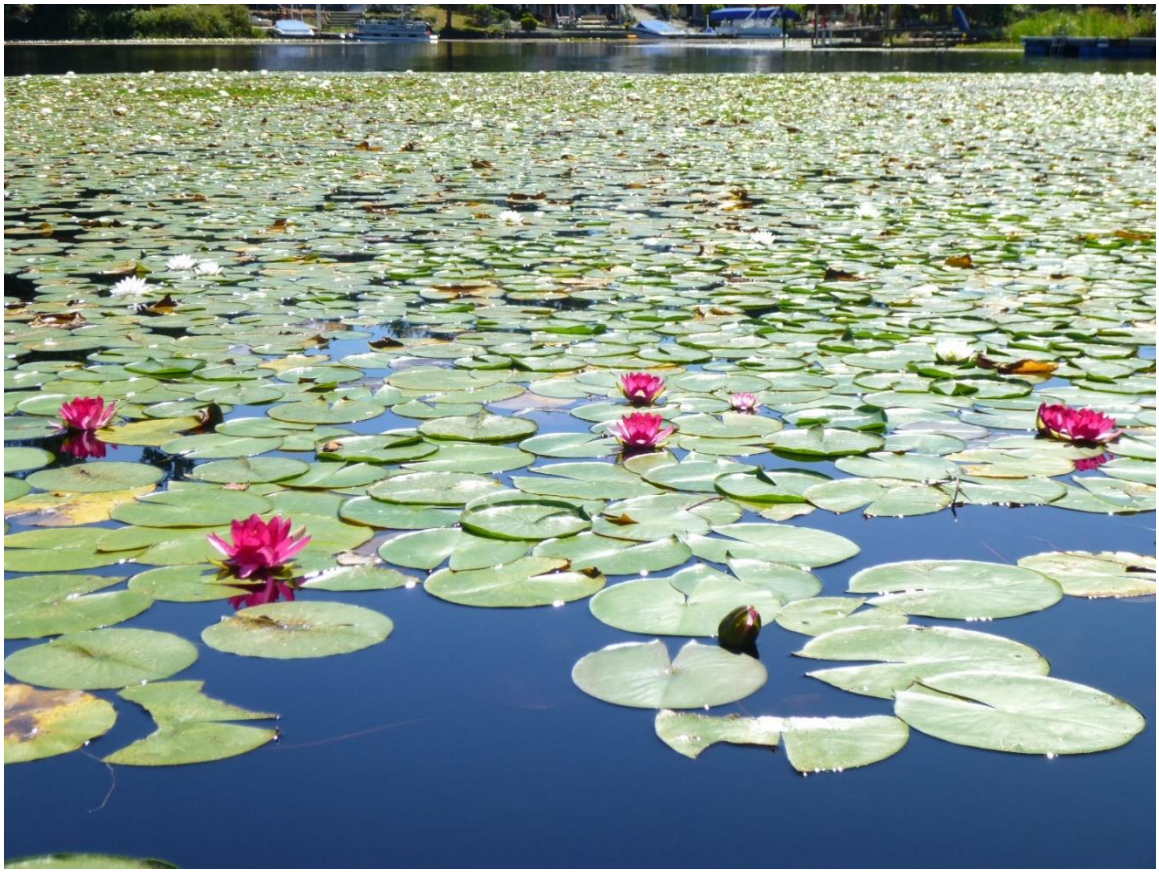
Integrated Aquatic Vegetation Management Plan

Spencer Lake

Mason County, Washington



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SPENCER LAKE INTEGRATED AQUATIC VEGETATION MANAGEMENT PLAN – 2018

Prepared for
Citizens of Spencer Lake and Mason County

Prepared by
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Acknowledgement

The Mason County Noxious Weed Control Program wishes to thank the members of the Steering Committee for their role in development of the Spencer Lake Integrated Aquatic Vegetation Management Plan. Members include Doris Zacher, Stephanie Brooks, Diane Cox, Steve Evander, Dave Mortensen, John Tolton, Bill Estep, Tricey Kruger, Lynda Ring-Erickson, Jack Urstadt and Patricia Grover.

In addition, Mason County Noxious Weed Control Board staff, including Patricia Grover, Keith Reitz, Aaron Kirby, and Kendall Carmen participated in the process, completing surveys, compiling data and document preparation. Jason Wells of the Mason County Public Works GIS section provided GIS support.

Thank you to Doris Zacher who offered her home for the Steering Committee meetings, Kristin Tolton, who provided the list of bird and animal species observed at the lake, and Stephanie Brooks for her information about the history of the Spencer Lake Community.

Thank you to Lizbeth Seebacher for her administration of the project.

Finally, special thanks to the Spencer Lake community. Their enthusiasm and commitment to improving the recreational opportunities, ecological integrity and aesthetic beauty of Spencer Lake will be the ultimate driving force of this plan.

Contents

Appendices

Figures

Tables

Executive Summary

Spencer Lake is a 213-acre lake located in Mason County, Washington. It is located in Water Resource Inventory Area (WRIA) 14, the Kennedy-Goldsborough Basin. It is approximately 7 miles northeast of Shelton and 1.5 miles east of Oakland Bay. Spencer Lake has a drainage basin area of approximately 1.7 square miles, no surface inlets and drains via Malaney Creek, which flows to Oakland Bay.

Surveys at Spencer Lake and the surrounding shoreline document two Class B noxious weed species, purple loosestrife (*Lythrum salicaria*) and Bohemian knotweed (*Polygonum X bohemicum*), and two Class C noxious weeds, fragrant waterlily (*Nymphaea odorata*) and yellow flag iris (*Iris pseudacorus*). An additional Class C noxious weed, reed canarygrass (*Phalaris arundinacea*) is found at the lake margins but is not considered for control in this plan. The fragrant waterlily and the yellow flag iris infestations are well developed, however, several additional species from nearby lakes have the potential to spread to Spencer Lake. At Mason Lake, approximately 4.7 miles north of Spencer Lake, the community has been working to reduce the infestations of Eurasian watermilfoil (*Myriophyllum spicatum*) and grass-leaved arrowhead (*Sagittaria graminea*) since 1998. At Lake Limerick, approximately 4.5 miles northwest of Spencer Lake, efforts to control Brazilian elodea (*Egeria densa*) have been underway since 1996. Due to the close proximity of these lakes, plants from them have the potential to infest Spencer Lake by vectors such as wind, animals, humans, boats, and boat trailer movement. All three of these species, if introduced, have the potential to greatly hinder recreational activities, and decrease habitat and water quality at Spencer Lake.

Several members of the Spencer Lake community brought their concerns about the expansion of noxious weeds, specifically fragrant waterlily, to the attention of the Mason County Noxious Weed Control program in October 2014. The opportunity to apply for an Aquatic Weeds Management Fund grant through the Washington Department of Ecology (Ecology) was sent to individuals who had expressed concern at a Mason County Noxious Weed Control booth at Oysterfest 2014. When contacted, those individuals supported the application. If the grant application was successful, residents were willing to volunteer time and materials for survey efforts and meeting requirements. Knowing that eradication will be difficult to achieve, Spencer lake volunteers are preparing for the long term effort that will be required and remaining vigilant of new introductions.

This Integrated Aquatic Vegetation Management Plan (IAVMP) is a planning document developed to ensure that the applicant and community have considered the best available information about the waterbody and watershed prior to initiating control efforts. Mason County Noxious Weed

Control program staff and members of the Spencer Lake community worked in partnership to develop this IAVMP. To address the task of generating community appreciation of, and action towards preserving the important ecological, aesthetic and recreational values of Spencer Lake, a core group of residents, along with the Coordinator for the Mason County Noxious Weed Control Board, formed an IAVMP Steering Committee. The Committee has worked to educate the community about the issues impacting Spencer Lake and developed a social media network for sharing information.

In development of the IAVMP, control goals were prioritized, focusing on the control measures that could be accomplished based on funding and other resource limitations. The community ultimately agreed on an IAVMP plan that incorporates an integrated treatment strategy to address the three target plants listed in priority of control: purple loosestrife, fragrant waterlily, and yellow flag iris. Mason County Noxious Weed Control is working with several property owners to control Bohemian knotweed and residents are organizing to begin control measures for the yellow flag iris and remove the few purple loosestrife plants located during the survey.

This 2018 IAVMP proposes to treat one quarter of the fragrant waterlily with glyphosate annually for the first four years (approximately 5 acres each year from 2019-2022). Each treatment will involve an initial treatment, with a possible second treatment a few weeks later. After four years, a majority of the waterlilies targeted for control will have been treated. Follow up spot treatment, or manual methods, will take place in year five and beyond. If waterlily root mats float to the surface, they will likely be towed to the WDFW access and hauled off.

Control activities will be done by a combination of hired contractors, Mason County Noxious Weed Control staff, and Spencer Lake community volunteers.

This IAVMP presents an overview of the aquatic weed problems, details about the community planning process, watershed and lake characteristics, a review of suitable control options, a management plan, budget and funding plans, and an implementation plan. The Appendix section contains background and supporting documents.

Section 1 - Problem Statement

Spencer Lake is a 213-acre lake located in Mason County, Washington. It is located in Water Resource Inventory Area (WRIA) 14, the Kennedy-Goldsborough Basin. It is approximately 7 miles northeast of Shelton and 1.5 miles east of Oakland Bay. Spencer Lake has a drainage basin area of approximately 1.7 square miles, no surface inlets and drains via Malaney Creek, which flows to Oakland Bay. It has approximately 93 acres of wetland, a portion of which extends from the southwest portion of the lake surrounding the Malaney Creek outlet and another area that extends from the lake to the northwest. Surrounding ownership consists of 187 parcels, ranging from smaller, less than 0.5 acre lots to 10 acres. Over 80% of these parcels are identified as "developed" by the Mason County Assessor's office. The lake has a public boat ramp operated by Washington Department of Fish and Wildlife, year round fishing and is used for boating, fishing, swimming, wildlife viewing and ecosystem processes.

Two Class B noxious weed species purple loosestrife (*Lythrum salicaria*) and Bohemian knotweed (*Polygonum X bohemicum*), and two Class C noxious weeds fragrant waterlily (*Nymphaea odorata*) and yellow flag iris (*Iris pseudacorus*) were documented in surveys conducted at Spencer lake in 2016. While the purple loosestrife and knotweed infestations are at their early stages of development, infestations of fragrant waterlily and yellow flag iris are rapidly expanding. Several nearby lakes are known to have infestations of several noxious weeds that are not yet documented at Spencer Lake. At Mason Lake, 4.7 miles north of Spencer Lake, the community has been working to reduce infestations of Eurasian watermilfoil (*Myriophyllum spicatum*) and grass-leaved arrowhead (*Sagittaria graminea*) since 1998. At Lake Limerick, 4.5 miles northwest, local community efforts have been undertaken to control Brazilian elodea (*Egeria densa*) since 1996. The close proximity of these lakes increases the potential for introduction of other noxious weeds into Spencer Lake by vectors such as: wind, animal, human, boat, and boat trailer movement. Eurasian watermilfoil has the potential to greatly hinder recreational activities, and decrease habitat and water quality at Spencer Lake. The outflow from Spencer Lake flows approximately 3.0 miles to Oakland Bay

Purple loosestrife (*Lythrum salicaria*) is an emergent aquatic noxious weed that degrades native wetland plant communities. Purple loosestrife can quickly adapt to environmental changes and expand its range to replace native plants used for groundcover, food, or nesting material. This noxious weed species was not found in abundance at the lake, however it will certainly disperse further around the lake and into the wetland if not controlled. The plant threatens to lower plant diversity and can alter hydrologic dynamics through sediment accretion along the shoreline. This emergent weed fails to provide the same forage and habitat for birds, mammals, and invertebrates as provided by native plant communities. Purple loosestrife has not been observed along Malaney Creek. Historic stream survey data suggests that the creek supports two species of salmonids and the potential exists for purple loosestrife infestations to spread from the Lake to Malaney Creek. Purple loosestrife produces a prolific number of seeds (up to two million seeds per mature plant) that could easily be transported downstream to degrade this valuable resource.

Fragrant waterlily (*Nymphaea odorata*) is the species that was the community's call to action. It is quickly expanding its distribution in the lake. When uncontrolled, this species can form dense, monospecific stands that can persist until senescence in the fall. Mats of these floating leaves prevent wind mixing and extensive areas of low oxygen can develop under the waterlily beds in the summer. Waterlilies can restrict lakefront access and hinder swimming, boating, and other recreational activities. They may also limit the distribution of the native waterlily (*Nuphar polysepala*) which occupies the same niche and provides food and habitat for a variety of animals and fish. Residents report that the fragrant waterlily is rapidly expanding on Spencer Lake.

Yellow flag iris (*Iris pseudacorus*) is an emergent aquatic noxious weed that grows in dense stands along the lake shoreline. The plant spreads through floating seeds and rhizomes, both of which spread by wind and wave action. Yellow flag iris, crowds out native species with impenetrable mats and is found in many areas along the Spencer Lake shoreline. The plant is very difficult to effectively control.

Recently, the non-native species, swollen bladderwort (*Utricularia inflata*), has become more obvious at the lake. Many plants were observed in late May 2018 at the southern end of the lake. The native bladderwort, *Utricularia vulgaris*, was found during the aquatic vegetation survey of the lake conducted in 2016 for this IAVMP.

Collectively, these invasive plants:

- Pose a safety hazard to swimmers and boaters by entanglement.
- Snag fishing lines and hooks, eventually preventing shoreline fishing.
- Crowd out native plants, creating monocultures lacking in biodiversity.
- Significantly reduce fish and wildlife habitat, thereby weakening the local ecosystem and degrading the wildlife and wildlife viewing opportunities.
- Potentially impact water quality by decreasing dissolved oxygen under plant canopies and increasing water temperature from reduced water circulation and solar absorption.
- Pose a threat to adjoining ecosystems.
- Reduce property value.

While individual landowners and the Mason County Noxious Weed Control program have initiated control efforts for some of these species, there has not been a coordinated effort to control the widespread infestations of fragrant waterlily or yellow flag iris. Immediate lake-wide action is necessary to control these invasive weeds. Without action, the lake will likely become more infested with aquatic weeds, severely degrading the lake ecosystem and making eradication difficult. Additionally, a plan which includes prevention and detection strategies is needed to reduce the potential for new plant invasions that could become problematic. The community is in support of this IAVMP and recognizes that the effort to control these species, and prevent the introduction of new species, will be a long term commitment.

Section 2 - Management Goals

The overall management goal for this Integrated Aquatic Vegetation Management Plan (IAVMP) is the control of noxious aquatic weeds at Spencer Lake in a manner that allows sustainable native plant and animal communities to thrive, maintains acceptable water quality conditions, and facilitates recreational enjoyment (boating, fishing, and swimming) of the lake.

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

- Control of fragrant waterlily to reduce existing populations to reduce impact on recreational activities and ecological function of the lake.
- Prevent the introduction of floating and submerged aquatic noxious weeds.
- Control of regulated shoreline noxious weeds to reduce existing populations below the level of significant impact and to prevent spread.
- Involve the Spencer Lake community in planning and implementation of the IAVMP.
- Utilize the best available science to identify and understand likely effects of management actions on aquatic and adjoining terrestrial ecosystems prior to implementation.
- Review the efficacy of management actions through monitoring.
- Adjust the management strategy as necessary to achieve the overall goal.
- Seek funding sources to continue long term control of invasive aquatic plants.
- Maintain good water quality and prevent toxic algae blooms.

With adoption of the IAVMP, the Spencer Lake IAVMP Steering Committee will coordinate initial aquatic vegetation management activities. Work plans will be developed annually for implementation of specific activities to further management goals.

