This prescription is based on the current updated Written Findings for Fragrant Waterlily by the Washington State Noxious Weed Control Board.

**Geographic Distribution:**
Fragrant waterlily, is native to eastern and central North America. Fragrant waterlily, has been introduced over much of North America, including Washington, for its attractiveness. It has also been introduced to other areas of the world. Several species of *Nymphaea*, including Fragrant waterlily, are important ornamental plants, and many have been introduced outside their native ranges as ornamental pond plants.

**History and Distribution in Washington:**
The first record of Fragrant waterlily, in Washington is from 1911 in Lake Washington (consortium of Pacific Northwest Herbaria database, [http://www.pnwherbaria.org/data/search.php](http://www.pnwherbaria.org/data/search.php)). It is rumored to have been introduced during the 1909 Seattle World’s Fair (J. Frodge, pers. comm. 2013). Although found throughout Washington, Fragrant waterlily, is especially prevalent in western Washington lakes where it has been intentionally planted by property owners who admired the showy flowers. Surveys conducted in Washington by the Department of Ecology between 1994 - 2012 documented the presence of Fragrant waterlily, at 155 of 534 survey locations in Washington.

**Black Lake Fragrant waterlily**
A survey conducted in 2011 is shown on the map to the right. Seventy eight infestations of Fragrant waterlily were found growing along the shorelines of Black Lake. All of the infestations are growing at depths of 10’ or less. About a dozen infestations are dominant with Fragrant waterlily covering approximately 3 acres. An additional 23 acres of pioneering infestations were found around the perimeter of Black Lake. The Fragrant waterlily directly impacts and threatens the native waterlily population in Black Lake. Uncontrolled Fragrant waterlily beds are expected to continue to expand and outcompete the native lily population and other native plants present in Black Lake.

The biological potential of fragrant waterlily if left unchecked could grow to over 100 acres at Black lake and occupy all of the areas inside the blue lines (depth 10’ or less) on the map to the right. Black lake has a healthy population of native yellow water lily (*Nuphar polysepala*). Fragrant waterlily is a Class C noxious weed meaning it is widespread in Washington State. The goal of Fragrant waterlily control in Black Lake is Containment per RCW 17.10 means: confine a noxious weed and its propagules to an identified area of infestation. Spread of Fragrant waterlily from Black Lake has already occurred with scattered new infestations floating down Blacks Ditch to Percival Cove and Capitol Lake. Black Lake is the most likely source of those infestations.
Description:
Fragrant waterlily, is an aquatic, perennial plant. Leaves and flowers generally float on the water’s surface, growing from submerged rhizomes. Fragrant waterlily plants are rooted in the sediment and its stems and flowers grow to the water surface, forming a lily pad. They commonly grow in dense patches such that leaves cover the entire surface of the water - limiting light for other submersed aquatic plants and depleting oxygen needed for aquatic invertebrates and fish. The flowers are only open during the day when pollen-covered insects are attracted to the flower and fall into a fluid-filled center of the flower where fertilization occurs. The flower is only receptive to pollen the first day of flowering, and in fact, within three days pollen is released from the flower and again becomes submersed. Mature seeds are released and spread by water currents or waterfowl that consume the seeds.

Fragrant waterlily, as described in Hitchcocks “Flora of North America”, recognizes two subspecies, subsp. odorata and subsp. tuberosa. Historical reference of Fragrant waterlily, included additional varieties, which are now treated as subsp. odorata.

Roots:
Plants have rhizomes that are frequently branched and creeping and are anchored by adventitious roots arising in groups below the leaf bases. They are cylindric in cross section, and covered with short black hairs. Rhizomes of Fragrant waterlily, can tolerate some desiccation, and makes constrictions at rhizome joints to form detachable tubers.

Leaves:
Fragrant waterlilies do not have an upright stem, rather the leaves grow on top of a petiole that is directly attached to the rhizome. Leaf petioles grow to the water surface and increase in width and length with increased water depth. Petioles may be striped or faintly striped in color if they are subspecies odorata, or have brown purple stripes if they are subspecies tuberosa. Petioles have central air canals that move gases from younger leaves to the rhizomes and roots and then out older leaves. Mature leaf blades are rounded to nearly circular in shape with a slit on one side. Leaf blades typically have smooth margins. Leaves are green above and typically reddish or purplish, though sometimes green, below.

