percent) (U.S. Department of Agriculture, 2017). These soils generally support wetland and wet forest plant communities. Directly north of and about a mile west of Crystal Lake are areas of “peat” soil (2 percent) (U.S. Department of Agriculture, 2017). This soil, supports sphagnum moss, Labrador tea, and cranberry plants, is acidic and has a high water holding capacity (U.S. Department of Agriculture, 1973) (Mitsch & Goesselink, 1993). The remaining 3 percent of the watershed is open water (U.S. Department of Agriculture, 2017).

**Land Use Activities in the Watershed and Potential Nonpoint Nutrient Source Locations**

In general, development and housing around Cottage Lake is not dense. The majority (85 percent) of the Cottage Lake watershed falls outside King and Snohomish County’s Urban Growth Boundaries (KCGIS Center, 2017b) (Snohomish County, 2018a).

The entire shoreline of Cottage Lake is zoned RA-5, “Rural Area” with a housing density limit of “one dwelling unit per five acres” (KCGIS Center, 2017c) (Snohomish County, 2018b). Land use in the watershed is predominantly rural (80 percent) along with industrial park/business park (8 percent), low density residential (6 percent), transportation/roads (4 percent), and neighborhood commercial (2 percent) (KCGIS Center, 2017c) (Snohomish County, 2018b).

The unincorporated King County part of the watershed, including Cottage Lake, is within the Bear Creek/Sammamish Community Service Area, and the Upper Bear Creek Unincorporated Area Council, both King County government designations (King County, 2018b).

**Human History**

A well-researched history of Cottage Lake has been written by Cottage Lake resident Susie Egan. It is published in Cottage Lake-Welcome to your Lake (King County, 2010b) ([http://www.friendsofcottagelake.org/Documents/WelcometotheLakeBook_10.pdf](http://www.friendsofcottagelake.org/Documents/WelcometotheLakeBook_10.pdf)).

**Current Lake Shoreline Use**

The majority of the Cottage Lake shoreline is occupied by rural residential houses (91 percent). The remainder 9 percent) is occupied by Cottage Lake Park, owned by King County (KCGIS Center, 2017d). It appears that most of the residential houses are occupied year round and are not “vacation cottages”. Landscaping on private property shoreline varies from landscaped or cleared beach areas and bulkheads to a mix of native and weedy vegetation. As of 1996 there were 74 “on-site septic systems” at Cottage
Lake (King County, 1996b). Analyses described in the Cottage Lake Management Plan suggest that in 1993 at least two septic system drain fields had failed and were leaking into the lake (King County, 1996b). No analysis of potential septic system leaks has been done since that time. Septic systems leaking into the lake can affect nutrient loading, algae, aquatic weed growth and public health.

As of 2015 there were 50 private docks on Cottage Lake, most 20 to 60 feet long (KCGIS Center, 2015). At Cottage Lake Park there is one 200-foot “J” shaped dock, often used for fishing, next to the hand-carry boat launch beach, and another smaller 30-foot dock just south of the large dock. Most of the residential parcels around the lake are long and narrow in shape, maximizing the density of waterfront houses (KCGIS Center, 2017d). The majority of waterfront private parcels have between 40 and 150 feet of shoreline. Exceptions are a few larger parcels at the lake’s outlet, the Cottage Lake Beach Club property, and the King County Cottage Lake Park.
Figure 3. Cottage Lake Bathymetric Map (contour line depth in feet, “X” = location of water quality sampling) (King County, 2017).

Waterbody Characteristics
Cottage Lake is 63 acres in size, has an average elevation of 231 feet and falls in Township 26N, Range 06E, Section 07 (U.S. Geological Survey, 1970). The lake has a maximum depth of 35 feet and a mean depth of 15 feet (Figure 3) (King County, 2017). Cottage Lake flushes an estimated 1,053 percent of (or about ten times) its volume annually. This number was derived by multiplying the average annual rainfall (46 inches), by the watershed area (4,328 acres), then dividing by the estimated lake volume (1,575 acre-feet = 63 acres x 25 feet mean depth) (U.S. Department of Agriculture, 2002). This value is an overestimate, as it does not account for water lost to evaporation from within the watershed.
Cottage Lake is fed by Daniels Creek and an unnamed creek to the northeast of the lake (Figure 2). The
waterbody is also fed by rainfall and runoff from the surrounding watershed. Water exits the southwest corner of the lake through Cottage Lake Creek, which connects with Bear Creek four miles downstream. The lake bottom is likely similar to most small lakes in the area: “mostly muck with some silt and gravel” (Dion & et al., 1976).

Dominant wind direction at the lake varies by season. During the colder months (October through April) the dominant wind direction is from the southeast (blowing towards the northwest) (WoodinvilleWX.com, 2018). During the warmer months (May into September) the dominant wind direction is from the northwest (blowing towards the southeast) (WoodinvilleWX.com, 2018).

The underlying “hydroparcells” of the lake, Property Identification Numbers 163070HYDR and 072606HYDR, are confirmed to be “State owned aquatic Lands” by the Washington State Department of Natural Resources (Olmstead, 2017).

Beneficial and Recreational Uses
The lake is often fished by residents and non-residents alike. The hand-launch boat area of Cottage Lake Park is used frequently, especially during the summer months. The large pier at this park is a popular fishing spot. Local residents swim in the lake, from the private community beach and swim platforms on the north shore, private swim beaches primarily along the deeper north, east shores of the lake, and from docks. Swimming also occurs at Cottage Lake Park’s lake access points. Fishing occurs from the large public dock at Cottage Lake Park as well as from private, hand-launched boats. Fishing is allowed by the Washington Department of Fish and Wildlife seasonally from mid-April through October (Washington Department of Fish and Wildlife, 2018a). More information about past recreational uses of the lake is included in Susie Egan’s “History of Cottage” lake noted in the “Human History” section above.

Since 1950 Cottage Lake, including a 300 foot buffer around the lake, has been a “no shooting” area where “the shooting of firearms is hereby prohibited” (King County Code 12.68.200). As of 1980, internal combustion engine use or operation has been prohibited on boats in Cottage Lake (King County Code 12.44.340).

It is likely that water withdrawals for residential irrigation use occur at Cottage Lake, but the extent is not known. As of December 2017, there were five surface water “Certificates”, 15 surface water “Claims” and one “New Application” on the lake (Washington State Department of Ecology, 2017a).

Lake Water Quality and Quantity
Water quality in Cottage Lake has been monitored by volunteer data collectors from 1995 to 2009 and again since 2014 (Figure 3 notes the sampling location). These data demonstrate the generally predictable nature of Cottage Lake water quality. Extensive work has been done focusing specifically on water quality issues at Cottage Lake in the 1996 Cottage Lake Management Plan (King County, 1996b). The lake is light-moderately colored, a result of naturally occurring tannins (King County, 2017).

The Trophic State Index (TSI), developed by Robert Carlson (Carlson, 1977), is a common index of a lake’s biological productivity. TSI values are calculated from Secchi depth (a measure of water clarity),
chlorophyll-a concentrations (a measure of algal biomass), and total phosphorus concentrations (the main nutrient that feeds algal growth). These three TSI estimates are all scaled between 0 and 100.

Oligotrophic lakes (TSI <40) are very clear, with low nutrient concentrations and low algal growth. These are often mountain lakes, or lakes in undisturbed forests. Eutrophic lakes (TSI >50) have cloudy water, with high nutrient concentrations and high algal growth. These are often highly altered lakes, and may have frequent algal blooms. Mesotrophic lakes (TSI 40-50) are in the middle, with fairly clear water, and moderate nutrient concentrations and algal growth. Mesotrophic lakes are common in lowland western Washington, especially in areas with some development along the shoreline and in the watershed.

In 2017, the three TSI values for Cottage Lake were in the upper mesotrophic to lower eutrophic range. Mesotrophic Lakes “may support abundant populations of rooted aquatic plants” and cool water fish (Gettys, Haller, & Belland, 2009).