Section 3 - Public and Community Involvement

Community Commitment

Support for aquatic vegetation management at Spencer Lake continues to grow. The IAVMP provided a catalyst for community members to come together and learn about the issues associated with noxious weeds. Several members of the Steering Committee have expressed interest in creating a Lake Management District to continue the momentum of the plan into the control phase.

Steering Committee, Outreach, and Education Process

October 2014: Work began to contact and meet with members of the Spencer Lake community about the opportunity to control aquatic noxious weeds at the lake through creation and implementation of an IAVMP.

March 2015: Background research related to the Spencer Lake IAVMP began in March 2015, shortly after learning about receiving funding from the Department of Ecology.

May 2015: The Agreement was fully executed on May 13, 2015.

February 2016: Several blue green algae blooms during the winter of 2015/2016 prompted action by local residents. On February 22, 2016, 5 Spencer Lake residents met with Lizbeth Seebacher from Department of Ecology and Margaret Bigelow from Washington's Department of Fish and Wildlife.

March 2016: Project planning begins; first informal meeting of property owners. Email messages and word of mouth about the first meeting provided an informal network of sharing information. Twenty-six community members and the Mason County Noxious Weed Control Board coordinator, Patricia Grover, attended a March 19, 2016 meeting held at the Zacher residence. Pat provided a brief presentation about noxious weeds at Spencer Lake, history of the grant request and the process for developing the IAVMP as written in the *A Citizen's Manual for Developing Integrated Aquatic Vegetation Management Plans*. Consistent with the message received at Oysterfest in 2014, those in attendance were supportive of the process of developing the IAVMP. Attendees asked questions about the timeline and goals of the IAVMP and seven attendees volunteered to be on the Steering Committee.

April 2016: The first meeting of the Steering Committee was held on April 09, 2016 at the Zacher residence. Doris Zacher volunteered to chair the committee with a request for a co-chair. The meeting followed the process outlined in *A Citizen's Manual for Developing Integrated Aquatic Vegetation Management Plans* with development of a Problem Statement and discussion about the Public Meeting (See Appendix A for agenda and meeting minutes).

June 2016:

- The second Steering Committee Meeting was held on June 11, 2016.
- Agenda and meeting minutes can be found in Appendix A.
- On June 24, 2016, letters informing recipients about the plan and the public meeting were sent to 188 Spencer Lake property owners (Appendix A). The mailing indicated that the meeting would provide a community update about the plan and a discussion of the IAVMP planning process. In addition, steering committee members visited additional waterfront residences by boat to share information.
- Information was sent to the local newspaper and radio and a social media page, *Spencer Lake Aquatic Invasive Species*, was created.

June – July 2016: Arline Fullerton, an aquatic plant specialist and MCNWCB staff completed plant surveys. During these surveys, frequent contacts were made with local residents or lake users and the IAVMP was discussed.

July 2016: On July 22, 2016, a public meeting was held at the Mason PUD 3 building with over 49 community members in attendance. Doris Zacher provided an introduction for the meeting. Arline Fullerton, local aquatic plant specialist and experienced surveyor of Mason County lakes and Katie Otanez, an environmental health specialist with Mason County Public Health, provided additional information.

January 2018: Draft IAVMP provided to Co-Chairs.

March – June 2018:

- Steering Committee meetings were held on March 24, 2018, April 14, 2018 and May 04, 2018.
- Agenda and meeting minutes can be found in Appendix A.
- On April 14, 2018, 160 "Save the Date" postcards were sent to Spencer Lake property owners.
- On May 11, 2018, a second public meeting was held at the Mason PUD 3 building with over 50 community members in attendance. After a brief introduction and power point presentation, the audience was invited to ask questions and provide comment. Those in attendance were also asked to complete a brief survey. The survey and results may be found in Appendix A.

June 2018:

- Completion of draft *Spencer Lake Integrated Aquatic Vegetation Management Plan*
- Notification to meeting attendees and interested parties and posting of the management plan to the Mason County website.

Appendix A contains the following "Community Involvement and Outreach" materials:

▪ February 22, 2016	Meeting notes
▪ March 19, 2016	Steering Committee agenda
▪ April 09, 2016	Steering Committee agenda
▪ April 09, 2016	Steering Committee meeting notes
▪ June 11, 2016	Steering Committee agenda
▪ June 11, 2016	Steering Committee meeting notes
▪ June 24, 2016	Letter to Spencer Lake property owners
	Public Meeting flyer
▪ July 22, 2016	Public Meeting Agenda
▪ March 24, 2018	Steering Committee agenda
▪ March 24, 2018	Steering Committee meeting notes
▪ April 14, 2018	Steering Committee agenda
▪ April 14, 2018	Steering Committee meeting notes
▪ April 14, 2018	Public Meeting "Save the Date" postcard
▪ May 04, 2018	Steering Committee agenda
▪ May 04, 2018	Steering Committee meeting notes
▪ May 11, 2018	Public Meeting Agenda
▪ May 11, 2018	Spencer Lake Community Survey
▪ May 11, 2018	Spencer Lake Community Survey Results

Section 4 – Watershed and Waterbody Characteristics

Watershed Characteristics

Location and Size of Watershed

Spencer Lake is located in Mason County, Washington, approximately 11 miles northeast of Shelton. (Figure 1). State resource agencies frequently use a system of Water Resource Inventory Areas (WRIA) to refer to the state's major watershed basins. Spencer Lake is located in WRIA 14, which refers to the Kennedy-Goldsborough combination watersheds and includes Mason Lake, Lake Limerick and the city of Shelton.

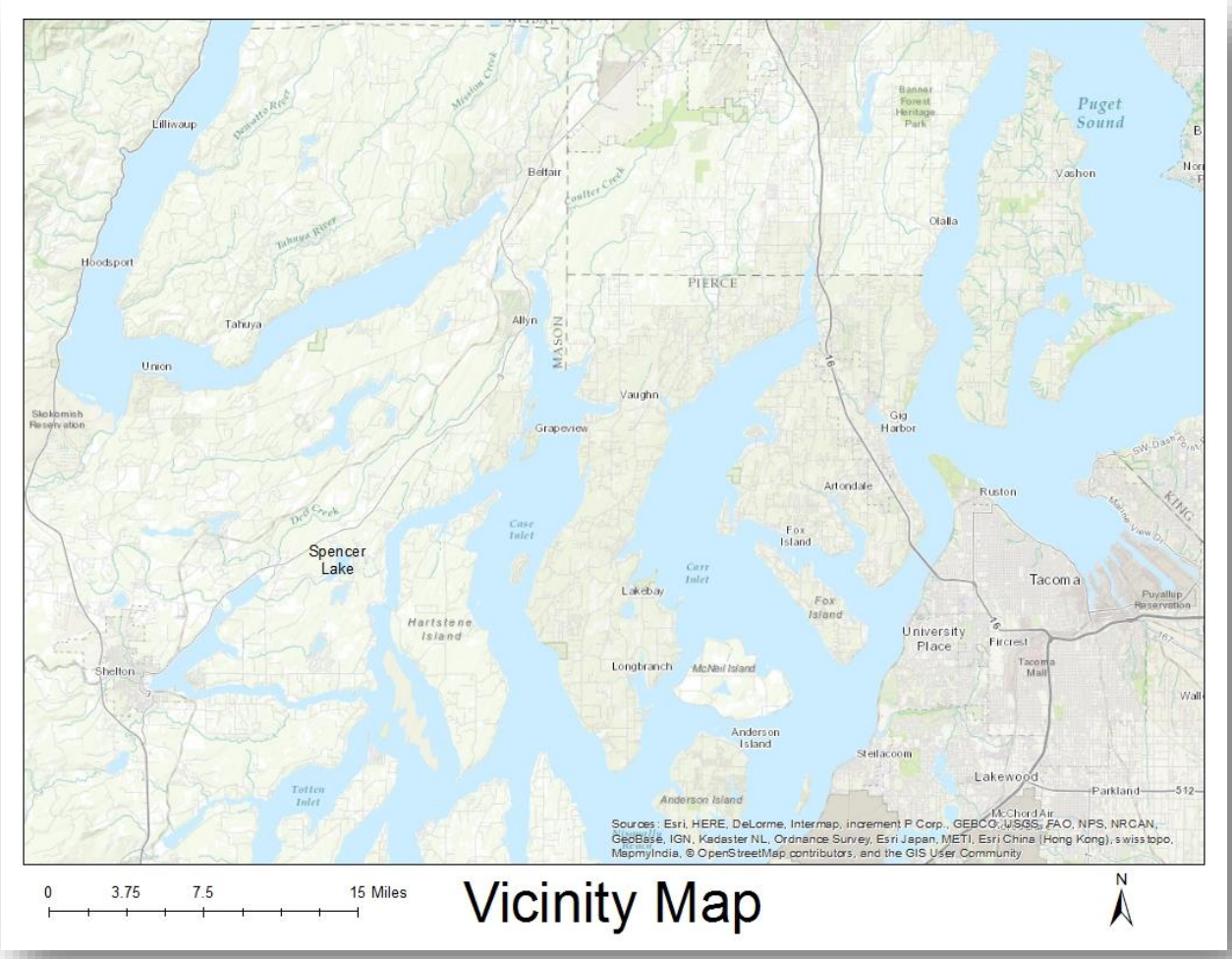


Figure 1 Spencer Lake map shows location of Spencer Lake and the cities of Shelton, Allyn, and Tacoma, Washington

Spencer Lake has a drainage basin area of approximately 1.7 square miles, no surface inlets, and flows to Oakland Bay via Malaney Creek. Spencer Lake is controlled by a concrete outlet structure that is twelve feet wide and five feet tall; the concrete span poses no barrier to fish migration into and out of Spencer Lake.

The drainage basin of Spencer Lake has been modified to varying degrees in the past. Some of the process modifications include:

- Conversion of pervious to impervious areas
- Logging adjacent to the lake
- Construction of an outlet control structure
- Residential development along the shoreline

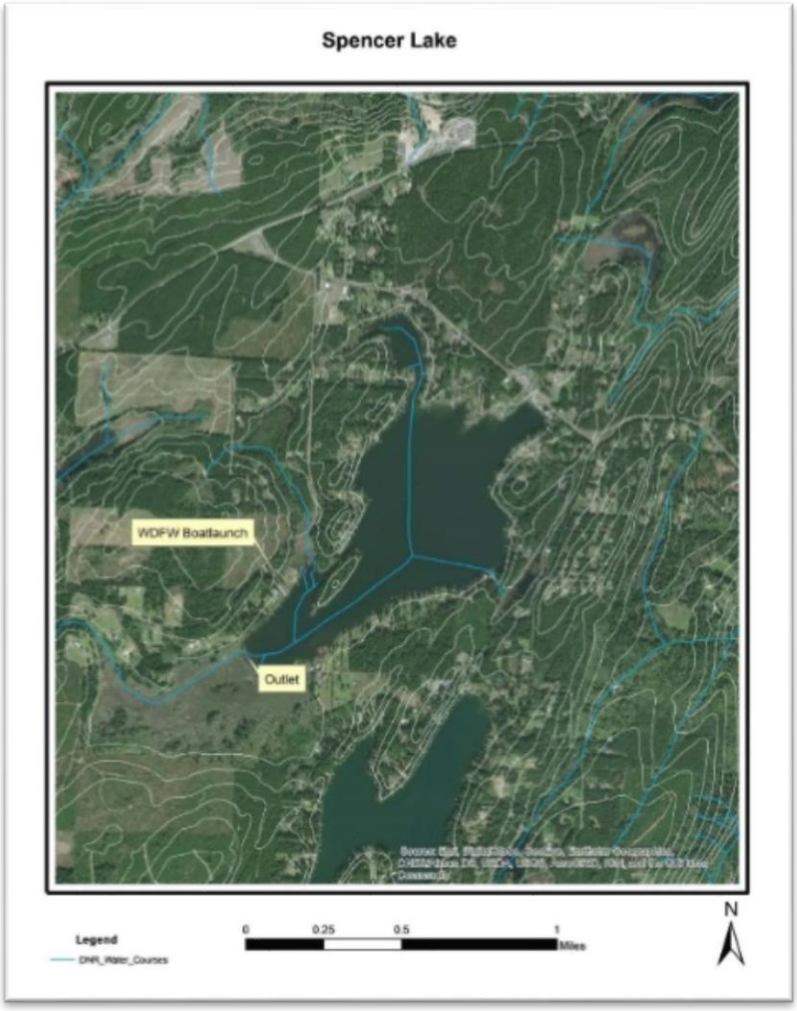


Figure 2 Spencer Lake Watershed Topography

Streams and Wetlands in the Watershed

Spencer Lake has approximately 93 acres of wetland. A large wetland area extends from the southwest portion of the lake surrounding the Malaney Creek outlet. Wetland also extends from the lake to the northwest to E. Spencer Lake Road.

Geology and Soils

There are 13 major soil types in the area surrounding Spencer Lake (Figure 3). The most common soil type is Alderwood gravelly sandy loam (Ab). This soil covers about 75 percent of the area and dominates the Spencer Lake shoreline.

Table 1 – Soil Types

Map Unit Symbol	Map Unit Name	Acres in Area of Interest (AOI)	Percent of AOI
Ab	Alderwood gravelly sandy loam, 8 to 15 percent slopes	1,186.8	74.3%
Ac	Alderwood gravelly sandy loam, 15 to 30 percent slopes	12.6	0.8%
Be	Bellingham silty clay loam, 0 to 3 percent slopes	13.9	0.9%
Ee	Everett gravelly loamy sand, 5 to 15 percent slopes	9.8	0.6%
Ib	Indianola loamy sand, 5 to 15 percent slopes	12.8	0.8%
Kb	Kitsap silt loam, 5 to 15 percent slopes	3.3	0.2%
Kd	Kitsap silty clay loam, 0 to 5 percent slopes	3.9	0.2%
Ke	Kitsap silty clay loam, 5 to 15 percent slopes	6.3	0.4%
Mg	Mukilteo peat, 0 to 2 percent slopes	48.1	3.0%
Ne	Norma silt loam, 0 to 3 percent slopes	1.9	0.1%
Oa	Orcas peat, 0 to 2 percent slopes	18.2	1.1%
Sb	Semiahmoo muck, 0 to 2 percent slopes	14.1	0.9%
So	Sinclair shotty loam, 5 to 15 percent slopes	18.7	1.2%
W	Water	248.0	15.5%
Totals for Area of Interest		**1,598.2**	**100.0%**