Flowers:
Large, fragrant flowers are solitary on long peduncles. Flowers are floating or elevated slightly above the water’s surface. Each flower has four green or reddened sepals. Petals are white to pink, and numerous. Stamens are yellow. There is one pistil in each flower. Flowers open in the morning and close in the afternoon and bloom June through October. Flowers are pollinated by flies, bees and beetles.

Fruits and Seeds:
The fruit is a leathery, with a berry-like capsule and numerous seeds.

Reproduction: Plants reproduce by seed and spread by growth of underground rhizomes. If broken up, rhizome fragments will also float to new areas and create new plant patches. The tubers will also readily detach and float off to form new plants, an important means of spread for those plants that make tubers. Seed germination of is enhanced by cold stratification. Richard and Cao (2012) studied the germination and early growth of seeds and found that seeds can germinate in water depths of up to 90 cm. Seedlings and juvenile plants that germinate in water grow as submerged aquatics until emergent floating leaves are produced.
Growth and Development: In spring new leaves grow from the rhizomes and unfurl as they grow up through the water until they reach the surface. Flowers open in the morning and close in the afternoon for three consecutive days. Self-fertilization is prevented by the timing of pollen release; flowers are receptive to pollen the first day, and release pollen the second and third day. After the flower has closed for the final time, the stalk forms a spiral and draws the fruit below the water. The fruits take 3 to 5 weeks to mature and split open when they have matured to release the seeds. Seeds are covered by a loose aril that forms a sac around each seed to trap gas and cause the seed to float to the surface.

Habitat: Grows in soft sediment of shallow ponds, lakes, slow streams and rivers, pools in marshes, ditches, canals and sloughs. Plants can typically grow in water depths up to 3 meters. It can grow in acidic or alkaline conditions and at elevations of 0-1700 meters.

Economic Importance:
Detrimental: Shallow lakes are particularly vulnerable to being totally covered by Fragrant waterlily. In an aerial photo from April 1974 of Giffin Lake, a 110 acre lake near Sunnyside in eastern Washington, there is open water and data indicate 11-25 percent of the lake was covered by emersed plants (unknown species). Twenty years later, nearly 100 percent of the lake’s surface was covered by Fragrant waterlily. When allowed to grow in dense stands, the floating leaves prevent wind mixing and extensive areas of low oxygen can develop under dense floating leaves during the summer. The dense leaf cover also shades the water below, reducing or eliminating native submersed aquatic plants.

Left unmanaged, Fragrant waterlily, will fill in areas of shallow water and soft sediment resulting in restricted lake-front access, reduced swimming opportunities and difficult boating. Fragrant waterlily, is frequently listed as a plant being controlled on permit requests received by Ecology. In several of the integrated aquatic plant management plans funded by Ecology, Fragrant waterlily, was considered the second nuisance plant after Eurasian watermilfoil (Myriophyllum spicatum) and was targeted for control. Drownings in King County have been attributed to swimmers getting tangled in dense water lily stems.

Beneficial: Fragrant waterlily is a fragrant, ornamental pond plant. Many hybrids have been developed in a variety of colors. The fragrant water lily and its hybrids is an extremely popular water garden plant and can be readily obtained at nurseries and through mail order catalogs. Beaver, moose, muskrat, porcupine, and deer eat water lily leaves and roots and waterfowl eat the seeds. Water lilies also provide cover for largemouth bass, sunfish, and frogs.