Table 1. Annual Average Trophic State Index Values for Cottage Lake (King County, 2017)

Section 303(d) of the federal Clean Water Act requires that States perform a water quality assessment to determine if waterbodies (such as lakes and rivers) are impaired for beneficial uses “such as for drinking, recreation, aquatic habitat, and industrial use” (Washington State Department of Ecology, 2017b). The Washington State Department of Ecology manages this program for the State.
Cottage Lake was listed as Category 5 for high total phosphorous concentrations in 2002. This listing led to the 2004 Cottage Lake Total Maximum Daily Load* (TMDL) study being conducted on the waterbody (Washington State Department of Ecology, 2004). For many years high concentrations of phosphorous in the lake have resulted in algal blooms and the associated low dissolved-oxygen concentrations in the lake in the summer (Washington State Department of Ecology, 2004).

High levels of phosphorous in lake water can potentially result in a bluegreen algae (cyanobacteria) bloom. Under the right conditions, these naturally occurring algae species can quickly multiply. Cyanobacteria can produce a toxin that is harmful to humans and other animals depending on the concentration of bluegreen algae. The King County Water and Land Resources Division monitors over 30 swimming beaches and streams in the County for bacteria, temperature and algal toxins (King County, 2018a). Cottage Lake was closed due to high levels of algal toxins in September-October 2015, 2016, and 2017 (Nidzgorski, 2018). Each closure lasted a minimum of three weeks.

Water level fluctuations at Cottage Lake were monitored by volunteers through the King County Lake Stewardship Program from 1994 to 2009. In general, the lowest annual lake levels were seen August-September and the highest lake water levels were seen in the late winter and spring (King County, 2017). On average, there has been a 30 to 40 cm fluctuation between the annual lowest lake level and the mid-winter peak however, there have been several high water events recorded that were about 40 cm higher than the water level a few weeks before or after (King County, 2017).

**Fish and Wildlife Communities**

Cottage Lake and the surrounding terrestrial habitat in the watershed support a variety of fish, birds, and animals by providing nesting, forage, and cover.

**Fish**

Several salmonid species have been documented and predicted to occur at Cottage Lake. The Washington Department of Fish and Wildlife’s SalmonScape map indicates that Fall Chinook, Coho, and Sockeye have all been documented at Cottage Lake (Washington Department of Fish and Wildlife, 2018b) (Williams, Laramie, & Ames, 1975). Winter Steelhead is also predicted-modeled to occur at the lake (Washington Department of Fish and Wildlife, 2018b). The primary target for those fishing at Cottage Lake is non-native Rainbow Trout (stocked) and native Coastal Cutthroat Trout (Washington Department of Fish and Wildlife, 2018a). Other non-native fish commonly sought at the lake are Yellow Perch, Largemouth Bass, Black Crappie, Brown Bullhead, Catfish (species unknown) and Bluegill (Washington Department of Fish and Wildlife, 2018a) (Mattson, 2018). Fishing is permitted by the Washington Department of Fish and Wildlife seasonally from mid-April through October (Washington Department of Fish and Wildlife, 2018a). In 2017 there were two releases of Rainbow Trout at the lake by Washington Department of Fish and Wildlife: 10,417 fish released on April 10 and 2,075 released on April 17 (Washington Department of Fish and Wildlife, 2018c). Both the native spatterdock and non-

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1 A Total Maximum Daily Load is a regulatory term in the U.S. Clean Water Act, describing a plan for restoring impaired waters that identifies the maximum amount of a pollutant that a body of water can receive while still meeting water quality standards.
native fragrant water lily plants are known to provide habitat for largemouth bass (King County Noxious Weed Control Program, 2010a) (Tennessee Valley Authority, 2016).

**Birds, Mammals, Reptiles, and Amphibians**

Cottage Lake supports a diverse population of native waterfowl and other birds. Areas around the lake, combined with nearby Cold Creek and Bassett Ponds Natural Areas provide excellent habitat for a variety of birds. Red-eared sliders and painted turtles, both non-native, have been recorded at the lake (Mattson, 2018). Another non-native animal that has been recorded at the lake is nutria (Mattson, 2018). There has not been a concerted effort to inventory mammals, reptiles and amphibians at Cottage Lake; however, many sightings of animals have been reported over the years and it is likely that numerous species use the wild habitat of the area.

Gary Mattson has been keeping careful records of bird sightings at his Cottage Lake residence since 2003. Here is a list of the nearly 50 species of seasonal and common birds he has noted over the years (Mattson, 2018): American Coot, American Wigeon, Anna’s Hummingbird, Barn Swallow, Black-capped Chickadee, Bufflehead, Bushtit, Canada Goose, Canvasback, Chestnut-backed Chickadee, Common Goldeneye, Common Merganser, Cormorant, Downy Woodpecker, Eurasian Wigeon*, Fox Sparrow, Gadwall, Golden-crowned Kinglet, Greater Scaup*, Green-winged Teal*, Hairy Woodpecker, Hooded Merganser, Horned Grebe*, House Finch, Junco, Lesser Scaup*, Loon, Mallard, Norther Flicker, Northern Pintail*, Northern Shoveler, Pied-billed Grebe, Pileated Woodpecker, Red-breasted Nuthatch, Red Breasted Sapsucker, Red-winged Blackbird, Red-necked Grebe*, Ring-necked Duck, Ruby-crowned Kinglet, Ruddy Duck, Rufus Hummingbird, Rufous-sided Towhee, Starling, Surf Scooter* Tree Swallow, Trumpeter Swan, Western Grebe, and Wood Duck (birds marked with *are uncommon sightings).

**Characterization of Aquatic Plants at Cottage Lake**

A diverse population of aquatic plant species can be found in the Cottage Lake watershed, including many wetland associated plants in wetland areas to the north, forest plants in the surrounding undeveloped areas, and horticultural plants at private residences. The waterbody itself hosts a wide range of plants from emergent species to submersed species. Aquatic vegetation serves a wide array of ecological functions, such as supporting food webs, providing habitat for a variety of animal species, intercepting sediments at the upland/water interface, removing toxic compounds from runoff, and providing erosion control/bank stabilization.
Figure 4. Aquatic Plants at Cottage Lake Surveyed July 31, 1995 (King County, 1996a)
Twenty-one aquatic plant species (Table 2) have been identified at Cottage Lake, including six emergent species, four floating species, and eleven submersed species.

- **Emergents** are plants that are rooted in the sediment at the water’s edge but have stems and leaves which grow above the water’s surface (Gettys, Haller, & Belland, 2009).
- **Floating** rooted plants are rooted in the sediment and send leaves to the water’s surface. These plants occur within the lake’s littoral zone (Gettys, Haller, & Belland, 2009).
- **Submersed** plants are either freely-floating or are rooted in the lake bottom but grow within the water column. These plants occur within the lake’s littoral zone (Gettys, Haller, & Belland, 2009).
- The **littoral zone** is the area of a lake’s shallow area where “sufficient light penetrates to the bottom to support the growth of plants” (Gettys, Haller, & Belland, 2009). At Cottage Lake, the littoral zone is affected by water clarity and lake bottom depth (Figure 3). The zone ranges from as little as 40 to 60 feet wide on the lake’s steeper west and southeast shores to over 350 to 400 feet wide at the lake’s north and south ends (Figure 4, 5).

A comprehensive survey of the aquatic plants at Cottage Lake was conducted on July 31, 1995 as part of a project funded by the Washington State Department of Ecology and King County (Figure 4) (King County, 1996a). This survey included emergent, floating and submersed plants and divided up the lake into six sections (Figure 4, Table 2). Prior to the 1995 survey, at least three other aquatic plant surveys had been done at the lake in 1976, 1978, and 1993 (Metro, 1976) (Metro, 1978) (King County, 1996b). Plant presence data from these surveys are included in Table 2.