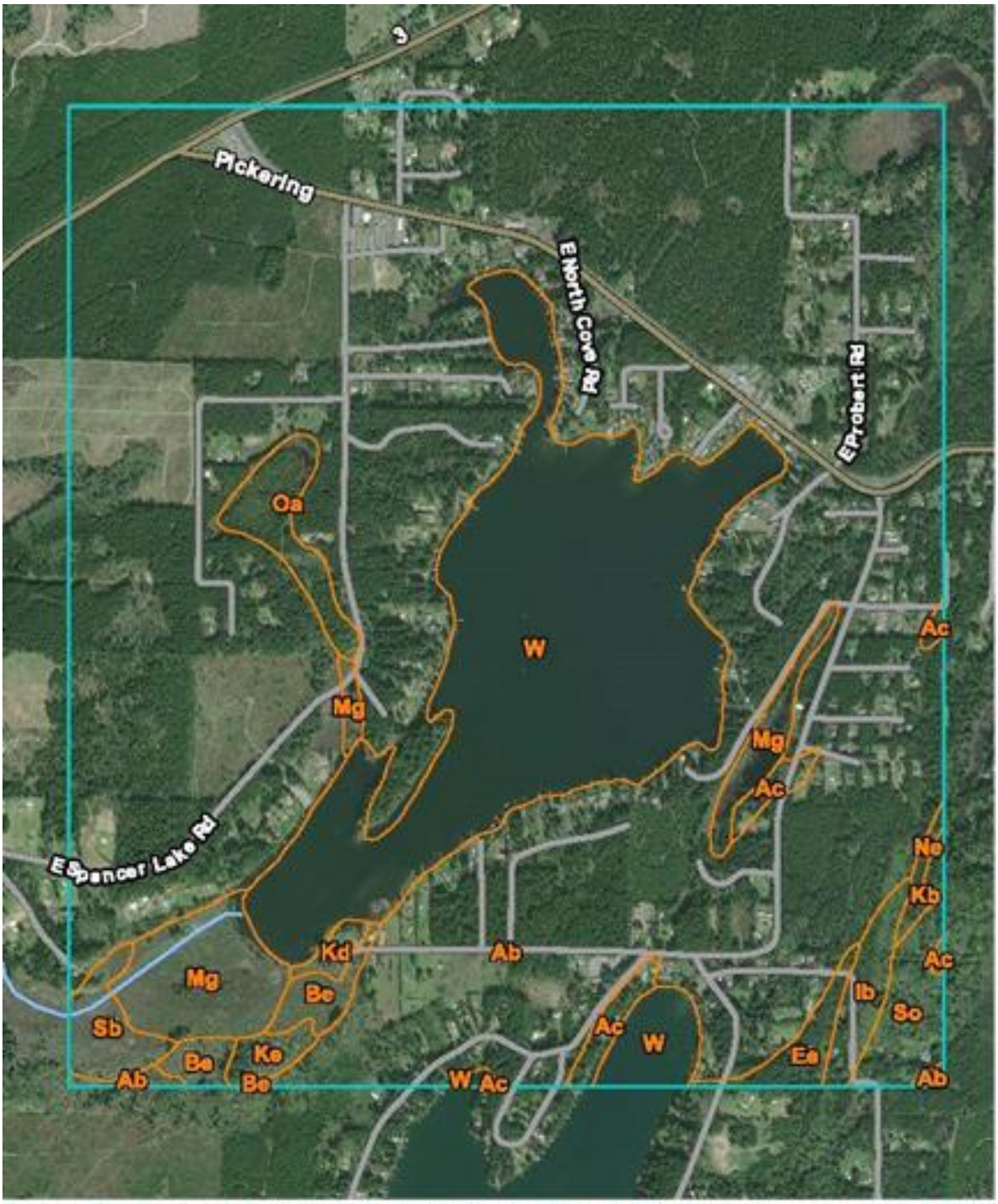


Figure 3 Soil map of Spencer Lake area, Mason County, Washington, produced by USDA NRCS

Physical and Ecological Features

According to the *MASON COUNTY SHORELINE MASTER PROGRAM UPDATE Inventory and Characterization Report* (Mason SMP 2012), Spencer Lake at 213 acres constitutes nearly 55% of the 391.2 acres of the Spencer Lake reach. The land cover within the reach consists of 3% developed, 49% open water, 3% beach, 17% forest, 6% wetland and 21% floodplain/riparian. There are no listed erosion or landslide areas identified in the reach.

The elevation of Spencer Lake is approximately 174 feet (USGS) and, utilizing Shelton's climate data, receives an average annual precipitation – rainfall of 65.7 inches.

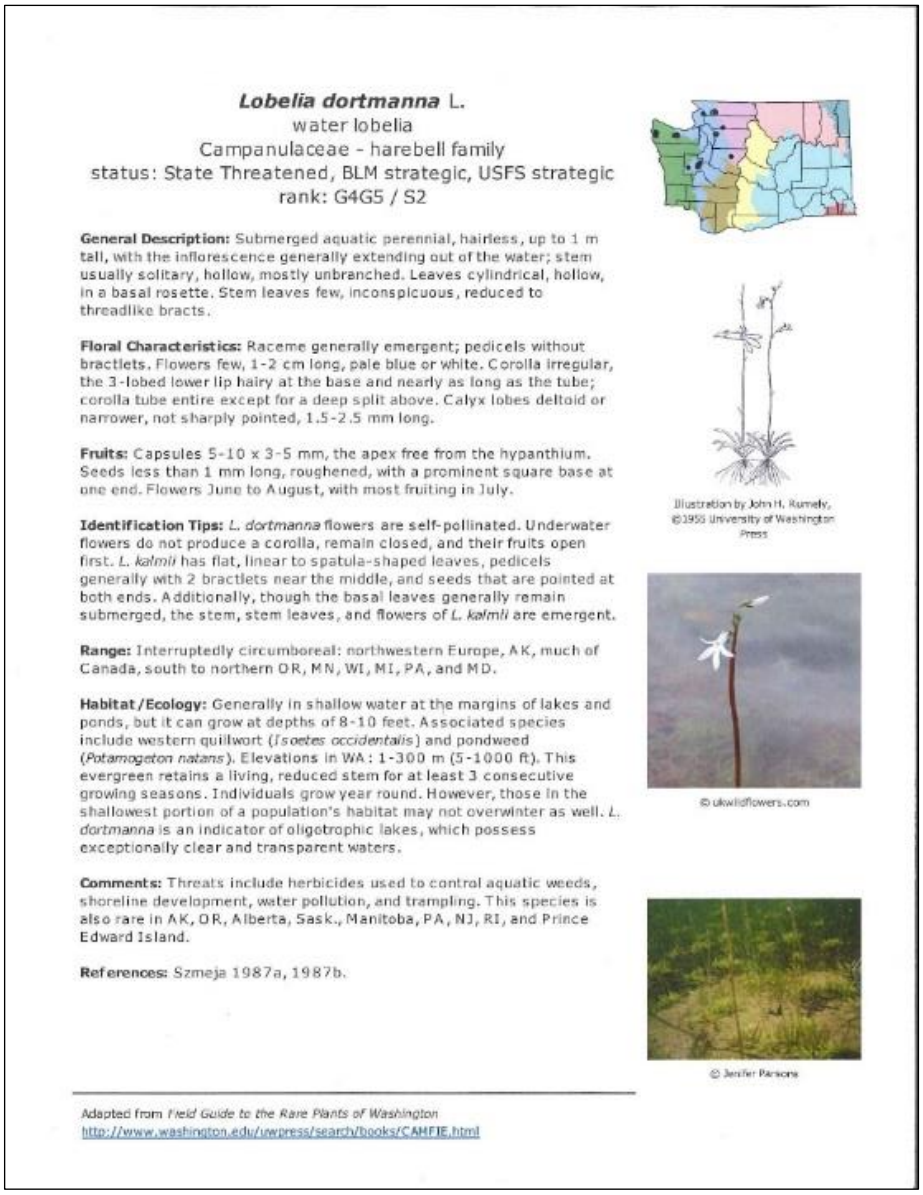
Table 2 - Physical Characteristics of Spencer Lake and Watershed	
Reach Area	391.2 acres
Surface Area	213 acres
Lake Volume	5,060 acre feet
Maximum Depth	36 feet
Average Depth	22 feet
Shoreline Length	5.0 miles

Critical or Priority Habitat and Species

Multiple state and federally-listed priority salmon and trout species are documented in Spencer Lake or Malaney Creek. Malaney Creek drains Spencer Lake and fish occur in the creek. No barriers to fish migration are presented by the concrete span at the outlet (Mason SMP).

Table 3 – Priority salmonid species documented for Spencer Lake or Malaney Creek (Mason SMP, page 6-30)

Common Name	**Scientific Name**	**Habitat Use**	**Federal Listing**	**State Listing**
Coastal cutthroat trout	*Oncorhynchus clarki clarki*	Migration/Spawning	~	~
fall Chum salmon	*Oncorhynchus keta*	Migration/Spawning	~	~
Coho salmon	*Oncorhynchus kisutch*	Migration/Spawning	Concern	~
Rainbow trout	*Oncorhynchus mykiss*	Migration/Spawning	~	~
winter Steelhead trout	*Oncorhynchus mykiss*	Migration/Spawning	Threatened	~



Lobelia dortmanna L.
water lobelia
Campanulaceae - harebell family
status: State Threatened, BLM strategic, USFS strategic
rank: G4G5 / S2

General Description: Submerged aquatic perennial, hairless, up to 1 m tall, with the inflorescence generally extending out of the water; stem usually solitary, hollow, mostly unbranched. Leaves cylindrical, hollow, in a basal rosette. Stem leaves few, inconspicuous, reduced to threadlike bracts.

Floral Characteristics: Raceme generally emergent; pedicels without bractlets. Flowers few, 1-2 cm long, pale blue or white. Corolla irregular, the 3-lobed lower lip hairy at the base and nearly as long as the tube; corolla tube entire except for a deep split above. Calyx lobes deltoid or narrower, not sharply pointed, 1.5-2.5 mm long.

Fruits: Capsules 5-10 x 3-5 mm, the apex free from the hypanthium. Seeds less than 1 mm long, roughened, with a prominent square base at one end. Flowers June to August, with most fruiting in July.

Identification Tips: *L. dortmanna* flowers are self-pollinated. Underwater flowers do not produce a corolla, remain closed, and their fruits open first. *L. kalmii* has flat, linear to spatula-shaped leaves, pedicels generally with 2 bractlets near the middle, and seeds that are pointed at both ends. Additionally, though the basal leaves generally remain submerged, the stem, stem leaves, and flowers of *L. kalmii* are emergent.

Range: Interruptedly circumboreal: northwestern Europe, AK, much of Canada, south to northern OR, MN, WI, MI, PA, and MD.

Habitat/Ecology: Generally in shallow water at the margins of lakes and ponds, but it can grow at depths of 8-10 feet. Associated species include western quillwort (*Isoetes occidentalis*) and pondweed (*Potamogeton natans*). Elevations in WA: 1-300 m (5-1000 ft). This evergreen retains a living, reduced stem for at least 3 consecutive growing seasons. Individuals grow year round. However, those in the shallowest portion of a population's habitat may not overwinter as well. *L. dortmanna* is an indicator of oligotrophic lakes, which possess exceptionally clear and transparent waters.

Comments: Threats include herbicides used to control aquatic weeds, shoreline development, water pollution, and trampling. This species is also rare in AK, OR, Alberta, Sask., Manitoba, PA, NJ, RI, and Prince Edward Island.

References: Szmeja 1987a, 1987b.

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Adapted from *Field Guide to the Rare Plants of Washington*
http://www.washington.edu/uwpress/search/books/CAMFIE.html

Figure 4. Lobelia dortmanna Washington State Department of Natural Resources, Natural Heritage Program

Spencer Lake has approximately 93 acres of wetland, a priority habitat, which includes palustrine emergent and scrub shrub habitat types. A large wetland area extends from the southwest portion of the lake surrounding the Malaney Creek outlet. Wetland also extends from the lake to the northwest to E. Spencer Lake Road. No priority wildlife species occurrences have been mapped in the vicinity of the lake. The Washington State Natural Resources (DNR) Natural Heritage Program (NHP) has identified 28.5 acres of water lobelia, a State Sensitive perennial plant species within Spencer Lake.

A survey of Spencer Lake on June 19, 2018 by Jenifer Parsons, aquatic plant specialist with the Washington State Department of Ecology, and Patricia Grover, coordinator for the Mason County Noxious Weed Control Board, documented several locations for the water lobelia.

Table 4 – From 2018 Washington Vascular Plant Species of Special Concern

Species Common Name	Heritage Rank	State Status	Federal Status	Dist. Pattern	County	Eco-Region	Managed Area
Lobelia dortmanna **water lobelia**	G4G5/S3	Sens	Strat	Sparse	Clm, Kin, Mas,Saj, Skg, Sno, Whc	NC, PC, PT	Moran SP Olympic NP

Land Use

Existing land use and ownership within the Spencer Lake reach is characterized as over half of the area (54%) classified as residential; 29% forestry; 16% vacant/rural; and Parks, Open Space and recreation areas accounts for 1%. There are individual docks/piers associated with many residences and a Washington Department of Fish and Wildlife (WDFW) public boat launch at the southwest end of Spencer Lake.

Summary of Key Management Issues

Key management issues for Spencer Lake:

1) protect and preserve lake water quality; for example through management of fertilizers, pet waste, and herbicides used on residential properties

2) protect in-water habitats and cold water sources for salmon including coastal cutthroat trout

3) control of invasive aquatic plant species, and

4) limit dock proliferation and construction of new overwater structures

There is potential for more development as year round homes replace summer cabins. Residential development in the past 40 years may have resulted in increased water flow, in the form of runoff into Spencer Lake. Residents also report evidence of increased times of high water. This rise in levels may provide for leakage from old, residential septic systems and contribute to nutrient loading in the lake. (Discussion, March 2016)

Figure 5. Spencer Lake 1990

Community History

Stephanie Brooks provided the following information:

History of the Lake Water Level: (This information was gathered from long-time residents, property owners in the area of the outlet/dike and from observations during January 2016). Spencer Lake in Mason County was the 2nd cleanest lake in the state for many years prior to the 1960s. It was the drinking water source for several families on the lake and the water didn't require any treatment. There was virtually no sediment at that time on the bottom of the lake while there is quite a bit now. This is a 220 acre spring fed lake. There is another very small spring fed pond just to the northwest that drains into Spencer Lake through a wetland area. There are no known storm drains that flow into the lake. During the mid-1960s, the WA state Department of Fish and Wildlife treated the lake with rotenone several times to purge the lake of all aquatic species so that it could be stocked as a pure trout lake for fisherman. As part of this plan, the state built a dike and concrete outlet structure at the southwest end of the lake to prevent fish from leaving the lake and other native species from coming back. The dike was constructed primarily of gravel and, as you can see in the google earth photo below, trees have grown in a line along the high ground/dike over the last 50 years but a low swampy/wetland area is still behind the dike. The entire south end of the lake was the drainage for this lake prior to the dike and outlet. The concrete outlet structure had a screen and a powered turbine type device intended to keep the screen from getting clogged with vegetation. The screen and turbine were removed a number of years ago as the screen could not be kept clean by the turbine (more than 20 years ago according to residents). In addition to the dike and outlet, the state dug deep ditches to direct the water flow in Malaney Creek. I was told that the banks of this ditch were up to 5' high above the water in many places. From the information I was able to get from long-time residents, these ditches were located between the outlet structure and East Agate Road, but not necessarily that whole length. As a result of the installation of the dike and outlet structure, the level of the lake rose several feet over the following year or two. In the subsequent 50+ years, the lake continues to creep higher every year with an estimated total increase in water level since the lake was altered of about 4 feet. The outlet, ditches and dike have not been maintained by the state in many years.

Figure 6. Dike and outlet at southwest end of Spencer Lake

Currently, as the lake level recedes in the summer months, there is no water flow through the outlet. It appears that sediment/rocks/sand have built up in this area preventing any water flow once the lake drops below a certain level. When the dike and outlet were first put in, water flowed through the outlet opening year round even with the lake level being lower from what I've been told by longtime residents. Before the dike and outlet went in, the lake also drained year round through the entire south end wetland (behind the dike). Currently, there are two natural "breaches" in the dike in a low area although the water flowing through these sections is only 2-3" deep and a few feet wide. These breaches are marked on the map above and are not very close to the outlet structure. Beaver dams have also blocked the water flow and historically have been removed by the state and residents. This is no longer permitted under Fish and Wildlife rules however there are certain possible alternatives if there is property damage or ecosystem damage occurring from beaver related high water.

Waterbody Characteristics

Spencer Lake is a 213 acre lake located in Mason County, Washington. It has a maximum depth of 36 feet and a mean depth of 22 feet. It has an estimated volume of 5060 acre-feet.