► Injury/Action level: For 2014, the fragrant waterlilies that were not chemically treated in 2013 (Northwest shoreline and southern outflow to Black River) will be targeted for selective glyphosate treatment. The scattered infestations that were treated in 2013 will not be chemically treated in 2014. Instead, these areas will be evaluated for efficacy of the 2013 controls. Manual (cutting) and/or cultural techniques (covering) may be utilized in the 2013 treated areas if needed. Additional research on non-chemical controls will be conducted in 2014 and incorporated into a revised fragrant waterlily prescription for 2015. Areas in the lake that represent a low risk of escaped fragments leaving the lake and starting new infestations will be targeted for non-chemical control.
Cultural / Habitat:
Prevent the spread of Fragrant waterlily to new locations by cleaning boats, boat trailers and any other equipment of Fragrant waterlily, seeds and rhizomes. Never plant ornamental pond plants in a natural waterbody such as a lake, pond or river.

Cultural/habitat continued...
Localized control (in swimming areas and around docks) can be achieved by covering the sediment with an opaque fabric which blocks light from the plants (bottom screening). However, it is sometimes very difficult to place and secure the fabric to densely packed, tough, fleshy Fragrant waterlily rhizomes. Barriers should be installed in early spring.

Biological: There are no approved biological agents for Fragrant waterlily in Washington State. A study of impacts of grass carp on various aquatic plant species found that these herbivorous fish had little to no impact on Fragrant waterlily in Washington. Therefore grass carp are not recommended for Fragrant waterlily management in Washington. In its native range, many insects are known to feed on the roots, leaves and flowers of Fragrant waterlily. It is unknown at this time how many of those insects are found in the western U.S., however, Fragrant waterlily appears to be less impacted by invertebrate herbivores that the native yellow waterlily (Nuphar polysepala) in Washington.

Manual / Mechanical: There are mechanical/manual treatments that can result in excellent control of Fragrant waterlily, although plant fragmentation that occurs resulting in the spread of the species rather than containment and long-term control. Control by cutting is accomplished with a hand held cutting tool or a mechanical device connected to a boat. Harvesting utilizes a specialized boat equipped with a cutter and collection system in one. Harvesting has been used extensively on Long Lake in Thurston County, to control Fragrant waterlily. Cutting is less efficient than harvesting because cut plants must then be removed from the water. However, Fragrant waterlily will grow back, so several cuttings per growing season are usually required. Several lake residents have reported success in eliminating Fragrant waterlily from waterfront lots by the process of carbohydrate depletion due to ongoing manual removal of all emerging leaves.

Underwater rototilling (called rotovation) was successfully used to remove Fragrant waterlily from a small Seattle area lake. Rotovation dislodges the large, fleshy rhizomes which can then be removed from the water. Although rotovation is a much more expensive process than harvesting or cutting, it results in the permanent removal of Fragrant waterlily rhizomes. It would be important to remove all rhizome fragments and tubers to prevent regrowth.

Thurston County has experimented with using a barge-mounted backhoe to excavate Fragrant waterlily rhizomes from the sediment. Like rotovation, excavating the rhizomes results in permanent removal of the plant, but care must be taken to remove rhizome fragments and tubers. Both rotovation and excavation require that the project proponent obtain a number of environmental permits before proceeding.

Chemical: Generally, a systemic aquatic herbicide is recommended for long-term lily control. The active ingredient glyphosate is the recommended herbicide for Fragrant waterlily control because it can be directly applied to the floating leaves, unlike the active ingredient fluridone which must be applied within the water and will kill other plants in the treatment area. The application of glyphosate allows the selective removal of Fragrant waterlily from areas with Yellow waterlily (Nuphar polysepala), our native water lily.

Use of pesticides in water is regulated in Washington and restricted to WSDA licensed aquatic applicators. All applicators must have an aquatic endorsement on their pesticide applicators license, which is issued by the Washington Department of Agriculture. In addition, coverage under a NPDES permit issued by the Department of Ecology is required.

Timing:
Control should commence once the first flowers are present in early Summer. Multiple applications may be necessary as treated leaf surfaces will desiccate and untreated leaves will emerge following the initial controls.

READ AND FOLLOW ALL LABEL DIRECTIONS AND RESTRICTIONS. Obey all label precautions and safety measures. Always use personal protective equipment that includes coveralls, waterproof gloves, shoes plus socks, and protective eyewear. Use of brand names does not connote endorsement and is for reference only; other formulations of the same herbicides may be available under other names. Information provided is current as of the date of the prescription.