More recent aquatic plant surveys are included in Table 2. On July 24, 2017 while mapping purple loosestrife locations at Cottage Lake, King County Noxious Weed Control Program (KCNWCP) employees noted the occurrence of several aquatic plants at the lake. On September 22, 2017 two KCNWCP employees surveyed the west side and north end of the lake for primarily submerged aquatic plants. This survey was done about seven weeks after the August 7, 2017 Eurasian watermilfoil and water lily treatments. During this survey Eurasian watermilfoil was not found. Five native submerged and floating-leaf species and copious amounts of blue-green algae were found (Table 2). It is notable that the plants found did not seem to be affected by the herbicide used to control the Eurasian watermilfoil and fragrant water lily plants.
### Table 2. Aquatic Plants Found at Cottage Lake 1976 to 2017.

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Scientific Name</th>
<th>Plant Community</th>
<th>Status (and noxious weed class)</th>
<th>Sections Found in 1995 survey (King County, 1996a)</th>
<th>1976, 1978 Metro Surveys survey (Metro, 1976)</th>
<th>1993 Cottage Lake Mgmt. Plan Survey (King County, 1996b)</th>
<th>July 24, 2017 KCNWCP* survey</th>
<th>Sept. 22, 2017 KCNWCP* survey</th>
</tr>
</thead>
<tbody>
<tr>
<td>American waterweed/ common water weed</td>
<td>Elodea canadensis</td>
<td>Submersed</td>
<td>Native</td>
<td>1, 2, 3, 4, 5, 6</td>
<td>x</td>
<td>x</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>big-leaf pondweed</td>
<td>Potamogeton amplifolius</td>
<td>Floating</td>
<td>Native</td>
<td>1, 2, 3, 6</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>cattail</td>
<td>Typha latifolia</td>
<td>Emergent</td>
<td>Native</td>
<td>1, 2, 3, 4</td>
<td>x</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>common bladderwort</td>
<td>Utricularia vulgaris</td>
<td>Submersed</td>
<td>Native</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>coontail</td>
<td>Ceratophyllum demersum</td>
<td>Submersed</td>
<td>Native</td>
<td>1, 3, 4</td>
<td>x</td>
<td>x</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Eurasian watermilfoil</td>
<td>Myriophyllum spicatum</td>
<td>Submersed</td>
<td>Noxious (Class B non-designate)</td>
<td></td>
<td>x</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>fragrant waterlily</td>
<td>Nymphaea odorata</td>
<td>Floating</td>
<td>Noxious (Class C non-designate)</td>
<td>1, 2, 3, 4, 6</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>hardhack</td>
<td>Spiraea douglasii</td>
<td>Emergent</td>
<td>Native</td>
<td>1, 2, 3, 4</td>
<td>x</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>marsh cinquefoil</td>
<td>Potentilla palustris</td>
<td>Emergent</td>
<td>Native</td>
<td>2, 3, 4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>muskgrass</td>
<td>Chara sp.</td>
<td>Submersed</td>
<td>Native</td>
<td></td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>naiad, slender water-nymph</td>
<td>Najas flexilis</td>
<td>Submersed</td>
<td>Native</td>
<td>2, 5</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>nitella</td>
<td>Nitella sp.</td>
<td>Submersed</td>
<td>Native</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>purple loosestrife</td>
<td>Lythrum salicaria</td>
<td>Emergent</td>
<td>Noxious (Class B regulated)</td>
<td>1, 3, 4, 5, 6</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ribbon-leaf pondweed</td>
<td>Potamogeton ephiphydus</td>
<td>Submersed</td>
<td>Native</td>
<td></td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Richardson’s pondweed</td>
<td>Potamogeton richardsonii</td>
<td>Submersed</td>
<td>Native</td>
<td>1, 4, 5</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>rush</td>
<td>Juncus sp.</td>
<td>Emergent</td>
<td>Native</td>
<td>1, 2, 3, 5, 6</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>small pondweed</td>
<td>Potamogeton pusillus</td>
<td>Submersed</td>
<td>Native</td>
<td>1, 2, 3, 4, 5, 6</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>spatterdock</td>
<td>Nuphar polysepala</td>
<td>Floating</td>
<td>Native</td>
<td>2, 3, 4</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>watershield</td>
<td>Brasenia schreberi</td>
<td>Floating</td>
<td>Native</td>
<td></td>
<td>x</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water-starwort</td>
<td>Callitriches sp.</td>
<td>Submersed</td>
<td>Native</td>
<td>1, 4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yellow flag iris</td>
<td>Iris pseudacorus</td>
<td>Emergent</td>
<td>Noxious (Class C non-designate)</td>
<td>1, 2, 3, 4, 5, 6</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Noxious Weeds at Cottage Lake

Table 2 includes the 21 aquatic plant species found at Cottage Lake within the past 41 years. Included in this table are the four listed noxious weed species: Eurasian watermilfoil (Myriophyllum spicatum), fragrant water lily (Nymphaea odorata), purple loosestrife (Lythrum salicaria), and yellow flag iris (Iris pseudacorus). These four species are the focus of the aquatic plant management efforts at Cottage Lake.

The term “noxious weed” refers to those non-native plants that are legally defined by Washington State’s Noxious Weed Control Law (RCW 17.10) as “highly destructive, competitive, or difficult to control once established” (King County Noxious Weed Control Program, 2017b). Noxious weeds have usually been introduced accidentally as a contaminant, or as ornamentals. Non-native plants often do not have natural predators (i.e. herbivores, pathogens) or strong competitors to control their numbers as they may have had in their home range. The King County Noxious Weed Control Board has designated three of these four noxious weeds as “non-regulated noxious weeds” (Eurasian watermilfoil, fragrant water lily and yellow flag iris). These “non-regulated” weeds have a large impact on the environment where they occur; however, since they are widespread in King County, property owners are not required to control these species (King County Noxious Weed Control Program, 2017b). The emergent noxious weed purple loosestrife is categorized as a Class B “regulated” noxious weed by the King County Noxious Weed Control Board and the Washington State Noxious Weed Control Board. This plant is regulated in Washington because it has limited distribution in the state but has potential to become much more widely distributed and therefore have a larger impact.

Surveys for noxious weeds at Cottage Lake occurred as early as the summer of 1998, which is the first year purple loosestrife, was documented at the lake by the KCNWCP (King County Noxious Weed Control Program, 2017a). Employees of KCNWCP have been tracking regulated noxious weeds at the lake (i.e. purple loosestrife) annually ever since.

Sources of native and noxious aquatic plants are known to exist upstream in Crystal Lake, connected to Cottage Lake by Daniels Creek (Figure 2). A June 2016 survey of Crystal Lake done by the Washington State Department of Ecology found the noxious weed purple loosestrife, described as “one patch mapped but maybe more”, as well as an undescribed amount of the noxious weed yellow flag iris (Washington State Department of Ecology, 2017c). Herbicide spray records for Crystal Lake in 2006, 2007, 2009, 2010, and 2013 cite the target plant as fragrant water lily, so it is likely the plant still occurs at the lake (Washington State Department of Ecology, 2017c). While the native milfoil (also known as “whorled milfoil”) was found at Crystal Lake, Eurasian watermilfoil has not been noted at the lake during any of the recorded surveys in 2005, 2006, 2007, 2008, or 2016 or as a target plant for any herbicide applications (Washington State Department of Ecology, 2017c).

See Figure 5 for a map of the Eurasian watermilfoil and purple loosestrife locations found at the lake in July 2017.
Figure 5. Location of Two Aquatic Noxious Weeds at Cottage Lake 2017.
Eurasian watermilfoil (Myriophyllum spicatum)

Eurasian watermilfoil (Myriophyllum spicatum) is a submersed aquatic noxious weed that proliferates to form dense mats of vegetation in the littoral zone of lakes. It reproduces by fragmentation, and those fragments can “hitch-hike” on boat trailers from one lake to another.