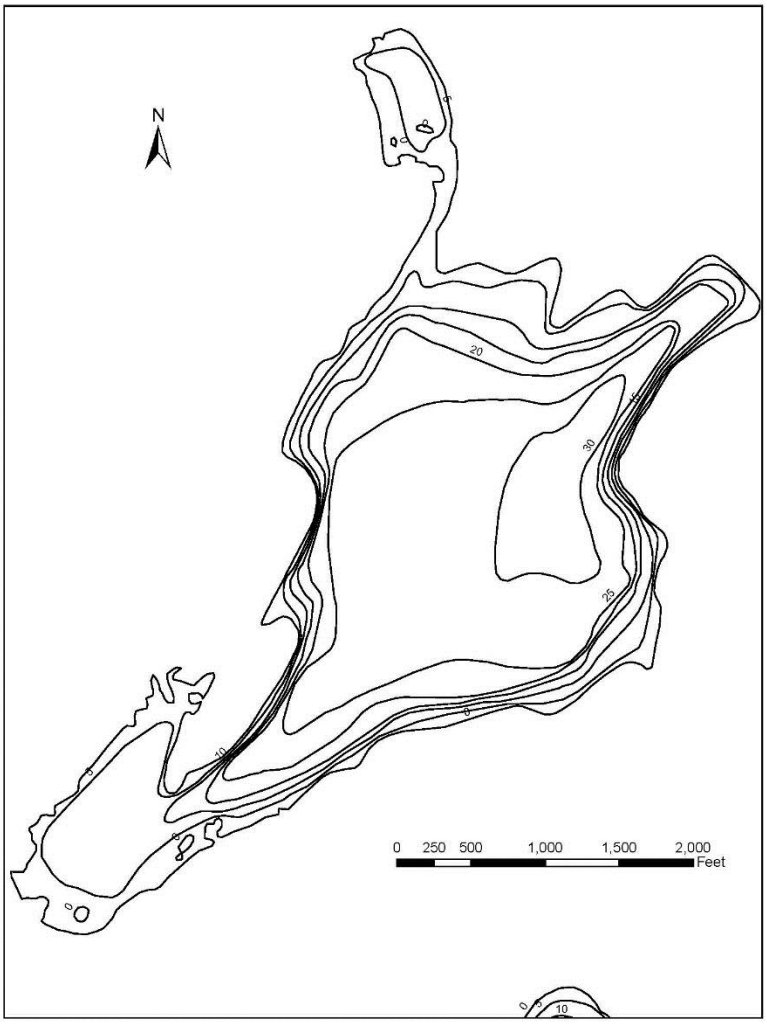

Figure 7. Spencer Lake Bathymetric Map

Beneficial and Recreational Uses

Spencer Lake supports a variety of beneficial and recreational uses. A wide variety of boaters recreate on Spencer Lake using motorized, electric, wind, and human propelled vessels. Many of the developed lake-front properties have boats at the shore ready for use, and small docks from which to experience the water. During warmer weather, swimming is a popular activity, mainly from private docks. Residents and visitors also use the lake for bird watching and wildlife viewing. Spencer Lake's one public boat ramp is located in the southwest part of the lake and managed by the Washington Department of Fish and Wildlife (WDFW). The boat ramp exists largely to facilitate recreational fishing on the lake. Public access to the lake is confined to the WDFW access.

The lake is a popular local fishing destination and used by both visitors and lake residents. WDFW stocks Spencer Lake annually with rainbow and cutthroat trout. The busiest fishing time is in the spring, after the lake has been stocked.

Spencer Lake and watershed support a variety of additional recreational uses. Many who live within the watershed and those who come from elsewhere utilize its resources.

Water Quality

Water quality data for Spencer Lake was collected by the Washington State Department of Ecology from 1990-1998. The data record for this period is largely complete with data missing for 1997.

The assessment of biological activity, or trophic state, results in the classification of lake water quality into three general categories: oligotrophic, mesotrophic, and eutrophic. Lakes with low biological activity are considered oligotrophic, lakes with high biological activity are considered eutrophic. Lakes whose quality ranges between eutrophic and oligotrophic are considered mesotrophic. One of the most common measures used to calculate a lake's water quality classification is the numerical trophic state index (TSI) developed by Robert Carlson (1977). This index allows comparison of lake water quality by rescaling water clarity, phosphorous, and chlorophyll *a* along a trophic continuum based on a scale of 0 to 100 related to algal biovolumes.

Average summer total phosphorus, chlorophyll *a*, and Secchi disk readings are each used to calculate TSIs. TSI of 0 to 40 indicates an oligotrophic, or low productivity lake, TSI of 41-50 indicates a mesotrophic, or moderately productive lake. TSI of greater than 50 indicates a eutrophic, or highly productive lake characterized by poor water clarity and high algae growth.

The Lake was sampled in 1998 (Bell-McKinnon) and was given a trophic status of OM (oligomesotrophic). This is a trophic state that is borderline between oligotrophic and mesotrophic.

Table 5 – Average values for Spencer Lake Trophic Data, 1990 to 1998. Compiled from the Washington State Department of Ecology's Environmental Information Management System

Year	No. of Samples	Secchi (meters)	Dissolved oxygen (mg/L)	pH	Specific Conductivity (umhos/cm)	Temperature (degree C)	Chl *a** (ug/L)	TP* (ug/L)	Total Persulfate Nitrogen (mg/L)
1990	11	3.35							
	19		7.5	6.4	40	17.6			
	2							11.28	0.306
1991	11	4.47							
	1								0.218
1992	11	3.51							
	4							11	0.313
	2						1.205		
1993	2						3.165		
	18		7.0	7.1	32.2	18.15			
	4							22.25	0.270
	12	4.05							
1994	1						1.83		
	10			7.58					
	19				31.3	18.3			
	4							14.15	0.172
	11	3.74							
1995	2						1.9		
	17		8.10	7.12	34.6	16.3			
	4							12.45	0.242
	12	4.18							
1996	1						2.5		
	18		8.98	7.03	30.17	16.8			
	2							10.3	0.219
	11	4.64							
1997	No Data								
1998	25		5.75	7.32	43	17.14			
	10	4.6							

*Chl *a*=chlorophyll *a*, TP=total phosphorus

Photos courtesy of Ben Legler

Spencer Lake is included on Ecology's 303 (d) list of impaired waters for possible impairments related to the presence of big floating bladderwort (*Utricularia inflata*), otherwise known as swollen bladderwort, identified in 2002. Big floating bladderwort is a non-native, invasive aquatic weed that is freely floating, rootless and carnivorous. This aquatic weed is native to the southeastern US, primarily Florida.

Fish and Wildlife Communities

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

Fish

Bluegill, brown bullhead, largemouth bass, pumpkinseed, rainbow trout, general sculpin, smallmouth bass and yellow perch are fish species identified during Washington Department of Fish and Wildlife surveys in 2012 (Caromile 2012).

Table 6 - Species composition by weight and by number, from fish population surveys at Spencer Lake, Mason County, June and September 2012.

	Weight		Number		Size Range	
Species	Kg	% of Total	n	% of Total	Min.	Max
Spring 2012						
Bluegill	0.6	0.6	14	0.6	97	190
Brown Bullhead	5.2	5.4	21	0.9	171	375
Largemouth Bass	4.6	4.8	29	1.3	88	521
Pumpkinseed	5.7	5.9	141	6.2	84	127
Rainbow Trout	16.5	17.2	38	1.7	256	495
Sculpin, General	0.4	0.4	33	1.4	80	120
Smallmouth Bass	2.6	2.7	31	1.4	87	405
Yellow Perch	60.4	62.9	1973	86.5	80	263
Fall 2012						
Bluegill	2.6	2.9	105	6.5	80	165
Brown Bullhead	4.0	4.5	21	1.3	150	361
Cutthroat Trout	2.1	2.4	2	0.1	450	521
Largemouth Bass	18.3	20.5	162	10.0	80	517
Pumpkinseed	8.4	9.4	235	14.5	80	175
Rainbow Trout	2.4	2.7	26	1.6	137	382
Sculpin, General	0.2	0.2	11	0.7	87	117
Smallmouth Bass	3.1	3.4	35	2.2	118	395
Yellow Perch	48.1	53.9	1026	63.2	81	285

In addition, residents report catfish and sunfish in the lake.

Spencer Lake is managed for recreational trout fishing. While coho and chum salmon have been found in Malaney Creek, as close as one mile from the lake, these species are not known from the lake.

According to the WDFW's 2018 Trout and Kokanee Stocking Plan for Region 1, the stocking plan for Spencer Lake includes 12,644 Catchable rainbow trout in April/May, 440 Jumbo rainbow trout in March, 4,400 Jumbo rainbow trout in October and 520 Jumbo cutthroat in February. Spencer Lake is a popular fishery and is open all year to recreational fishing. Spencer Lake falls under the General Statewide Regulations for limits and size restrictions set by Washington Department of Fish and Wildlife (WDFW).

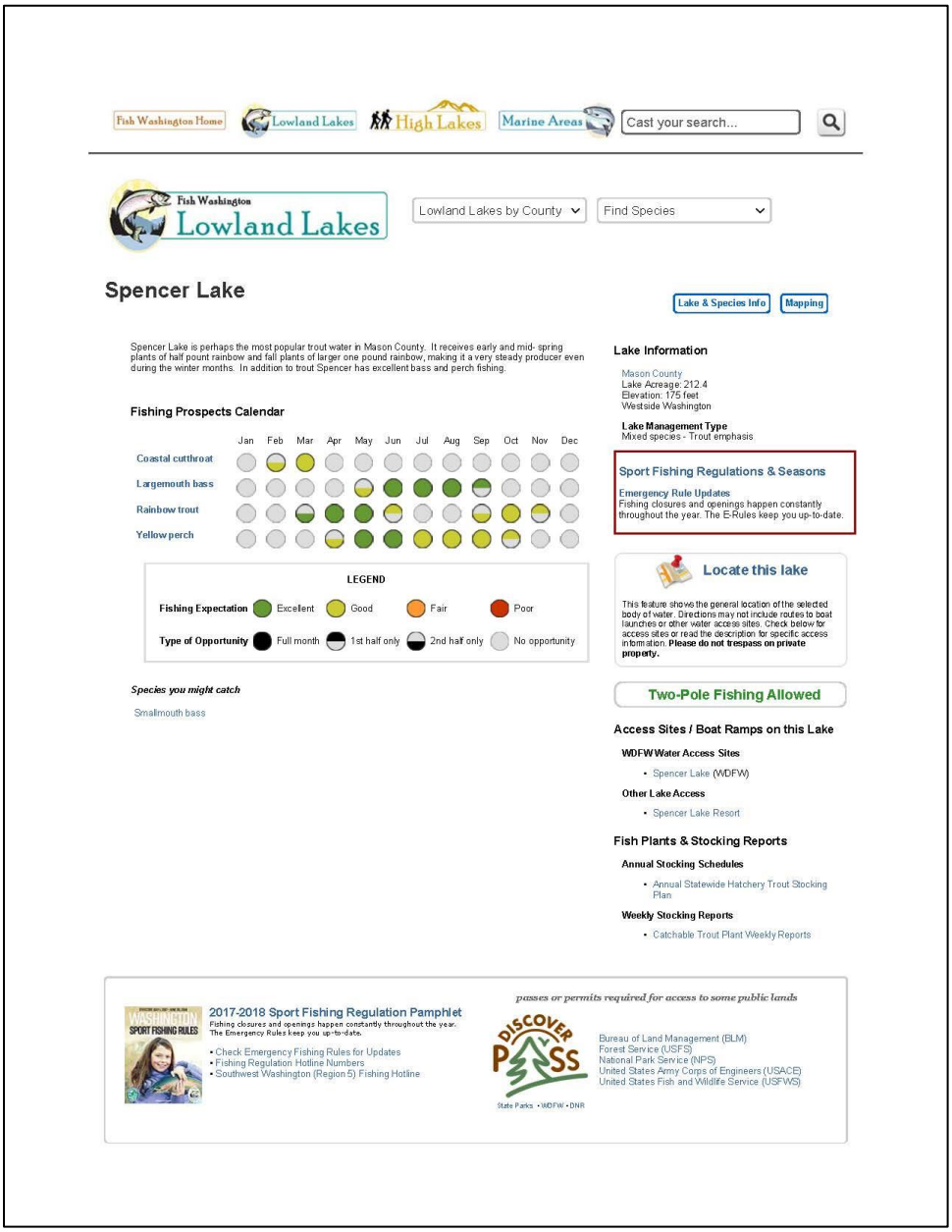

Figure 8. Spencer Lake fish report

Birds, Mammals, Reptiles and Amphibians

A variety of mammals, reptiles and amphibians utilize the Spencer Lake watershed during various times in their life cycle. Birds are attracted to Spencer Lake due to the mix of forest, wetland, and open water habitats. A resident of Spencer Lake has generated a list of birds and mammals seen at Spencer Lake in the past several years (Table 7). This list includes six species of regulatory significance including the great blue heron, bald eagle, osprey, common goldeneye, hooded merganser, and bufflehead.

*Table 7 Spencer Lake Bird and Animal List***

BIRDS

Ban-tailed Pigeons
Mourning Doves
Anna's Hummingbird
Rufous Hummingbird
Belted Kingfisher
Red Breasted Sapsucker
Downy Woodpecker
Northern Flicker
Steller's Jay
Western Scrub Jay
American Crow
Violet Green Swallows
Barn Swallows
Black-capped Chickadee
Chestnut Backed Chickadee
Red Breasted Nuthatch
Brown Creeper
Robin
Varied Thrush
European Starling
Cedar Wax wing
Western Tanager
Spotted Towhee
Chipping Sparrow
Song Sparrow
White Crowned Sparrow
Dark Eyed Junco
Black Headed Gross Beak
Red Winged Black Bird
Brewer's Black Bird
Brown Headed Cow Bird
Purple Finch
House Finch
Pine Siskin
American Gold Finch
Evening Gross Beak
Bald Eagle
Osprey
Sea Gulls
Cormorant
Great Blue Heron
Killdeer
Spotted Sandpiper

DUCKS:

Canada Goose
Wood Ducks
Gadwall
American Widgeon
Mallards
Northern Shoveler
Northern Pintail
Ring Neck Duck
Lesser Scaup
Bufflehead
Golden Eye
Barrows Golden Eye
Hooded Merganser
Common Merganser
Ring Necked Pheasant
Common Loon
Pied Billed Grebe
Red Necked Grebe

MAMMALS:

Snakes
Frogs
Beavers
Squirrels
Fruit Bats
Raccoon
Possum
Deer

****List compiled by Spencer Lake residents, John and Kris Tolton 2016

Characterization of Aquatic Plants

Spencer Lake hosts a wide range of plants from emergent species to submersed species. Aquatic vegetation serves an array of ecological functions such as supporting food chains, 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. Generally, native plants are considered beneficial, however they may become a nuisance when their growth is excessive and out of balance to the point of impacting the beneficial uses of the lake.

As part of this IAVMP, a plant survey was conducted on August 03, 2016 by Arline Fullerton, a contract aquatic plant specialist and Keith Reitz, MCNWCB staff. The survey started at the public boat launch and proceeded clockwise around the lake. The lake was divided into 5 separate survey districts.

Table 8 lists those plant species identified at Spencer Lake during the August 03, 2016 survey, including 17 emergent types, six floating types, three free floating types and two plant like algae:

- **Emergents** are plants that are rooted in the sediment at the water's edge but have stems and leaves which grow above the water surface.
- **Floating** rooted plants are rooted in the sediment and send leaves to the water's surface.
- **Submersed** plants are either freely-floating or are rooted in the lake bottom but grow within the water column.

Table 8 - Aquatic Plant List for the Spencer Lake Survey August 03, 2016			
Plant Type	**Common Name**	**Scientific Name**	**Status**
Emergent Plants	Bulrush	*Schoenoplectus* spp.	Native
	Common cattail	*Typha latifolia*	Native
	Douglas' spiraea	*Spiraea douglasii*	Native
	Hairy-leaf rush	*Juncus supiniformis*	Native
	Mint	*Mentha* spp.	Native
	Purple loosestrife	*Lythrum salicaria*	Noxious Weed- Class B
	Purple (marsh) cinquefoil	*Comarum palustre*	Native
	Quillwort	*Isoetes* spp.	Native
	Rush	*Juncus* spp.	Native
	Sedges	*Carex* spp.	Native
	Spikerush	*Eleocharis* spp.	Native
	Water horsetail	*Equisetum fluviatile*	Native
	Water lobelia	*Lobelia dortmanna*	Native
	Waterpepper	*Polygonum hydropiperoides*	Native
	Western water-hemlock	*Cicuta douglasii*	Native
	Yellow-flag iris	*Iris pseudacorus*	Noxious Weed- Class C
Floating Leaved Rooted Plants	Fragrant waterlily	*Nymphaea odorata*	Noxious Weed- Class C
	Grass-leaved pondweed	*Potamogeton gramineus*	Native
	Large-leaved pondweed	*Potamogeton amplifolius*	Native
	Thin-leaf pondweed	*Potamogeton* spp.	Native
	Watershield	*Brasenia schreberi*	Native
	Yellow pond lily	*Nuphar polysepala*	Native
Submersed Free Floating Plants	Common bladderwort	*Utricularia vulgaris*	Native
	Common waterweed	*Elodea canadensis*	Native
	Whorl-leaf watermilfoil	*Myriophyllum verticillatum*	Native
Plant-Like Algae	Muskgrass	*Chara* spp.	Native
	Nitella	*Nitella* spp.	Native

The Washington State Department of Ecology (Ecology) has records of plant surveys on Spencer Lake dating back to 1994 (Ecology 2018). The following comprehensive aquatic plant list for Spencer Lake has been derived from the Washington State Department of Ecology's Lakes data. Table 9 includes the aquatic plant species found at Spencer Lake during the period 1994-2016. Of those species, four are classified as noxious weed species in Washington State and are included on the Washington State Noxious Weed List (WSNWCB 2018). Most of the remaining plant species are native species.

Table 9 - Comprehensive Plant List, Spencer Lake Surveys 1994-2016

Plant Type	Common Name	Scientific Name	Status	Abundance 2016
Emergent Plants	American water-plantain	*Alisma triviale*	Native	N/A
	Buckbean	*Menyanthes trifoliata*	Native	N/A
	Bulrush	*Scirpus* spp.	Native	N/A
	Cattail	*Typha* spp.	Native	N/A
	Common cattail	*Typha latifolia*	Native	1
	Creeping loosestrife	*Lysimachia nummularia*	Native	N/A
	Dulichium	*Dulichium arundinaceum*	Native	N/A
	Grass sedge or rush-like	*Poales* spp.	Native	N/A
	Knotweed	*Polygonum*	Noxious Weed-Class B	N/A
	Mint	*Mentha* spp.	Native	1
	Naked-stemmed bulrush	*Schoenoplectus*	Native	2
	Narrowleaf bur-reed	*Sparganium angustifolium*	Native	N/A
	Purple (marsh) cinquefoil	*Comarum palustre*	Native	2
	Purple loosestrife	*Lythrum salicaria*	Noxious Weed – Class B	1
	Quillwort	*Isoetes* spp.	Native	2
	Reed canary grass	*Phalaris arundinacea*	Noxious Weed – Class C	N/A
	Rush	*Juncus* spp.	Native	2
	Sedge	*Carex* spp.	Native	2
	Small fruited bulrush	*Scirpus microcarpus*	Native	N/A
	Softstem bulrush	*Schoenoplectus tabernaemontani*	Native	N/A
	Spike-rush	*Eleocharis* spp.	Native	1
	Spiraea, hardhack	*Spiraea douglasii*	Native	N/A
	Spirea	*Spiraea* spp.	Native	2
	Swamp smartweed	*Persicaria hydropiperoides*	Native	1
	Tufted loosestrife	*Lysimachia thyrsiflora*	Native	N/A
	Water clubrush	*Schoenoplectus subterminalis*	Native	N/A
	Water gladiole, Water lobelia	*Lobelia dortmanna*	Native	2
	Water horsetail	*Equisetum fluviatile*	Native	1
	Waterplantain	*Alisma* spp.	Native	N/A
	Water-plantain family	*Alismataceae* spp.	Native	N/A
	Water-purslane	*Ludwigia palustris*	Native	N/A
	Western water-hemlock	*Cicuta douglasii*	Native	1
	Wool-grass	*Scirpus cyperinus*	Native	N/A
	Yellow flag	*Iris pseudacorus*	Noxious Weed – Class C	2

Plant Type	Common Name	Scientific Name	Status	Abundance 2016
Floating-Leaved Rooted Plants	Fragrant waterlily	*Nymphaea odorata*	Noxious Weed – Class C	3
	Grass-leaved pondweed	*Potamogeton gramineus*	Native	1
	Large-leaf pondweed	*Potamogeton amplifolius*	Native	2
	Pondweed thin leaf	*Potamogeton* spp.	Native	2-3
	Ribbonleaf pondweed	*Potamogeton epihydrus*	Native	N/A
	Rocky Mountain pond-lily	*Nuphar polysepala*	Native	1
	Slender pondweed	*Potamogeton pusillus*	Native	N/A
	Watershield	*Brasenia schreberi*	Native	2-3
Submersed Plants	Big floating bladderwort	*Utricularia inflata*	Non-native – Monitor	N/A
	Bladderwort	*Utricularia* spp.	Native	N/A
	Common bladderwort 1	*Utricularia vulgaris*	Native	2
	Common elodea	*Elodea canadensis*	Native	2
	Sago pondweed	*Stuckenia pectinata*	Native	N/A
	Water-milfoil	*Myriophyllum*	Native	N/A
	Waterweed	*Elodea* spp.	Native	N/A
	Whorled watermilfoil	*Myriophyllum verticillatum*	Native	2
Plant-Like Algae	Muskwort	*Chara* spp.	Native	3
	Stonewort	*Nitella* spp.	Native	3

N/A - Species not recorded during 2016 survey

Figure 9. Mapped locations of Lobelia dortmanna

A rare native species, *Lobelia dortmanna* is found at Spencer Lake. Water lobelia (*Lobelia dortmanna*), is a Washington State Sensitive species and is mapped at two locations within the lake. Water lobelia is an indicator of oligotrophic lakes, which possess exceptionally clear and transparent waters. The Washington State Department of Natural Resources, Natural Heritage program, which is the source of scientific information about rare plants and ecosystems of the state, identifies herbicides to control aquatic weeds, shoreline development, water pollution, and trampling as threats to this species

Noxious Weed Species at Spencer Lake

Included in the table are four listed noxious weed species: purple loosestrife (*Lythrum salicaria*), fragrant waterlily (*Nymphaea odorata*), yellow flag iris (*Iris pseudacorus*), and reed canarygrass (*Phalaris arundinacea).* Bohemian knotweed (*Polygonum X bohemicum*) has been documented at several locations by the MCNWCB and is not included in this list.

The term "noxious weed" refers to those nonnative plants that are legally defined by Washington's Noxious Weed Control Law (RCW 17.10) as highly destructive, competitive, or difficult to control once established. Noxious weeds have often been introduced accidentally as a contaminant, or as ornamentals. Nonnative plants usually do not have natural controls (i.e., herbivores, pathogens) or strong competitors to control their numbers as they may have had in their home range. In Washington State, WAC 16.750 sets out three classes (A, B, and C) of noxious weeds based on their distribution in the state, each class having different control requirements:

- Class A weeds are weeds that are limited in their distribution, and the goal is to prevent them from gaining a foothold in Washington. By law, all Class A noxious weeds must be eradicated.
- Class B weeds are non-native, invasive species that are abundant in some areas of the state, but absent or limited in other areas. The statewide goal is to "draw the line" around and contain infested regions, to keep these noxious weeds from spreading into new areas. They are designated for mandatory control in areas where they have not yet invaded or where distribution is still limited. In regions where a Class B species is already abundant, control is decided at the local level, with containment as the primary goal.
- Class C weeds are typically widespread in Washington, or are of special interest to the state's agricultural industry. The State Weed Board provides educational resources about these species but does not require control of them. The Class C status allows counties to require control if locally desired. Other counties may choose to provide education or technical consultation.

The state also maintains a monitor list for certain plant species, which are weeds that are under consideration for future listing as noxious weeds.

There are no Class A noxious weeds at Spencer Lake, there are two Class B weeds, two Class C weeds, and one plant on the state monitor list. The Mason County Noxious Weed Control Board has selected purple loosestrife (*Lythrum salicaria*), a Class B Noxious Weed, as a regulated noxious weed, meaning its control is required. Fragrant waterlily (*Nymphaea odorata*), yellow flag iris (*Iris pseudacorus*), and reed canarygrass (*Phalaris arundinacea*) are Class C noxious weeds and Bohemian knotweed is a Class B. Because of their widespread distribution in the county, control is not required for these species. Big floating bladderwort (*Utricularia inflata*) is on the State Monitor list.

Recent surveys and mapping have documented the current location of the noxious weeds, except reed canarygrass at Spencer Lake. During the summer of 2016, MCNWCB staff surveyed Spencer Lake for purple loosestrife, fragrant water-lily, and Bohemian knotweed. In 2017 a survey was completed to map the distribution and abundance of yellow flag iris. This survey was conducted by Mason County Noxious Weed Control staff, Keith Reitz, from a kayak. Information was recorded utilizing Collector software and transferred to, and compiled in, the Geographic Information System (GIS) program ArcMap 10.2.

Figure 10. Points and polygons were collected for fragrant waterlily and yellow flag iris infestations.

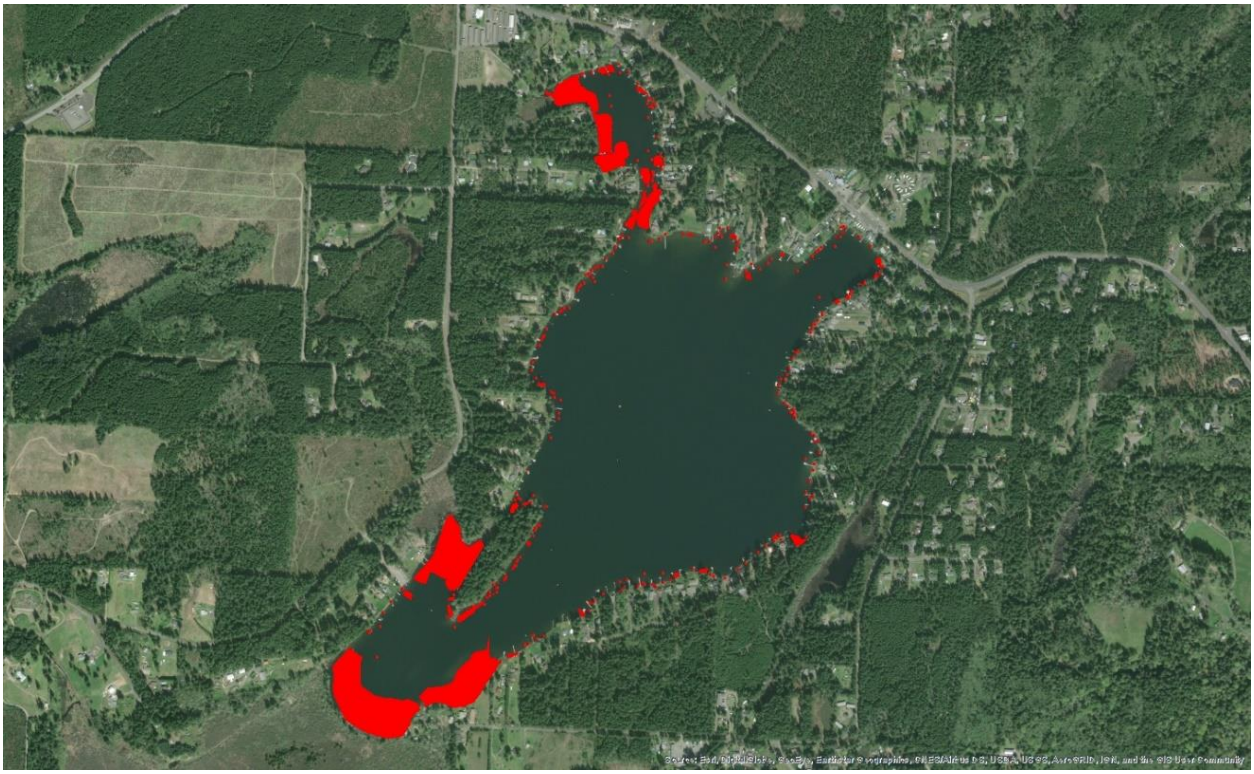

Figure 11. Fragrant waterlily at Spencer Lake 2016

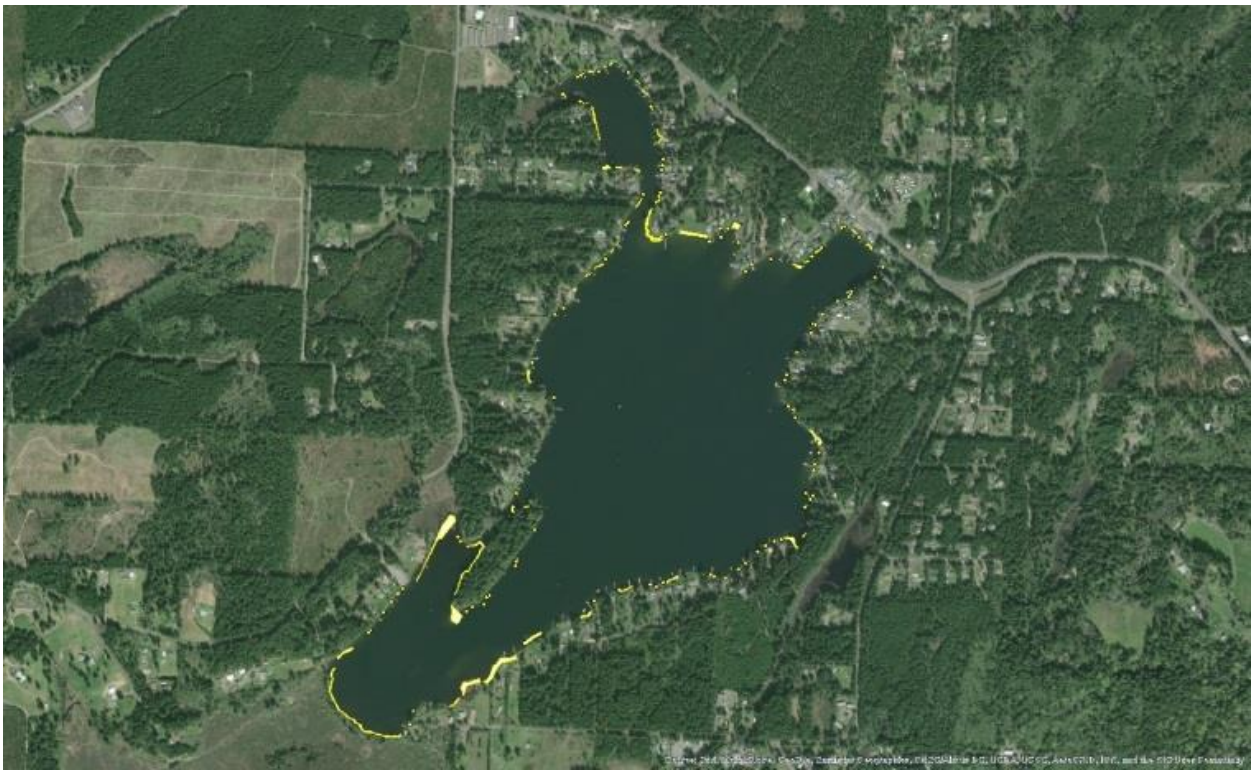

Figure 12. Yellow flag iris at Spencer Lake 2017

Targeted Plant Descriptions

Fragrant waterlily, purple loosestrife, and yellow flag iris are targeted for control in this 2018 IAVMP. Information about these plants and other aquatics can be found in *An Aquatic Plant Identification Manual for Washington's Freshwater Plants* (Ecology 2001) or on the Washington State Noxious Weed Control Board website at: https://www.nwcb.wa.gov

Fragrant waterlily (*Nymphaea odorata)*

Fragrant waterlily is native to eastern North America. Its many subspecies and varieties may be found floating in ponds, lakes and sluggish streams just about everywhere in North America. It was introduced to Washington as a water garden plant and has since escaped into numerous natural lakes and ponds, often growing so densely that it negatively impacts recreation and habitat**.** Fragrant waterlily is affecting Spencer Lake, and is quickly expanding its distribution in the lake. When uncontrolled, this species tends to form dense, monospecific stands that can persist until senescence in the fall. Mats of these floating leaves prevent wind mixing and extensive areas of low oxygen can develop under the waterlily beds in the summer. Dense mats can also increase water temperature, and the warm, shallow stagnant water among them creates perfect mosquito breeding habitat. See appendix B for the Fragrant Waterlily Best Management Practices document that describes the plant in-depth and reviews control techniques.