Eurasian watermilfoil can degrade the ecological integrity of a water body in a few growing seasons. Dense stands of milfoil crowd out native aquatic vegetation, which in turn alters predator-prey relationships among fish and other aquatic animals (King County Noxious Weed Control Program, 2010b). The plant can also reduce dissolved oxygen: first, by inhibiting water circulation in areas where it grows, and second, by oxygen consumption from bacteria decomposing dead plant material. The decomposition of Eurasian watermilfoil also adds nutrients to the water that can contribute to increased algal growth connected with water quality problems. Further, dense mats of milfoil can increase water temperature by absorbing sunlight, create mosquito breeding areas, and negatively affect recreational activities such as swimming, fishing, and boating. Finally, Eurasian watermilfoil presence in a lake has been found to significantly decrease property values (on average a $50,000+ reduction) on lakefront homes in King County (Tamayo & Olden, 2010).

The first documented record of Eurasian watermilfoil at Cottage Lake was in 2007 during a survey by the King County Lake Stewardship Program (King County, 2010a). Prior to this finding, the lake had been surveyed for aquatic plants, including Eurasian watermilfoil, several times in the previous 15 years. Eurasian watermilfoil was not seen in September 1993 when the lake was surveyed for aquatic plants as part of the Cottage Lake Management Plan (King County, 1996b). Eurasian watermilfoil was not seen in July 1995 when the lake was surveyed for aquatic plants as part of a project funded by the Washington State Department of Ecology and King County (King County, 1996a). Eurasian watermilfoil was not seen
in the summer of 2001 when the lake was surveyed specifically for the plant as part of a study done for King County Water and Land Resources Division by two private contractors (Envirovision Corporation and AquaTechnex LLC, 2002). This survey involved the use of polarized glasses, underwater viewing tube and snorkelers to inspect likely lake habitat for the plant.

Based on these surveys, Eurasian watermilfoil was probably introduced into the lake between the summer of 2001 and early 2007.

Whole-lake scale Eurasian watermilfoil control efforts have been occurring at Cottage Lake starting in 2008 when King County Water and Lake Resource Division (WLRD) helped secure grant funding from the Washington State Department of Ecology (WSDOE) to do the work.

Table 3. Whole-lake Eurasian Watermilfoil Treatments at Cottage Lake

<table>
<thead>
<tr>
<th>Year</th>
<th>Activity</th>
<th>Funding</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>granular triclopyr herbicide treatment (Renovate OTF)</td>
<td>WSDOE Aquatic Weed Management Fund (AWMF) grant via King County</td>
</tr>
<tr>
<td>2009</td>
<td>granular triclopyr herbicide treatment (Renovate OTF)</td>
<td>WSDOE Aquatic Weed Management Fund (AWMF) grant via King County</td>
</tr>
<tr>
<td>2010</td>
<td>granular triclopyr herbicide treatment (Renovate OTF)</td>
<td>WSDOE Aquatic Weed Management Fund (AWMF) grant via King County</td>
</tr>
<tr>
<td>2014</td>
<td>SCUBA crew pulling as well as snorkel hand pulling</td>
<td>Hired by Friends of Cottage Lake</td>
</tr>
<tr>
<td>2015</td>
<td>SCUBA crew pulling as well as snorkel hand pulling</td>
<td>Hired by Friends of Cottage Lake</td>
</tr>
<tr>
<td>2017</td>
<td>liquid 2,4-D herbicide treatment</td>
<td>Woodland Resource Services Inc. Hired by Friends of Cottage Lake</td>
</tr>
</tbody>
</table>


In addition to whole-lake Eurasian watermilfoil control work, several Cottage Lake residents hand-pull Eurasian watermilfoil plants that grow on their waterfront.

More information on Eurasian watermilfoil can be found in Appendix 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.

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.

The first record of fragrant water lily at Cottage Lake was in 1976, where a report found “a continuous band of plants around the shoreline to a depth of 9 to 12 feet” (Metro, 1976). Two years later, during a second King County Metro plant survey, it was found that “lilies in general had increased in areal
The 1995 King County plant survey at the lake found fragrant water lily in five of the six “sections” of the lake, nearly encircling the shore (Table 2; Figure 4) (King County, 1996a). Fragrant water lily was also known to occur upstream in Crystal Lake as recently as 2013 (Washington State Department of Ecology, 2017c).

Table 4. Whole-lake Fragrant Water Lily Control Activity at Cottage Lake

<table>
<thead>
<tr>
<th>Year</th>
<th>Activity</th>
<th>Funding</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>Aquatic herbicide treatment of most lily pads with glyphosate, large patches at the north and south end were partially treated. (Contractor = AquaTechnex)</td>
<td>WaterWorks grant from King County Department of Natural Resources and Parks to Friends of Cottage Lake</td>
</tr>
<tr>
<td>2007</td>
<td>Aquatic herbicide treatment of most lily pads with glyphosate, large patches at the north and south end were partially treated. (Contractor = AquaTechnex)</td>
<td>Hired by Friends of Cottage Lake</td>
</tr>
<tr>
<td>2008</td>
<td>Aquatic herbicide treatment using glyphosate, focused on large area of lily pads at the north, south and east ends of the lake (Work done by King County Small Lakes Program Staff)</td>
<td>WSDOE Aquatic Weed Management Fund (AWMF) grant via King County Small Lakes Program</td>
</tr>
<tr>
<td>2009</td>
<td>Aquatic herbicide treatment using glyphosate, better control at the north and south ends of the lake. (Contractor = Northwest Aquatic Ecosystems)</td>
<td>Hired by Friends of Cottage Lake</td>
</tr>
<tr>
<td>2010</td>
<td>Aquatic herbicide treatment using glyphosate, all plants treated. (Contractor = Northwest Aquatic Ecosystems)</td>
<td>Hired by Friends of Cottage Lake</td>
</tr>
<tr>
<td>2011</td>
<td>Aquatic herbicide treatment using glyphosate, all plants treated. (Contractor = AquaTechnex)</td>
<td>Hired by Friends of Cottage Lake</td>
</tr>
<tr>
<td>2016</td>
<td>Aquatic herbicide treatment using glyphosate, all plants treated (two treatments, but the first treatment occurred during light precipitation, so likely ineffective). (Contractor = Woodland Resource Services Inc.)</td>
<td>Hired by Friends of Cottage Lake</td>
</tr>
<tr>
<td>2017</td>
<td>Aquatic herbicide treatment using glyphosate, all plants treated. (Contractor = Woodland Resource Services Inc.)</td>
<td>Hired by Friends of Cottage Lake</td>
</tr>
</tbody>
</table>


More information on fragrant water lily can be found in **Appendix 5**.
Purple Loosestrife (*Lythrum salicaria*)

Purple loosestrife (*Lythrum salicaria*) was not noted in the 1976 and 1978 King County Metro plant surveys at the lake, but it could be that the surveyors were not mapping emergent plants at that time (Metro, 1976) (Metro, 1978). The first documented record of purple loosestrife at Cottage Lake was in 1993 during the vegetation survey done for the Cottage Lake Management Plan (King County, 1996b).

Since 1998 purple loosestrife locations have been mapped annually by KCNWCP staff. In 2017 a total of 42 separate patches of the plant were found around the lake on 25 separate parcels (Figure 5) (King County Noxious Weed Control Program, 2017c).