Legal status in Mason County, Washington

Fragrant waterlily is a Class C noxious weed on the Washington State Noxious Weed List, first listed in 2002. In Mason County, it is on the non-regulated noxious weed list. Property owners are not required to control this species, however containment is recommended.

Identification

Leaves float on the water's surface and are nearly circular in shape. They are notched to the center and the leaf lobes are pointed. The leaves are on the top of long stalks that extend from long rhizomes in the mud. Fragrant waterlily flowers are showy, white to pink and aromatic. Flowers of unusual color and shape are characteristic of hybrid waterlilies. The stems are flexible so when the water level lowers, the plants don't stick up out of the water like they do with the native spatterdock (*Nuphar polysepala*).

Habitat and impact

This aquatic perennial herb spreads aggressively, rooting in murky or silty sediments in water up to 10 feet deep. It prefers quiet waters such as ponds, lake margins and slow streams and will grow in a wide range of pH. Fragrant waterlily spreads by seeds and by rhizome fragments. One rhizome can cover about a 15-foot diameter circle in 5 years.

Waterlilies can restrict lakefront access and hinder swimming, boating, and other recreational activity. They may also limit the distribution of our native waterlily (*Nuphar polysepala*) which occupies the same niche and provides food and habitat for a variety of animals and fish. The fragrant waterlily has been expanding in patches on Spencer Lake and, as these patches connect, recreational activities have become more difficult.

Fragrant waterlily can contribute to algal growth and water quality problems. It is currently found in many lakes and numerous ponds throughout Mason County.

Growth and reproduction

Usually flowers from June to October. After fertilization, the flower stalk curls like a corkscrew, drawing the flower underwater. The seeds float back to the surface and are spread through water movement. The thick, fleshy rhizomes can spread vegetatively when rhizome fragments break off. The plants die back in the fall and decay on the water's surface.

Purple loosestrife (*Lythrum salicaria*)

Purple loosestrife (*Lythrum salicaria*) is an emergent aquatic noxious weed that degrades native wetland plant communities. Purple loosestrife can quickly adapt to environmental changes and expand its range to replace native plants used for ground cover, food, or nesting material. This noxious weed species occurs intermittently along the shoreline and has the potential to spread around the lake, into adjacent wetlands or along Malaney Creek if not controlled. The threat of infestation of these areas remains as long as the infestation at Spencer Lake exists. This emergent weed fails to provide the same forage and habitat for birds, mammals, and invertebrates as provided by native plant communities. Purple loosestrife produces prolific seed (up to two million seeds per mature plant) that could easily be transported downstream. See appendix B for the Purple Loosestrife Best Management Practices document that describes the plant in-depth and reviews control techniques.

Legal status in Mason County, Washington

Purple loosestrife is a Class B noxious weed on the Washington State Noxious Weed List, first listed in 1988. In Mason County, it is selected for control and is on the regulated noxious weed list. Property owners are required to control this species.

Identification

Purple loosestrife can reach up to 10 feet tall and 5 feet wide and has a persistent, perennial tap root and spreading rootstock. Flowers are densely clustered on a 4-16 inch terminal flowering spike. Flowers are showy and magenta with 5 to 7 petals. Leaves are alternate, opposite or in whorls of 3. They are 1.5 to 4 inches long, lance-shaped to narrowly oblong and sometimes are covered with fine hairs. Stems are herbaceous and upright, branched or unbranched and somewhat square with 4 to 6 sides. Each plant may have 30 to 50 stems with flowers that form at the ends. Seeds are in capsules.

Habitat and impact

Purple loosestrife occurs in freshwater and brackish wetlands. It is a successful colonizer and potential invader of any wet, disturbed sites in North America. Associated species include cattails, rushes, sedges and reeds. Purple loosestrife alters wetland ecosystems by replacing native and beneficial plants reducing nesting habitat for waterfowl, animals, and birds. Agriculture may also be impacted by a loss of wild meadows, hay meadows and wetland pastures.

Growth and reproduction

A mature plant can produce 2.7 million seeds. Water dispersal includes floating seedlings and floating ungerminated seeds. Purple loosestrife also spreads vegetatively. Adventitious buds with the ability to produce shoots or roots are found on buried stems. Disturbance to the plants, such as stomping and breaking underground stems, or breaking off stems or roots during incomplete plant removal, does initiate bud growth.

Yellow flag iris (*Iris pseudacorus*)

When flowering, yellow flag iris is unmistakable with its showy yellow flowers colorfully displayed along the edge of water and in wetlands. Yellow flag iris (*Iris pseudacorus*) was introduced as a garden ornamental and erosion control species and is the only yellow iris found in Washington's wet areas, but when not flowering it may be confused with cattail (*Typha latifolia*) or broad-fruited bur-reed (*Sparganium eurycarpum*). Look for the fruits in the summer, or the fan-shaped plant-base at other times of year.

Because yellow flag iris is so prolific at the lake and difficult to control, the plant is not the target of this management plan. However, individual homeowners are encouraged to begin control of yellow flag iris on their own. See appendix B for the Yellow-Flag Iris Best Management Practices document that describes the plant in-depth and reviews control techniques.

Legal status in Mason County, Washington

Yellow flag iris is a Class C noxious weed on the Washington State Noxious Weed List, first listed in 2002. In Mason County, it is on the non-regulated noxious weed list. Property owners are not required to control this species, however containment is recommended.

Identification

Yellow flag iris is a perennial, aquatic, herbaceous plant which grows 2-3 feet tall along shores in shallow water. Rhizomes spread and form large clumps. Leaves are broad, sword-shaped and sessile. Stems are solid.

Habitat and impact

Yellow flag grows in temperate wetlands along the margins of lakes and slow-moving rivers. It is most commonly found in very shallow water or mud. It tolerates drying and anoxic sediment and is also tolerant of some salinity, and high soil acidity.

It will sicken livestock if ingested, and is generally avoided by herbivores. Contact with the resins can cause skin irritation in humans.

This noxious weed is well established at Spencer Lake, growing in multiple locations around the lake (Figure 12). In addition to threatening to lower plant diversity, yellow flag iris can alter hydrologic dynamics through sediment accretion along the shoreline. Yellow flag iris has not yet been observed downstream along Malaney Creek, however this species produces prolific seed that could easily be transported downstream to invade this area.

Growth and reproduction

Yellow flag dies back in harsh winter conditions, but the rhizomes will overwinter. In spring the long leaves and flower stalks regrow from the rhizomes and flower by late spring or early summer. The rhizomes spread to form dense stands that exclude native wetland species.

Yellow flag spreads by rhizomes and seeds. Up to several hundred flowering plants may be connected rhizomatously. Rhizome fragments can form new plants if they break off and drift to suitable habitat.

Past Management Efforts

Noxious weed control history at Spencer Lake

While noxious weeds have been an issue at Spencer Lake for many years, there has not been a coordinated control effort. While no lake-wide efforts have targeted submersed or floating noxious weeds at Spencer Lake, some individual land owners have targeted plants on their waterfront. Techniques employed by land owners have included cutting, raking and weed mats, all which can control submersed and floating plants but not eradicate them. See the Management Alternatives section later in this document for more details on these control methods.

Aquatic herbicide treatments in Spencer Lake are permitted through the Washington State Department of Ecology's permit program. Only one documented treatment of aquatic plants was reported. (Table 10).

	Table 10 - Summary of Permitted Aquatic Herbicide Use for Spencer Lake				
Date	Target Plant	Chemical Used	Amount	Acres Treated	Permit Number
09-30-2006	Potamogetons	Diquat dibromide	0.5 gallon	0.25 acres	994128

Additional management efforts include:

1) Mason County Noxious Weed Control has been treating Bohemian knotweed at multiple locations in the vicinity of Spencer Glen Homeowner's Association (HOA) and the WDFW boat launch since 2013.
2) Mason County Noxious Weed Control manually removed fragrant waterlily at Spencer Glen Homeowner's Association in 2016.
3) Release of the biocontrol agent, *Galerucella* spp., a loosestrife leaf beetle, has not been documented at Spencer Lake. Due to the scattered occurrence of purple loosestrife, use of the beetles would likely not contribute to control. These insects are most effective in large, dense, contiguous patches of the plant where remaining flower heads/seed heads are regularly removed.

Section 5 - Management Alternatives

A wide variety of control methods have been developed to address the general problem of aquatic noxious weeds. The methods chosen for aquatic plant control vary depending upon several factors, including: the species of aquatic plant targeted; whether the control goal is management or eradication; the cost of a method and availability of funds; the impacts to water quality and habitat; the safety and feasibility of a method; and support from lake residents. Control methods considered for Spencer Lake include:

- Chemical treatments
- Manual control methods
- Mechanical control methods
- Diver dredging
- Bottom screening
- No action

All control options have been considered and evaluated for each noxious weed species as it relates to the conditions at Spencer Lake (table 11). This table provides a summary of each method considered, its advantages and disadvantages, and suitability for Spencer Lake. The discussion below describes control methods that warrant further consideration, both at the large scale (whole lake treatment) or small scale (private property waterfront) and those methods that are not applicable at Spencer Lake.

Since control of Bohemian knotweed is well underway, control measures for this species are not included in the table.

Full descriptions of each method, as well as advantages and disadvantages, permits, costs, and suitability for Spencer Lake, are summarized in Appendix C. Much of the information in Appendix C is taken directly from Ecology's Aquatic Plant Management website (Ecology 2016). This information, however, is no longer available on Ecology's website. In addition, Appendix B provides information prepared by King County Noxious Weed Control on best management practices for each target species.

Table 11 - Summary of Management Alternatives – page 1

Broad control method category	Specific method	Compatible with Spencer Lake water body characteristics	Effectiveness for purple loosestrife	Further consideration	Effectiveness for fragrant waterlily	Further consideration	Effectiveness for yellow-flag iris	Further consideration
Manual and environmental manipulation control methods	**Hand pulling/digging**	YES	Effective in some situations, can be part of an IPM solution.	YES*	Not practical for a large area, can be useful for individuals to maintain open water in small areas.	YES*	Effective in some situations, can be part of an IPM solution.	YES*
	Diver hand pulling	YES	Not relevant	no	Not practical for a large area, can be useful for individuals to maintain open water in small areas.	YES*	Not relevant	no
	Raking	YES	Not relevant	no	Not relevant	no	Not relevant	no
	Bottom barriers	Area of infestation too large	Not relevant	no	Not practical for a large area, can be useful for individuals.	no*	Not practical for a large area, can be useful for individuals.	no*
	Water level drawdown	Not possible	Not relevant	no	Not relevant	no	Not relevant	no
Mechanical control methods	**Cutting**	YES	When cut at the base at flower-drop, will stop seed production. Will not eradicate. Can be part of an	YES*	Effective for short term control of small areas, must be done frequently. Will not eradicate.	YES*	Repeated cutting over several years may be effective. Cutting flowering plants will stop seed dispersal.	YES*
	Mechanical Weed Cutters	Can't be done around docks, logs and other in-water obstructions.	Not relevant	no	Effective for short-term control of large infestations. Expensive. Must be done frequently.	no	Not relevant	no
	Rotovators	Difficult around docks, logs, and other in-water obstructions.	Not relevant	no	Will fragment rhizomes and may spread infestation.	no	Not relevant	no
	Diver dredging	YES	Not relevant	no	Not practical for a large area	no	Not relevant	no
	Sediment dredge	Difficult around in-water obstructions, causes water quality issues and fish habitat degradation.	Not relevant	no	Can be effective. Causes severe short- term water quality disturbance. Requires extensive permits. Very expensive.	no	Not relevant	no
	Sediment agitation (weed rollers)	YES	Not relevant	no	Useful around individual docks, but not relevant for larger infestation control.	YES*	Not relevant	no

* Starred methods can be employed by individual property owners for small-scale temporary control

Table 11 - Summary of Management Alternatives **–page 2.**

Broad control Method category	Specific method	Compatible with Spencer Lake water body characteristics	Effectiveness for purple loosestrife	Further consideration	Effectiveness for fragrant waterlily	Further consideration	Effectiveness for yellow-flag iris	Further consideration
Biological Control Methods	**Galerucella beetles for purple loosestrife**	YES	Not effective on scattered populations..	no	Not relevant	no	Not relevant to this species	no
	Other biocontrol agents for purple loosestrife: seed and root feeding weevils	YES	Availability more limited than *Galerucella* beetles. Not currently known on site. Would take several years for populations to build up to controlling levels. Needs to be combined with manual control of seeds	no	Not relevant	no	Not relevant	no
Chemical control methods	**Glyphosate**	Aquatic formulations are compatible	Not desirable for purple loosestrife control; it is non-selective and monocots (cattails, grasses, and sedges) may be damaged	no	Aquatic formulations can be very effective when applied by a skilled contractor. Can result in dead, floating root mats that may need to be dealt with.	**YES**	Aquatic formulations can be very effective when applied by a skilled contractor.	**YES**
	Imazapyr	Aquatic formulations are compatible	Not desirable for purple loosestrife control; it is non-selective and monocots (cattails, grasses, and sedges) may be damaged	no	Not recommended	no	Aquatic formulations can be very effective when applied by a skilled contractor.	**YES**
	Triclopyr	Aquatic formulations are compatible	Very effective, if properly applied. Selective: won't harm monocots (cattails, grasses, and sedges)	**YES**	Not recommended	no	Not relevant	no

* Starred methods can be employed by individual property owners for small-scale temporary control

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 method as appropriate.

Purple loosestrife (*Lythrum salicaria*)

For more information on the following purple loosestrife control methods reference Appendix B – BEST MANAGEMENT PRACTICES Purple Loosestrife and Appendix C –Control Method Options.

Hand-Pulling or Cutting (only suitable for small areas or used in combination with other methods)

Hand pulling or digging of purple loosestrife plants is possible in areas where plants are growing out of soft substrate and the root mass of the plants are reachable. The entire root mass must be removed, bagged, and disposed of. Plants that are growing in rock or riprap, in amongst large downed wood, or amongst woody vegetation may not be able to be completely removed using this method. Hand pulling is feasible in the small scale, and would be appropriate for the limited distribution of this plant at Spencer Lake.

Cutting plants at the base when in flower may prevent seeding, but cut plants may continue to produce flowers. Sites should be consistently and regularly monitored until frost to cut and remove any subsequent flowers. Cutting will not kill the plants, and they will need to be controlled every year. Care must also be taken to properly dispose of root and stem fragments to prevent the growing of new plants. Cut plant parts must not be left on site, because root and stem fragments can root and form new plants. Using cutting to control purple loosestrife may work at Spencer Lake only if it is part of an IPM solution that incorporates several control tactics such as hand pulling, bio controls, weed mats, and selective herbicide use.

Hand pulling or cutting to control purple loosestrife may work at Spencer Lake if it is part of an IPM solution that incorporates other control tactics such as long-term persistent cutting, weed mats, bio controls, and selective herbicide use.

Bottom Barriers/Weed Mats (only suitable for small areas)

The use of thick cardboard or plastic, staked down, and covered by six inches of mulch to cover closely cut purple loosestrife plants can prevent seed spread but will not eradicate the plant. Weed mats are an option where the terrain is flat, and not interrupted by logs, other vegetation, or rock. Weed mats need to be checked often because they can become damaged and will need to be repaired or re- installed. Using weed mats to control purple loosestrife may work at Spencer Lake only if it is part of an IPM solution that incorporates several control tactics such as hand pulling, bio controls, long-term persistent cutting, and selective herbicide use.

Biological Control (used in combination with other methods)

Purple loosestrife population density and the number of flowering plants can be reduced, but there will always be some plants remaining when using biological control agents. Typically, biocontrol releases should be made only at sites where loosestrife infestations are large and immediate eradication of the weed is not the primary objective. Biological control can take up to six years to have a significant impact on the infestation. Currently, purple loosestrife is known from only a few locations around the lake.

Release of the biocontrol agent, *Galerucella* spp, is unknown at Spencer Lake. (Jennifer Andreas, Integrated Weed Control Project Director, Washington State University Extensions, personal communication, 2018) The beetles, if present, need to be combined with the removal and bagging of plant flowers. By its nature, biocontrol methods may result in reduced infestation of the target plant but not result in eradication.

Chemical Control

For large infestations of purple loosestrife, herbicide use may be necessary for effective control. The application of herbicide to the emergent purple loosestrife is best conducted by manual spot applications. Control of purple loosestrife is most effectively achieved using a selective herbicide such as an aquatic approved version of triclopyr. Triclopyr-TEA in particular has been very effective in killing purple loosestrife plants and has the lowest human and ecological side effects. Selective herbicides also have the advantage of not harming monocot plants (cattails, grasses, sedges, etc). These aquatic herbicides must be used with a Washington State Department of Ecology approved aquatic surfactant.

An experienced and licensed aquatic herbicide applicator can selectively target individual emergent weed species and limit damage to other species. This is especially true when infestations are small so that large areas with a diverse plant distribution don't have to be treated. Since the emergent noxious weed infestations at Spencer Lake are small and still confined to the shoreline, it should be relatively simple for the applicator to avoid off target damage and preserve the native plant community.

Treatment of purple loosestrife will likely have to occur twice during the growing season in order to ensure that no plants were 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.

Fragrant waterlily (*Nymphaea odorata*)

For more information on the following fragrant waterlily control methods reference Appendix B – BEST MANAGEMENT PRACTICES Fragrant Waterlily and Appendix C –Control Method Options.

Hand Pulling or cutting (only suitable for small areas)

Hand pulling and cutting can be used to temporarily control fragrant waterlily in a small area, such as around a dock, if repeated on a regular basis. Hand pulling will likely not eradicate the plant from a water body and is impractical for large infestations. While cuttings won't increase the spread of fragrant waterlily, all pulled or cut plants and plant parts must be removed from the water, and an HPA pamphlet permit is required. Several years of monitoring are needed for signs of plants growing from root fragments and from the seed bank. Fragrant waterlily can be composted on dry land or placed in yard waste bins.

Bottom Barriers (only suitable for small areas)

An opaque bottom barrier can be used to suppress waterlily growth in small areas such as a boat launch or around a swimming area. Barriers need to be regularly cleaned and maintained because plants will root in the sediment that accumulates on top of them. Bottom barriers are not practical for large-scale infestations such as the whole of Spencer Lake.

Sediment Agitation (Weed Rolling) (*only suitable for small areas*)

Weed rolling is a suitable way to temporarily control, not eradicate, waterlily in a small area such as at the end of a dock but is not suitable for any larger area. 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. The Washington State Department of Fish and Wildlife pamphlet, *2015 Aquatic Plants and Fish* limits the area of removal to "no more than two thousand five hundred square feet". Weed rolling is not applicable to a lake wide infestation.

Chemical Control

Chemical methods used to control fragrant waterlily can be very effective and are appropriate for whole lake treatments. The most effective herbicide and environmentally low toxic herbicide suitable is an aquatic version of glyphosate (see Appendix D 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 precise foliar spraying by an approved aquatic herbicide contractor. Foliar application of the herbicide reduces the chance that the herbicide will come in contact with and affect non-target plants. Glyphosate also has the advantage of working through translocation whereby the chemical gets moved through the plant and kills the plant to the roots.

Due to the extensive infestation of fragrant waterlily, treatment will need to occur multiple times over a four to six year period. It is recommended that treatments identify satellite populations and that large waterlily beds be treated gradually over the course of several years. This practice should minimize the development of floating mats since there are live rhizomes that should hold the mass down at the bottom to decay. If mats do float up, they are smaller and more easily managed. This could be accomplished by treating a strip around the edge each year, gradually working toward the center or making strips through the bed that gradually join over a few years (Parsons communication 2018). The control effectiveness of fragrant waterlily is easy to measure through visual surveys due to the floating leaves.

A drawback of using herbicide to control waterlily is the potential for "uplifting" of mats of decomposing waterlily roots that can form floating islands in the lake after the plants have died. The infestation of waterlily at Spencer Lake consists of numerous newly formed, small, circular patches and several areas with large monospecific stands. The smaller areas may not generate floating sediment mats because of their size, but the larger areas would likely generate the floating mats. Natural decay of fragrant waterlily can also often create these floating mats. Removal of the 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.

Yellow flag iris (*Iris pseudacorus*)

For more information on the following yellow flag iris control methods reference Appendix B – BEST MANAGEMENT PRACTICES Yellow-flag iris and Appendix C –Control Method Options.

Hand Pulling or cutting (only suitable for small areas)

Hand pulling of yellow flag iris is a feasible option for small to moderate infestations. In damp or wet soils seedlings can be easily removed while mature plants may require the use of heavier tools such as pick axes, pulaskis, or saws. When removing plants, care must be taken to remove all rhizomes as any rhizomes left have the potential to sprout new plants. Manually cleared areas should be monitored for new growth. Emergent plants that are continually inundated can be cut below the waterline for effective control. It is recommended to cut them before flowering. Rhizomes can continue to grow up to 3 months without water so disposal of plant material must be done in dry locations.

When removing yellow flag iris manually, care should be taken to protect the skin, as resins in the leaves and rhizomes can cause irritation.

Bottom Barriers (only suitable for small areas)

Small patches of yellow flag iris can be controlled using a heavy tarp weighted at the edges. The tarp must extend beyond the edges of the infestation and needs to be checked periodically to insure plants aren't growing up around the tarp. Materials such as landscape fabric and heavy plastic may not be study enough to effectively control the plants. Coverings must be left in place for up to several years.

Chemical Control

Chemical control for yellow flag iris can be an effective alternative and may be the only option for large infestations. Yellow flag iris is a monocot and only non-selective herbicides are effective. These non-selective herbicides can injure or kill any plants they come in contact with and special care must be used to minimize off target damage when using these chemicals. Glyphosate is the most commonly used herbicide for yellow flag iris control. It should be applied in late spring or summer and needs to be applied directly to foliage or fresh cut leaves and stems. Yellow flag iris may require higher concentrations so the label directions must be strictly followed. Imazapyr is also an effective treatment and may be applied in conjunction with glyphosate for good control. Imazapyr has been shown to have some residual soil activity so care must be taken to not spray the root zones of desirable plants or replant for several months. Both herbicides are most effective in combination with a surfactant such as Competitor (selected surfactant must be approved for aquatic use). Multiple treatments may be required for dense infestations and retreatment is generally recommended. All aquatic herbicides must be applied by a licensed pesticide applicator and label directions must be followed.

Section 6 – Integrated Treatment Plan

Spencer Lake and its associated shoreline contain five listed noxious weed species whose presence has diminished the quality of Spencer Lake as an ecological and human resource. The goal of the treatment plan is to halt and reverse the degradation caused by the targeted plants. The two wide spread target species fragrant waterlily (*Nymphaea odorata*) and yellow flag iris (*Iris pseudacorus*) each require different treatment and monitoring techniques. Control efforts are underway for the Bohemian knotweed (*Polygonum X bohemicum*) and property owners with purple loosestrife (*Lythrum salicaria*) are being encouraged to control this species. The infestation of reed canarygrass *(Phalaris arundinaceae)* is too widespread and not considered for control in this IAVMP (see: SECTION 5 - MANAGEMENT ALTERNATIVES). Although the four species considered for control at Spencer Lake are highly aggressive and difficult to control and eventually eradicate, the goal of control and reduced levels of infestation are reasonable for all of them and may be achieved within the 5 year timeframe of the project. All methods suggested combine to form an Integrated Pest Management (IPM) strategy that is a balance between target weed eradication and environmental protection.

Permits

Most aquatic weed control activities require permits. Many manual and mechanical control methods are covered under the "Aquatic Plants and Fish" pamphlet, a Hydraulic Project Approval (HPA) from the Washington Department of Fish and Wildlife. This HPA pamphlet permit applies only to use by individual land owners, not the whole lake, and applies to some types of aquatic weed or plant control. Depending on the method you select to control aquatic noxious weeds or beneficial plants, an individual HPA may be required. A National Pollutant Discharge Elimination System (NPDES) permit must be obtained before aquatic herbicides can be applied to natural water bodies in Washington State, including Spencer Lake. The Washington Department of Agriculture holds an NPDES permit for the management of noxious weeds growing in wet areas such as lake shores, freshwater wetlands, river banks, and estuaries. Licensed applicators can obtain coverage under this permit free of charge. For herbicide treatment of in-lake plants (floating or submersed weeds) the project will need an Aquatic Plant and Algae Management NPDES permit from the Washington Department of Ecology. This permit must be held by the herbicide applicator or the legal entity hiring the applicator, it must be applied for at least sixty days before beginning the aquatic plant control activities that will result in a discharge to waters of the state. The herbicide application, and a permit fee applies. Permit fees are set by rule in WAC 173-224-040. In 2018 the permit fee is $585.00 increasing to $618.00 in FY 2019.

The schedule laid out below prioritizes fragrant waterlily control and is tentative. It will be reassessed each year depending on the density and distribution of fragrant waterlily found during surveys. Large or dense fragrant waterlily patches will generally be treated using herbicide, but when surveys indicate sparse coverage, diver pulling or other manual methods may be employed.

Fragrant waterlily (*Nymphaea odorata*)

Control (years 1-5)

A pre-treatment survey of fragrant waterlily is not necessary because the distribution of the plants was well documented during surveys in 2016. The expected abundance and distribution can be based on this survey and aerial interpretation.

Initial control of fragrant waterlily will be accomplished using a broad-spectrum aquatic herbicide formulation of glyphosate (*see **Appendix D** for herbicide label*). Suitable formulations include, but are not limited to: Rodeo®, Roundup Custom®, and AquaNeat®. The herbicide will be applied by a licensed aquatic herbicide contractor, on a calm, dry day to ensure good herbicide contact with the plants. Treatment of waterlily will occur in mid-summer (July) when the plant is storing energy in the rhizomes for the next growing season.

Treatment will be accomplished over a 5-year period. Small satellite infestations will be prioritized for treatment and large waterlily beds will be treated gradually over the 5-year period. Methods may include, treating a strip around the edge of larger infestations, gradually working toward the center, or making strips through the bed that gradually join over the multi-year period. Adopting this methodology may reduce the potential for mud mat formation.

Follow-up control (years 5+)

Treatment beyond the 5 year project will consist of spot herbicide treatments in July/August. After several years of herbicide treatments, the populations of lily will become smaller and cutting and/or hand pulling may become a viable option for remnant infestations.

Floating mud mats

When waterlilies die, often their root masses will swell with gas and rise to the surface, bringing up all the muck from the bottom of the lake around them. This is a natural process and will occur at the end of the life cycle of a water lily patch whether it died naturally or was controlled using herbicide. Occasionally these mats will sink again on their own, but just as often they will persist and become floating islands of vegetation. Many lake communities choose to leave them in place, but they can also be removed mechanically if desired. This plan provides for the removal of any mud mats that may form during the second and fifth years. If they do form as a result of the waterlily control, the community can assess their effect on the lake and decide at that point whether to remove them or leave them in place.

Monitoring

Surveys after the initial application are essential to determining the success of the effort, and will be used to determine what measures need to be implemented to complete the waterlily control in successive years.

Yellow flag iris (*Iris pseudacorus*), Bohemian knotweed (*Polygonum X bohemicum*) and Purple loosestrife (*Lythrum salicaria*)

Control (years 1-5)

Control strategies are underway by the Mason County Noxious Weed Control program and engaged property owners for these three noxious weeds. The success of those efforts will be monitored during the 5 year duration of the proposed fragrant waterlily treatment.

Section 7 – Plan Elements, Costs and Funding

Implementation of the Spencer Lake IAVMP is scheduled to span five years, at a total estimated cost of $48,000.00. Table 12 outlines the tasks and estimated costs of implementation on an annual basis. The budget is broken into five one-year segments. This partitioning will allow for more definitive budget strategizing in the short term and adaptive management in the later years of the project. It is anticipated that the majority of the costs would accrue in the first three years, the period of most aggressive treatment. As the project progresses, more funds are dedicated at detecting and controlling reintroduction of aquatic noxious weed species.

Costs of the Plan

Many of the planning costs have already been incurred through the creation of this IAVMP. Approximately 75% of the cost of surveys, researching, planning for and writing this management plan came in the form of a grant from the Washington State Department of Ecology's Aquatic Weeds Management Fund. The remaining costs came in form of salary match from Mason County Noxious Weed Control staff and volunteer participation by Spencer Lake residents on the Steering Committee. Total planning costs are estimated to be $32,000.00.

Capital Costs

There are no capital costs associated with this IAVMP. It is not anticipated that any equipment will need to be purchased.

Operational and Maintenance Costs

The majority of expenses associated with implementation of the Spencer Lake IAVMP are operational and maintenance costs. These costs include hiring of herbicide contractors, mapping and surveying, follow- up weed removal, community outreach, and project administration and management (Table 12).

Sources of Funding

Funding for implementation of the Spencer Lake IAVMP will come from a combination of sources that may change as the project progresses. Potential sources of funding such as grants, formation of a Lake Management District, and self-funding were all considered by the Steering Committee. The grant funding option depends on a blend of contributed funds, matching cash funds, and matching in-kind volunteer hours.