![Purple Loosestrife](image.jpg)

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

Many individual waterfront property owners consistently control purple loosestrife plants. Comparing records of where plants have been seen in the past to the 2017 purple loosestrife survey, 69 percent of the known sites were controlled by owners (King County Noxious Weed Control Program, 2017c). The Figure 5 map shows the location of purple loosestrife plants in 2017 as well as past year locations, which
have either been eradicated or controlled by landowners (Figure 5). Control by landowners has been done by a variety of methods including mowing, digging up the plant or cutting the flower head. At Cottage Lake Park, King County Parks staff annually spot spray purple loosestrife plants with an aquatic herbicide. In past years, KCNWCP staffs have noticed many plants being controlled by the herbivory activity of Galerucella sp. beetles. Purple loosestrife plants at all other sites had their flower heads removed by KCNWCP staff during the 2017 survey. Besides the herbicide treatments done at Cottage Lake Park, no whole-lakeshore spot herbicide treatments have been done at the lake. Spot treatment is the process of targeted herbicide applicant, usually from the wand of a backpack sprayer or a hand sprayer, directly to the foliage of the plant the applicator wants to control. Generally few, if any non-targeted plants are affected by her herbicide.

Purple loosestrife is known to exist upstream on the shore of Crystal Lake (Washington State Department of Ecology, 2017c) (Saw, 2017). Control efforts on Crystal Lake at this time depend on the presence of released biocontrol insects and pulling by waterfront residents (Saw, 2017). The released beetles could have made their way down Daniels Creek to Cottage Lake and been responsible for some of the control work at the lake.

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 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 coryck 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).

Yellow flag iris was not noted in the 1976 and 1978 King County Metro plant surveys at the lake, but it could be that the surveyors were not mapping emergent plants at that time (Metro, 1976) (Metro, 1978). The first documented record of yellow flag iris at Cottage Lake was during the 1993 survey conducted as part of the Cottage Lake Management Plan (King County, 1996b).

Cottage Lake Community members volunteered at Cottage Lake Park in the 2000’s and controlled (dug up) yellow flag iris plants. There are also likely several waterfront property owners that have controlled the plant on their shoreline. However, for the most part the majority of the yellow flag iris plants at the lake continue to be uncontrolled. Currently KCNWCP is not mapping yellow flag iris because it is a non-regulated noxious weed.

More information on yellow flag iris can be found in Appendix 5.
Other Noxious Weeds within the Cottage Lake Watershed

Within the greater Cottage Lake watershed (Figure 2) several other regulated and non-regulated noxious weeds occur. Some of the more common non-regulated noxious weeds that occur in the watershed include Himalayan blackberry, butterfly bush, common St. Johnswort, hedge bindweed, herb-Robert, English ivy, knotweed, poison-hemlock, reed canarygrass, Scotch broom, Canada thistle, and yellow archangel (King County Noxious Weed Control Program, 2017b). These plants have a large impact on the terrestrial environment but are not regulated due to their widespread distribution in the county. Please see the King County Noxious Weed Control Program web page for more information on identification, impacts, and control methods for these plants (www.kingcounty.gov/weeds).

Within the 4,330-acre Cottage Lake watershed there are several infestations of regulated terrestrial noxious weeds. These plants are scattered along roadides, in open space areas, pastures, and landscaped areas. KCNWCP tracks all infestations of regulated noxious weeds (an infestation is defined as a group of plants on a separate parcel or section of roadway). Program staff coordinate with the property owner or roadway manager to ensure the plants are controlled each year. Regulated noxious weeds found in the King County part of the watershed in 2017 include: buffalobur (one site), orange hawkweed (five sites), sulfur cinquefoil (one site) and tansy ragwort (fifteen sites).

Responsibility for Noxious Weed Control at Cottage 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 in Cottage Lake Creek and Bear Creek. 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 Cottage Lake (Eurasian water milfoil, 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. (I). 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 Cottage 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 Cottage 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 Cottage 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)

<table>
<thead>
<tr>
<th>broad control method category</th>
<th>Specific method</th>
<th>effectiveness for Eurasian watermilfoil</th>
<th>further consideration?</th>
<th>effectiveness for fragrant water lily</th>
<th>further consideration?</th>
<th>effectiveness for purple loosestrife</th>
<th>further consideration?</th>
<th>effectiveness for yellow flag iris</th>
<th>further consideration?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manual (by hand and hand tools) and Environmental Manipulation Control Methods</td>
<td>Hand pulling</td>
<td>possible in small areas or following whole-lake herbicide treatment</td>
<td>yes*</td>
<td>possible in small areas or following whole-lake herbicide treatment</td>
<td>yes*</td>
<td>possible in small areas with loose soil, need to get roots</td>
<td>yes*</td>
<td>not possible</td>
<td>no</td>
</tr>
<tr>
<td></td>
<td>Hand cutting</td>
<td>possible in small areas, causes fragmentation</td>
<td>yes*</td>
<td>possible in small areas, causes fragmentation</td>
<td>yes*</td>
<td>temporary seasonal control, helps prevent spread, won’t eradicate</td>
<td>yes*</td>
<td>will only result in temporary control, not eradication</td>
<td>no</td>
</tr>
<tr>
<td></td>
<td>Bottom barriers/tarping/sheet-mulch</td>
<td>can be useful for small areas of waterfronts, not practical for a large area</td>
<td>yes*</td>
<td>can be useful for small areas of waterfronts, not practical for a large area</td>
<td>yes*</td>
<td>for small areas: short term control; or possibly eradication of the plant if left and maintained for several years</td>
<td>yes*</td>
<td>for small areas: short term control; or possibly eradication of the plant if left and maintained for several years</td>
<td>yes*</td>
</tr>
<tr>
<td>Manual (by hand and hand tools) and Environmental Manipulation Control Methods</td>
<td>Water level drawdown</td>
<td>not possible</td>
<td>no</td>
<td>not possible</td>
<td>no</td>
<td>not relevant</td>
<td>no</td>
<td>not relevant</td>
<td>no</td>
</tr>
<tr>
<td>Biological Control Methods</td>
<td>Grass carp</td>
<td>Grass carp will eat Eurasian watermilfoil but only after they eat most of the other plants in the lake. Inefficient and environmentally</td>
<td>no</td>
<td>not relevant</td>
<td>no</td>
<td>not relevant</td>
<td>no</td>
<td>not relevant</td>
<td>no</td>
</tr>
<tr>
<td>Other weed-specific biological control insects</td>
<td>Milfoil weevils: require proper shoreline habitat and a lack of predators; there has been no documentation of the insect reducing milfoil infestations in Washington State</td>
<td>none available at this time</td>
<td>no</td>
<td>not relevant</td>
<td>no</td>
<td>not relevant</td>
<td>no</td>
<td>none available at this time</td>
<td>no</td>
</tr>
</tbody>
</table>

* starred methods can be employed by individual property owners for small-scale control
### Table 5. Summary of Management Alternatives (page 2)

<table>
<thead>
<tr>
<th>Broad control method category</th>
<th>Specific method</th>
<th>Effectiveness for Eurasian watermilfoil further consideration?</th>
<th>Effectiveness for fragrant water lily further consideration?</th>
<th>Effectiveness for purple loosestrife further consideration?</th>
<th>Effectiveness for yellow flag iris further consideration?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechanical Control Methods (using power machinery)</td>
<td>Cutting</td>
<td>will not control, will fragment and may spread infestation</td>
<td>no</td>
<td>effective for short term control of small areas, must be done frequently. Will eradicate if done frequently</td>
<td>yes*</td>
</tr>
<tr>
<td></td>
<td>Rotovation</td>
<td>will fragment rhizomes and may spread infestation, disturbs lake bottom sediment</td>
<td>no</td>
<td>will fragment rhizomes and may spread infestation, disturbs lake bottom sediment</td>
<td>no</td>
</tr>
<tr>
<td></td>
<td>Diver-operated dredging</td>
<td>uses a suction dredge to remove plants from lake bottom as pulled. Expensive. Useful in small areas or following whole-lake herbicide treatment</td>
<td>yes*</td>
<td>not relevant</td>
<td>no</td>
</tr>
<tr>
<td></td>
<td>Sediment dredge</td>
<td>will not control, may spread infestation. Causes severe short-term water quality disturbance.</td>
<td>no</td>
<td>will not control, may spread infestation. Causes severe short-term water quality disturbance.</td>
<td>no</td>
</tr>
<tr>
<td></td>
<td>Sediment agitation/weed rollers</td>
<td>Useful around individual docks, but not relevant for larger infestation control</td>
<td>yes*</td>
<td>not relevant</td>
<td>no</td>
</tr>
</tbody>
</table>

* starred methods can be employed by individual property owners for small-scale control.
### Table 5. Summary of Management Alternatives (page 3)

<table>
<thead>
<tr>
<th>Chemical Control (herbicide)</th>
<th>Broad control method category</th>
<th>Specific method</th>
<th>Effectiveness for Eurasian Watermilfoil</th>
<th>Effectiveness for Fragrant Water Lily</th>
<th>Effectiveness for Purple Loosestrife</th>
<th>Effectiveness for Yellow Flag Iris</th>
<th>Further consideration?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diaquat</td>
<td>will kill plants but roots remain intact, able to re-re sprout. Does not eradicate the plant. Fast acting.</td>
<td>no</td>
<td>not relevant</td>
<td>no</td>
<td>not relevant</td>
<td>no</td>
<td>no</td>
</tr>
<tr>
<td>Endothall</td>
<td>will kill plants but roots remain intact, able to re-re sprout. Does not eradicate the plant. Fast acting.</td>
<td>no</td>
<td>not relevant</td>
<td>no</td>
<td>not relevant</td>
<td>no</td>
<td>no</td>
</tr>
<tr>
<td>Fluridone</td>
<td>will control milfoil down to the roots however it requires a whole-lake treatment; very slow acting</td>
<td>no</td>
<td>not relevant</td>
<td>no</td>
<td>not relevant</td>
<td>no</td>
<td>no</td>
</tr>
<tr>
<td>Glyphosate</td>
<td>not relevant</td>
<td>no</td>
<td>not relevant</td>
<td>no</td>
<td>not relevant</td>
<td>no</td>
<td>no</td>
</tr>
<tr>
<td>Imazamox</td>
<td>Potentially a viable control method. Control of milfoil is listed on the label but no known field trials</td>
<td>yes</td>
<td>not very effective</td>
<td>no</td>
<td>not effective</td>
<td>no</td>
<td>no</td>
</tr>
<tr>
<td>Imazapyr</td>
<td>Potentially a viable control method. Not-yet widespread use. Used at Shadow Lake in 2017 with good results.</td>
<td>yes</td>
<td>not very effective</td>
<td>yes</td>
<td>Works well to control plants, timing and spray rates are important for success. Follow-up treatment is necessary</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>Triclopyr</td>
<td>The Triclopyr TEA formulation can be very effective if properly applied and concentrations are maintained for the required time period. Slow acting.</td>
<td>yes</td>
<td>not very effective</td>
<td>no</td>
<td>not effective</td>
<td>no</td>
<td>no</td>
</tr>
<tr>
<td>2,4-D</td>
<td>Very effective, if correct chemical is properly applied, slow acting</td>
<td>yes</td>
<td>not very effective</td>
<td>no</td>
<td>not effective</td>
<td>no</td>
<td>no</td>
</tr>
</tbody>
</table>
Eurasian watermilfoil (*Myriophyllum spicatum*)
For more information on the following Eurasian watermilfoil control methods reference Appendix 2 – Control Method Options and Appendix 5 – Eurasian Watermilfoil Best Management Practices document.

**Hand Pulling and Cutting**
Hand removal/control of Eurasian watermilfoil can be done in two ways. *Hand cutting* basically involves using a weed cutter, such as a Weed Razer or WeedShear, to cut the milfoil plants at their base. The tool is cast out into the littoral zone of the lake where Eurasian watermilfoil is growing. Then the tool is drug back to shore, cutting the plants at their base. Hand cutting temporarily removes most of the above ground plant part of milfoil and causes it to float in the water column. The roots remain in the lake sediment. This method is relatively slow and results in plant fragments (that can easily float away and re-grow) and short-term water turbidity.

*Hand pulling* involves wading, snorkeling or scuba diving into the littoral zone of the lake and carefully pulling Eurasian watermilfoil plants. Pulled plants are immediately put in to a mesh bag carried by the puller. Care is taken to remove the plant’s entire root while pulling. This is achieved by grabbing the plant near the base and pulling slowly, as to not break off the roots before the plant is removed. This control method is slow and labor-intensive. Root pulling can lead to a short-term water turbidity increase.

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

*Activity will lead to (for repeated cutting):* Localized *temporary removal* of the plant, for example at a property owner’s waterfront swimming area. Cut plant material will remain in the water column and the roots that remain in the lake substrate will quickly re-grow.

*Activity will lead to (for repeated hand pulling):* Localized control 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 and the roots are removed.

*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.

**Diver-operated Dredging**
Diver-operated dredging involves the use of a small, portable suction dredging hose in conjunction with the above-mentioned hand pulling technique. The suction dredging hose is held very close to the milfoil plant as it is pulled, and the hose sucks up the plant and plant fragments as they are dislodged from the lake bottom. The same care is taken to remove the entire plant root. The advantage of this technique over regular hand pulling is that the suction dredge hose quickly and completely removes all plant fragments from the work area. The suction dredging hose does not remove lake sediments. Diver-operated dredging can lead to a short-term water turbidity increase. This control method is slow and labor-intensive.
Bottom Barriers
An opaque bottom barrier can be used to suppress milfoil 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 end up preventing 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 may be a suitable way to temporarily control milfoil 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 control of the plant, as long as the roller is 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”.

Mechanical Harvesting
Mechanical 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.

Since harvesting causes major fragmentation of submersed weeds and cannot retrieve all fragments, harvesters often cause the infestation to spread. Also, harvesters do not remove milfoil 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.

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

**Activity will lead to:** Temporary control of the plant, re-harvesting will need to occur two or more times/growing season to achieve desirable levels of control.

**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.

**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.

The use of a formulation of 2,4-D DMA or triclopyr-TEA can provide excellent initial control of the Eurasian watermilfoil at Cottage Lake (see Appendix 4 for herbicide label). These systemic water-column-applied herbicides enter the Eurasian watermilfoil plants and are translocated to the plant’s roots, resulting in death of the entire plant. Both 2,4-D and triclopyr are selective for broadleaf plants (i.e. dicots) and will not affect most monocots such as the native pondweed species. Additionally, Eurasian watermilfoil is particularly sensitive to these two herbicides, so often a “lighter” application rate can “target” milfoil and not harm other dicots as much.

The loose sediments in Cottage Lake are high in organic content and are flocculent (fluffy) around much of the lake’s littoral zone. There is some concern that the granular formulations of 2,4-D BEE may settle by gravity into these sediments, which could inhibit the release of the 2,4-D to the water column. If this happened, the predicted level of control of Eurasian watermilfoil would not be achieved because the concentrations released to the water column would likely not be high enough to kill the plants. Determination of which form of herbicide (liquid, pellet, or granular) will be most effective at Cottage Lake should be made on the recommendation of experienced and licensed aquatic herbicide applicators. In general 2,4-D degrades in lake water due to microbial activity, which would likely be active in Cottage Lake (Wisconsin DNR, 2012a).
Triclopyr-TEA use for submerged plant situations requires careful monitoring of herbicide concentration levels over an extended time period to make sure that the concentration is high enough to kill the targeted plants but not so high as to cause adverse side effects. Two treatments may be required to keep the herbicide concentration at the appropriate level for the desired time period. In general, triclopyr degrades in lake water through photodegradation and microbial activity (Wisconsin DNR, 2012b). Due to the relatively (naturally) dark water in Cottage Lake it make take longer than expected for triclopyr to breakdown in the lake following a milfoil treatment. In fact, that is what was found to be the case following the 2008 triclopyr treatment at the lake (King County, 2010a).

Another option for chemical treatment of Eurasian watermilfoil is using fluridone. This systemic herbicide is very slow acting and will kill milfoil plants down to the roots. It is generally non-selective but when used in low concentrations it mostly affects milfoil. Fluridone treatments occur over a long time period (usually six to eight weeks). During that time, herbicide levels in the lake water are kept within a specific range, which targets milfoil but has little effect on other plants.

Regardless of what chemical is used, it is expected that herbicide treatment should occur over a two year period. The control effectiveness of Eurasian watermilfoil requires careful surveying, which would need to be done following each herbicide treatment. Any herbicide treatment for Eurasian watermilfoil should be done by an experienced, licensed aquatic herbicide contractor.

Water use restrictions are associated with the use of these herbicides for submerged aquatic weed control. In the short term following the herbicide application, there is a 24 hour no-swimming advisory. Longer term there is usually a 10 day (up to 2 month) restriction on using treated water for irrigation purposes because the treated water may harm the terrestrial plants it is used on.

*Activity appropriate for:* Large areas of lake shore, whole-lake littoral zone, or a whole lake treatment (for fluridone). Because of cost, logistics and permitting, this activity is usually cooperatively done by a group of land owners 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 re-introduced into the lake system due to transfer from other lakes by boats and trailers. 3. May kill or injure some native plants.

*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). See “A note about needed licenses, permits and permissions” at the end of this section.

**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 two 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.
**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.
Currently, the King County Noxious Weed Control Program has a Jenson Lake Mower that can be loaned-out to those wanting to use it for a week at a time.

**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 home owner 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 though 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. Most of the water lilies at Cottage Lake are in small, discrete circular patches as opposed to large monospecific stands. These smaller areas may not generate floating sediment mats because of their size. However, there are several places in Cottage Lake with a larger area covered with fragrant water lily where this might occur such as at the north and south ends 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 land owners 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 re-introduced 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 waterlily 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 is 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 is 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 that 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 Cottage Lake is more scattered and linear, ringing the shore (Figure 5). The use of the insects may be warranted in larger patches of the plant that occur at the wetlands of the north and south end of the lake. KCNWCP can potentially obtain biocontrol insects to release at the lake from the Washington State University Extension Integrated Weed Control Project.
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 Cottage 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.

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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 is 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/](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 Cottage 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/](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 web site: [http://agr.wa.gov/PestFert/LicensingEd/Licensing.aspx](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](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

Getting Permission from Property Owners
Any activity done on someone else’s property, be it private property or some kind of public property, requires permission from the landowner first. The King County Noxious Weed Control Program mails out permission forms to be filled out by landowners before herbicide treatment occurs. Any activity by Cottage Lake volunteers on someone else’s property will need to be done with some sort of prior permission.
Section 7 – Integrated Treatment Plan
An integrated treatment plan is the overarching strategy put forward to comprehensively address noxious weed issues at Cottage 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).

Eurasian watermilfoil (*Myriophyllum spicatum*)
Control of Eurasian watermilfoil requires persistence and thoroughness.

Short Term Action

*Careful Hand pulling*
In the short term, there are a range of control methods that lake residents can use to control Eurasian watermilfoil in localized areas of the lake. The most immediate and effective is careful hand pulling (either by wading, snorkeling, or SCUBA diving). Being careful to get all the plant roots and bag them in something like a divers bag that has a metal hoop to hold the opening open, will ensure plants do not fragment or return quickly. 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 (WDFW). Removed plant fragments can be composted at an upland site away from the water. Control of milfoil using this method will last several months if the initial removal is very thorough. Milfoil plants will likely return in subsequent years because the plant can spreads readily by fragments from plants elsewhere in the lake.

Other localized control strategies waterfront property owners may use include:

- Casting a *weed cutter* such as a Weed Razer or WeedShear (produces fragments, does not remove roots, and removes native aquatic plants in its path)
- **Bottom barrier** instillation (more expensive, annual maintenance, permits, inhibits growth of native plants too)
• Installing a **weed roller** at the end of a dock (more expensive, annual maintenance, permits, impacts native plants too)

**Lake-wide Control Strategy**

Lake-wide control strategies for controlling Eurasian watermilfoil depend 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 from reverting back to pre-treatment conditions.

**Year 1**

Careful mapping of all submerged aquatic plants by a contractor that specializes in this type of survey should be done first. This survey could be done using water penetrating sonar and will produce a detailed map of plant location and density. Sonar could detect plants that exist beneath water lily plants. This data will be combined with visual or diver surveys which verify the plant species present in different areas of the lake. Combined, this data will produce an accurate map of milfoil plants.

Due to the widespread distribution of Eurasian watermilfoil at the lake, the use of a systemic aquatic herbicide is recommended as the best chance to achieve temporary lake-wide eradication of the plant. Any control or eradication of milfoil from the lake will be temporary because there will always be the chance of plants being re-introduced by boats carrying viable fragments from another lake (thus far Eurasian watermilfoil is not known to be upstream, see “Eurasian Watermilfoil” in Section 5). Signs at the hand boat launch area of Cottage Lake Park alert boaters to inspect their watercraft when transferring their boat to and from the lake. The Washington State Department of Agriculture maintains a plant quarantine list, called 'Plants and Seeds Whose Sales are Prohibited in Washington State' (Washington State Department of Agriculture, 2016). This list includes Eurasian watermilfoil, and states that it is “prohibited to transport, buy, sell, offer for sale, or to distribute plants or plant parts of these regulated plants, into or within the state of Washington” However, there is little enforcement of this requirement.

Depending on the treatment used, a second treatment would potentially be needed every two to five years. It is recommended that an experienced, licensed herbicide contractor be hired to conduct the treatments. It is also recommended that these treatments be done in the late spring/early summer (June/early July) if possible, when the plants are actively growing. That timing will allow the treatments to be completed by July when more people are likely to be swimming and using lake water for irrigation. There are no fishing restrictions associated with any of the suggested herbicides.

A whole lake littoral zone application of **2,4-D DMA** would be an effective way to target milfoil plants while causing minimal damage to most other plants. Treating the littoral zone (the ring of shoreline around the lake where plants root to the bottom) would likely involve a band ranging from as little as 40-60 feet wide on the lake’s steeper west and southeast shores to over 350-400 feet wide at the lake’s north and south ends (Figure 4, 5). The treatment would take one day and the herbicide levels in the lake would gradually diminish over several weeks. There would likely be one day of advised swimming
restrictions immediately following the treatment. There would also likely be restrictions on using lake water for certain types of irrigation for several weeks following treatment.

Another option would be to use a whole lake treatment of the systemic herbicide **fluridone**. The fluridone treatment period last six to eight weeks because a very low dose of the herbicide is required for a long time period for it to be effective. This strategy also allows the herbicide to target Eurasian watermilfoil specifically. The aquatic herbicide contractor applies an initial treatment and then follow-up treatments based on water samples as required keeping the proper dose of herbicide in the water column for the total treatment period. While there are no swimming restrictions associated with fluridone, there will likely be restrictions on using lake water for certain types of irrigation for several weeks following the treatment period as the concentrations diminish.

**Year 2 to 3**

**Follow up treatment with 2,4-D DMA or fluridone.** If using 2,4-D this treatment may be only necessary in localized areas of the lake where plants are returning potentially at the north and south ends of the lake. These follow-up herbicide treatments would incur similar water use restrictions associated with the initial treatments. If a fluridone treatment is used the same procedure outlined in “Year 1” would need to be used. Fluridone is only effective as a six to eight week “whole lake treatment”.

**Diver hand pulling with a suction dredge** would be another option to follow up on smaller amounts of returning milfoil plants in the second and third years following herbicide treatment. This work would be done in the late spring or early summer, before the milfoil plants grew large.

**Long-term management**

The long-term strategy to keep milfoil plant largely eradicated from the lake depends on the ability to make adaptive management decisions yearly based on the intensity of milfoil return. It may be that after several (one to five) years of follow-up spot herbicide treatments and/or diver suction dredging, that it would be time again to do a whole-lake herbicide treatment. Without careful annual follow-up it is likely that milfoil plants will be either re-introduced to the lake by boat, or that some plants will be able to persist and spread despite control efforts.

An important addition to any lake-wide herbicide treatments would be creation of a new, eye catching **milfoil spread prevention sign at the Cottage Lake Park** public access points. This sign could alert people boating and using other forms of recreation on the lake (such as wading and fishing) to prevent the spread of weeds into the lake through fragment and seed. One small section of milfoil can easily remain viable when boats are transferred from one lake to another. If the milfoil at Cottage Lake is eradicated a new infestation can occur via new fragment. It is recommended that coordination occur with the King County Parks Department to develop a sign, or other method, to alert those at the park to the importance of this issue.

**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 straight-forward 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 be needed 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 fragment...
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.

**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 the 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. Due to the extent of the infestations of purple loosestrife 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 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 re-treating 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.

It would be realistic for volunteers to make their way around the lake once or twice per year doing spot treatments of any returning purple loosestrife plants. Eventually there would likely be very little or no purple loosestrife at the lake. Long term control of purple loosestrife at Cottage Lake in part depends on the effectiveness of control of the plant upstream at Crystal Lake. Even if the plant is eradicated from Cottage Lake, diligence will be required to keep it from returning and re-establishing at the lake.

**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 at the north and south ends of 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 retreat treating 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
If 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
Table 6 represents a proposed six year budget of aquatic weed control at Cottage Lake. The budget assumes one of two herbicide treatment regimens for Eurasian watermilfoil: either liquid 2,4-D or fluridone. The budget also assumes most of the field work (mapping, herbicide treatments, notifications associated with permit regulations, water sample testing) would be done by contractors.

Elements of the budget/treatment proposal can be added or removed as the desires of the Cottage Lake community dictate. Also, costs can be reduced by increased participation by lake volunteers in activities such as notifications, water quality testing, and mapping and treatment of purple loosestrife and iris.
Table 6. Estimated Cost for Implementation of Cottage Lake IAVMP

<table>
<thead>
<tr>
<th>Year</th>
<th>2018</th>
<th>2019</th>
<th>2020</th>
<th>2021</th>
<th>2022</th>
<th>2023</th>
<th>Total for first three years</th>
<th>Total for first six years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eurasian watermilfoil treatment</td>
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<td></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Milfoil survey</td>
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<td>$800</td>
<td>$800</td>
<td>$800</td>
<td>$800</td>
<td>$800</td>
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<tr>
<td>2,4-D liquid treatment</td>
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<td>$5,000</td>
<td>$5,000</td>
<td>$11,000</td>
<td>$6,000</td>
<td>$6,000</td>
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<td>Fluridone treatment</td>
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<td>$10,000</td>
<td></td>
<td></td>
<td></td>
<td>$25,000</td>
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<tr>
<td>Notifications and water quality testing for milfoil herbicide treatments</td>
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<td>$3,000</td>
<td>$3,000</td>
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<td>$3,000</td>
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<tr>
<td>Diver suction dredging</td>
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<td>$10,000</td>
<td>$10,000</td>
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<td>Frangrant water lily treatment</td>
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<td>Glyphosate herbicide foliar spray</td>
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<td>Notifications for fragrant water lily treatment</td>
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<td>$1,200</td>
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<td>Purple loosestrife &amp; yellow flag iris control</td>
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<tr>
<td>Survey and mapping by contractor</td>
<td>$800</td>
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<td>Herbicide control by contractor</td>
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<tr>
<td>Education and outreach</td>
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<td>Project administration and report writing (assuming grant received)</td>
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<td>$2,500</td>
<td>$2,500</td>
<td>$2,800</td>
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<tr>
<td>Total (using 2,4-D milfoil control option w/herbicide follow-up)</td>
<td>$27,400</td>
<td>$19,600</td>
<td>$17,600</td>
<td>$23,300</td>
<td>$19,300</td>
<td>$19,100</td>
<td>$64,600</td>
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<tr>
<td>Total (using fluridone milfoil control option w/herbicide follow-up)</td>
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<td>$24,600</td>
<td>$9,600</td>
<td>$9,300</td>
<td>$10,300</td>
<td>$38,100</td>
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<tr>
<td>Total (using 2,4-D milfoil control option w/diver dredging follow-up)</td>
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<td>$19,600</td>
<td>$19,300</td>
<td>$20,300</td>
<td>$20,100</td>
<td>$68,600</td>
<td>$128,300</td>
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<tr>
<td>Total (using fluridone milfoil control option w/diver dredging follow-up)</td>
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<td>$21,600</td>
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<td>$19,300</td>
<td>$20,300</td>
<td>$20,100</td>
<td>$79,600</td>
<td>$139,300</td>
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Cottage Lake Integrated Aquatic Vegetation Management Plan, January, 2018
Sources of Funding
Funding for implementation of the Cottage Lake IAVMP would come from a combination of sources that may change as the project progresses. Potential sources of funding such as self-funding (such as organization by the Friends of Cottage Lake), formation of a Lake Management District, and grants are all possibilities.

Self-Funding (Lake Associations)
A lake association is a voluntary group of interested community members that form around interest in their lake. Throughout Washington there are more than two hundred lake associations, many of which are formally organized non-profits. These groups advocate for lake stewardship and rally broader community support for lake-wide activity. The main sources of funding for lake associations are membership dues and fundraisers. Lake associations generally have smaller budgets to work with than Lake Management Districts but greater flexibility in how the funds are spent.  
http://www.walpa.org/lake-associations/ The Friends of Cottage Lake has been in existence since (at least) 2006 (http://www.friendsofcottagelake.org/). The association has been the primary organizer and facilitator around aquatic weed control at the lake. In many years the Friends of Cottage Lake has pooled their funds to hire contractors to control fragrant water lily (in 2007, 2009, 2016, and 2017) and milfoil (in 2014, 2015, and 2017) (See Section 5 – Eurasian Watermilfoil).

Lake Management Districts
Lake Management Districts (LMD) are special purpose governments set up to allow property owners to assess property taxes to finance lake management activities. LMDs are similar to a water, sewer, or conservation district. The district is run by a board and funds are raised by property taxes. Members of the district can include all waterfront property owners and upland lots with access to a community beach. The process to develop a LMD involves a public hearing and a vote.

Grants
In the past grants have been secured to improve the condition of Cottage Lake. Aquatic weed control has been funded by a WaterWorks grant from King County (in 2006) and an Aquatic Weeds Management Fund (AWMF) from the Washington State Department of Ecology (in 2008, 2009, and 2010). The 1996 completion of the Cottage Lake Management Plan was produced by King County and KCM, Inc. and funded by the Washington State Department of Ecology’s Centennial Clean Water Fund. The focus of the 1996 Cottage Lake Management Plan is primarily on the water quality of the lake The document thoroughly assesses the condition at the time and provides recommendations to improve the situation.

Future grant applications may be helped by the existence of this plan as a way to demonstrate that weed control history and future strategy has been carefully assessed. Potential sources of grant funding include King Conservation District, King County, and government and non-government organizations (NGOs). Currently, unless there is a new “early infestation” aquatic weed situation, grant funding from the Washington State Department of Ecology’s Aquatic Invasive Plant Management Program would be
unavailable because it is contingent upon having a public trailered boat launch (https://ecology.wa.gov/About-us/How-we-operate/Grants-loans/Find-a-grant-or-loan/Aquatic-Invasive-Plan-Management-Grants).

Long Term Sustainability
The long term sustainability of this project is dependent on the commitment of the Cottage 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 Cottage 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 Cottage 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 milfoil, 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 those involved with the Friends of Cottage Lake as well as, potentially, someone from the King County Noxious Weed Control Program and King County Parks (for representation of Cottage Lake Park). This important committee would guide how the plan is implemented.

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 four 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 Cottage 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 Cottage 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 Cottage 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 Cottage 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.
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