Grants

The Washington State Department of Ecology's Aquatic Weeds Management Fund (AWMF) is a potential source of funding for IAVMP Implementation. The Spencer Lake IAVMP has been developed to be consistent with all AWMF guidelines and requirements. The plan has overwhelming support from the Spencer Lake community and Mason County Noxious Weed Control is willing to work with the Implementation Committee on the application process.

Matching Funds

Awarding of the Ecology's AWMF grant requires matching funds. Requiring matching funds distributes the responsibility of funding between the state agency (Ecology) and the local stakeholders (Spencer Lake residents and the Mason County Noxious Weed Control Program). Both cash match and in-kind match are proposed to be used to fulfill this requirement. Cash matching funds are proposed to come from staff hours of Mason County Noxious Weed Control Program employees. The value of Mason County staff hours includes the total hourly cost of that employee's time. These total costs include: hourly rate, benefits, paid time off, and overhead. In-kind matching funds are proposed to come from volunteer labor and services/supplies provided by Spencer Lake residents.

Table 12 – Proposed Spencer Lake
IAVMP Implementation Budget

Task		Year 1	Year 2	Year 3	TOTAL Years 1-3	Year 4	Year 5	TOTAL Years 4-5	TOTAL (5 years)
	Fragrant waterlily Management: Permitting, Public Notification, Herbicide Application	$8,000.00	$6,000.00	$4,000.00	$18,000.00	$4,000.00	$4,000.00	$8,000.00	$26,000.00
	Waterlily mat cleanup	0	$2,000.00	$2,000.00	$4,000.00	$1,000.00	$1,000.00	$2,000.00	$6,000.00
	Contractor management	$200.00	$200.00	$200.00	$600.00	$200.00	$200.00	$400.00	$1,000.00
Weed surveys		0	$1,000.00	$700.00	$1,700.00	$500.00	$400.00	$900.00	$2,600.00
Education & Outreach	Education and Outreach (volunteers)	$200.00	$200.00	$200.00	$600.00	$100.00	$100.00	$200.00	$800.00
	Education and Outreach (Mason County staff)	$200.00	$100.00	$100.00	$400.00	$100.00	$100.00	$200.00	$600.00
Project Administration and Report Writing		$3,000.00	$2,000.00	$2,000.00	$7,000.00	$2,000.00	$2,000.00	$4,000.00	$11,000.00
	sub totals	$11,600.00	$11,500.00	$9,200.00	$32,300.00	$7,900.00	$7,800.00	$15,700.00	$48,000.00

	= hired contractor
	= Mason County staff
	= Spencer Lake community volunteers

Section 8 – Implementation, Monitoring and Evaluation

Implementation

The implementation of the plan will follow the process outlined below:

Convene a project Implementation Committee. This group will most likely consist of members from the Spencer Lake IAVMP steering committee, other interested community members and Mason County Noxious Weed Control, acting in an advisory capacity. They will direct the implementation of the IAVMP.

Identify Funding Sources. The most likely source for funds to support the implementation of this plan is the Washington State Department of Ecology Aquatic Weed Management Fund Grant (AWMF). Other local and regional grants may be pursued as well. The AWMF grant requires matching funds and time from the local agency and community and could fund the entirety of the plan. This type of grant requires that the local community works in conjunction with a local government agency (Mason County Noxious Weed Control).

Issue a Request for Proposal for noxious weed control work.

Select an Herbicide Contractor. An approved herbicide contractor will be selected by the Implementation Committee for treatment of the weeds outlined in this plan. Contract proposals will include costs for the permit application and annual invoices, herbicide applications, and notification and postings required by the permits.

Public Education and Communication. The residents of Spencer Lake will be notified about any upcoming herbicide applications as determined by the requirements in the NPDES permit, the results of yearly monitoring efforts, and any major changes made to the plan via the Implementation Committee, the Spencer Lake Facebook page or by the United States Postal Service. Much of this communication will be carried out by active members of the community who are involved in the Implementation Committee. The Committee will take into account public feedback when making decisions about the plan.

Application of Herbicide. Application of the herbicide will be completed as prescribed in this IAVMP unless consultation with the community, Ecology and/or the applicator leads to defensible changes in the plan and it is approved by the Implementation Committee and the Department of Ecology.

Apply follow-up treatment if necessary.

Long Term Monitoring and Maintenance. This will be done by Mason County Noxious Weed Control or professional contractors. Funding and timing of continued monitoring and maintenance will be determined by the Mason County Noxious Weed Control and Spencer Lake residents. Surveys will be done at the same time each year in order to get a comparable measure of the plants distribution and density. Members of the Spencer Lake community will evaluate the management of aquatic weeds and the effectiveness of plant management strategies. Residents will be encouraged to combine efforts, including manually removing aquatic plants.

Manual follow-up. Each year in late summer, a few weeks after herbicide treatment occurs, community members will manually remove the reproductive parts of plants that were not treated. This will include removal of purple loosestrife flower heads, removal of any yellow flag iris seedpods, and gathering of any nuisance dead waterlily mats.

Monitoring

Yearly surveying and monitoring of emergent, floating and submerged aquatic noxious weeds will be conducted at Spencer Lake. These surveys will evaluate the effectiveness of treatment strategies, help guide noxious weed control efforts and provide a year-to-year baseline for progress towards weed eradication. The surveys will be done by professional contractors, Mason County staff, or possibly volunteers, using small boats. During the surveys, mapping of the aquatic noxious weeds will be done using aerial photos and/or GPS data loggers. Collected data will then be transferred to GIS.

Change in the aquatic plant community will likely occur in response to any treatment. It is critical that frequent and thorough surveys be conducted to document these changes and to detect any new infestation of invasive plants.

Subject to funding availability, a GIS survey and mapping effort may be performed as a regular component of the long-term management of noxious weeds at Spencer Lake. This survey effort will identify all plant species present in the lake and their relative abundance. The survey map will include past management areas for comparison to plant densities observed in previous surveys and assessment of management effectiveness. The plant surveys will also help provide guidance for aquatic plant management in future years.

Evaluation

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

Long Term Sustainability

The long term sustainability of this project is dependent on the commitment of the property owners and residents of the Spencer Lake community to undertake successive weed control and the ability of the staff of the Mason County Noxious Weed Control Program to communicate weed control techniques, strategies and priorities. In the absence of the Washington State Department of Ecology's AWMF funding, options will be re-evaluated by the Steering Committee.

Through their participation in the development of this IAVMP, the Spencer Lake Community has demonstrated their desire to support this plan for the long term. Mason County Noxious Weed Control staff will be able to provide specific weed control strategies for situations as they arise in the future. Ideas introduced by community members for long term maintenance of the project's control efforts include:

- members of the Community acquiring and using an aquatic herbicide applicators license
- formation of a Lake Management District
- community weed pulling work days
- a new dedication by property owners to control noxious weeds on their property

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Appendix A

Meeting Agendas, Meeting notes, and Public Notices

Meeting Agendas

Informal Meeting

Spencer Lake Integrated Aquatic Vegetation Management Plan
Zacher Residence
290 E North Cove Rd.
Date: March 19, 2016

AGENDA

Introductions

Background of project

Timeline

Discussion

Next Steps

- Steering Committee
- Public meeting with larger lake community
    - Time of year/Day of week
    - Location

Steering Committee

Spencer Lake Integrated Aquatic Vegetation Management Plan

Zacher Residence

290 E North Cove Rd.

Date: April 09, 2016

AGENDA

Identify key members (2) of the steering committee

Initiate Phase I of the plan

- Develop a problem statement
- Identify management goals

Involve the public

- How, where, when

Action Items

Schedule next meeting of the steering committee

Other business

Steering Committee

Spencer Lake Integrated Aquatic Vegetation Management Plan

Zacher Residence

290 E North Cove Rd.

Date: June 11, 2016

AGENDA

Select a co-steering team leader

Public Meeting

2-3 potential dates

Draft letter

Schedule next meeting of the steering committee

Other business

COMMUNITY MEETING

Friday, July 22, 2016
6:00 PM
PUD 3
2621 E Johns Prairie Road
Shelton, WA 98584

Agenda

I. Introduction – Patricia Grover, Coordinator, Mason County Noxious Weed Control Board

II. Spencer Lake Steering Committee – Doris Zacher, Co-Chair, Spencer lake IAVMP Steering Committee

III. Harmful Algae Blooms and Shoreline Living – Katie Otanez, Environmental Health Specialist, Mason County Public Health

IV. Aquatic Plants – Arline Fullerton, Aquatic Plant Specialist

V. Questions

Steering Committee

Spencer Lake Integrated Aquatic Vegetation Management Plan

Zacher Residence
290 E North Cove Rd.
03/24/2018

AGENDA

9:30 AM	Introductions
9:45 AM	Administrative/Financial Update -Pat
10:00 AM	Draft Plan Review
11:00 AM	Funding Options – John Tolton
11:15 AM	Moving Forward

- Mason Lake Public Hearing for Lake Management District
- Next Steering Committee Meeting
- Public Meeting for Plan Review
- Other

11:30 AM	Braden O'Neil with Aquatechnex
12:00	Adjourn

Steering Committee

Spencer Lake Integrated Aquatic Vegetation Management Plan

Zacher Residence
290 E North Cove Rd.
04/14/2018

AGENDA

9:30 AM	Introductions
09:45	Postcard Mailing Prep
10:30 AM	May 11 Public Meeting Plans
11:00	Plan Review
11:45	Other Business
12:00	Adjourn

Steering Committee

Spencer Lake Integrated Aquatic Vegetation Management Plan

Spencer Lake Bar & Grill
1180 E Pickering Rd, Shelton, WA 98584
05/04/2018

AGENDA

12:00 PM	Introductions
12:15	Updates from steering committee members John and Steve – BOCC meeting and Mason Lake Pat Anyone else?
12:45	Format for Public Meeting Tasks to be completed Q & A response
1:45	Other Business
2:00	Adjourn

COMMUNITY MEETING

Friday, May 11, 2018
6:00 PM
PUD 3
2621 E Johns Prairie Road
Shelton, WA 98584

Agenda

I. Introduction – Patricia Grover, Coordinator, Mason County Noxious Weed Control Board

II. Spencer Lake Steering Committee – Doris Zacher, Co-Chair, Spencer lake IAVMP Steering Committee

III. Overview of project – Patricia Grover

IV. Questions

Meeting Minutes

February 22, 2016

Meeting Notes

Attending

Doris Zacher - Resident
Gerry Zacher - Resident
Jeannine Polaski –Resident
Bill Estep – Resident
Stephanie Brooks – Resident
Lizbeth Seebacher – Washington State Department of Ecology
Margaret Bigelow – Washington State Department of Fish and Wildlife

The occurrence of blue-green algae blooms during the winter months is what has prompted this meeting. It is secondary to the development of the IAVMP, however many of the same interested parties were in attendance.

Stephanie Brooks provided photos and history of her experiences at Spencer Lake. What her concerns are and what she had learned. This introduction was followed by a tour of the lake by boat, including those areas impacted by high water events and the dike at the south end of the lake which was built at some time in the 1960's.

A meeting with the Deffinbaughs, property owner with the WDFW easement (lake outlet) followed. The beaver dam at the outlet has been breached for some time, and did not seem to be contributing to the high water situation experienced recently at the lake.

WDFW will look into the status of the outlet re: maintenance, beaver populations, etc.., and rationale utilized for the number of fish released.

WSDOE/water quality/grant opportunities

MCNWCB proposed several dates/times for an informal meeting of lake residents to discuss the IAVMP.

April 09, 2016

Spencer Lake Steering Committee Meeting Notes

Time & Place

0900-1100
Zacher Residence

Attending

Bill Estep	John Tolton	Steve Evander
Diane Cox	Carol Lindahl	Doris Zacher
Gerry Zacher	Pat Grover	

I) **Steering Committee leads:** Doris Zacher and ?

II) **Existing Information:** Stephanie Brooks has undertaken extensive research pertaining to the history of Spencer lake, various studies and reports. Her work can provide much of the background information and foundation for the IAVMP.

III) **Problem Statement Development**

Who are the Users of the Lake?

Residents use of the lake is very diversified. Fishing, swimming, boating (including manual and motorized), waterskiing, underwater snorkel or scuba, photography, birdwatching and nature appreciation were all identified as activities residents engage in.

Public
The WDFW access provides public access to the lake for motorized and non-motorized watercraft. Fishing, both trout and bass, was identified as the primary activity this user group is involved in.

Float Plane – Aircraft from Kenmore Air and private aircraft utilize the lake for training and access

Some swimming by the public takes place at the lake although access is limited.

Other Community
The Spencer Glen community and Spencer Lake RV Park are community users of the lake.

Living Resources, including fish, birds and mammals
The lake ecosystem is utilized by a variety of wildlife, including deer, beaver, otters, birds. Non-native mammals, opossums, rats and mink have also been reported.

Government entities
WDFW and WDOE frequent the lake for fish count and identification, water quality and toxicology testing.
Mason County Public Health

What users consider to be the problem?

- Vegetation obstructs boat traffic, especially in the channel between the main waterbody and the north cove of the lake
- Dangerous for swimmers
- Impacts property values
- Limits general access to waterfront
- Potential to raise water levels over time with potential impacts to existing drain fields
- May contribute to blue-green algae growth
- Restricts air and water movement, potentially resulting in an increase in mosquitos or other insects
- Loss of bass habitat in the winter when plants die down

Group problems into categories:

Suggested categories might be:

Physical
Economic
Aesthetic
Biological

Problems were not categorized during the meeting. There would likely be overlap between categories for some of the problems.

IV) Public Meeting

The venue and content for a public meeting were discussed.

Possible public meeting locations:

Pioneer School could be available with the Certificate of Insurance being provided by the county.
The Spencer Lake Bar and Grill and the fire hall were also identified.

Suggestions for content included:

A representative from WDFW to answer fish questions
Historic photos depicting lake condition over time

A June meeting is a possibility.

V) Mailing to Residents

The group discussed the option for a mailing and felt that a non-threatening, informative one-page letter to all Spencer lake property owners would be useful. This letter would provide steering committee member signature and contact information. Pat will have a draft completed and back to the group by April 30. Grant funds can be utilized for this mailing. The Spencer lake Advisory Group, or SLAG, was suggested as a name.

VI) Next Meeting

The Doodle poll works for determining the best meeting time for the group.

Meeting Minutes for June 11, 2016

1. **Select a co-steering team leader**. John Tolton graciously agreed!

2. **Public Meeting**. It is a requirement to have a public meeting as part of the plan to let stakeholders know what is happening and not happening. As the team felt the most important participants are lake land owners, we will mail letters to those, but also there will be post in the newspaper and a few other places so that all stakeholders can have an opportunity to come. Likely only public health will send a rep on an evening or Saturday, but the Fisheries and Ecology will be invited. Thought was to have a simple meeting, a few tables and try to get it done in an hour, but 2 hours will be reserved. Two meeting location venues were raised: Pioneer School and PUD3. Four dates were selected and will be sent by Doddle Poll to those that attended the first info meeting. Two Friday evenings and two Saturday mornings as potential dates: July 8, 6-8 pm; July 22, 6-8 pm; July 23 9-11 am; Aug 6, 9-11 am.

    a. Dave Mortenson to check on School availability for those dates and Pat Grover on PUD3
    b. Pat will send out poll by end of week.

3. **Informative Letter to all Spencer Lake Property Owners**. Simple letter to all lake residents to make sure they know about the plan and invite them to the meeting. Pat had a listing of all property owners but it was quite large. Diane agreed that they would could the number of houses/cabins on the lake. She has done that and sent that to the steering committee today.

    a. Doris will draft a letter and send to the steering team, ready to insert a date and place
    b. From Diane: I counted 34 houses in the North Cove plus 120 houses on the big lake. I included the two houses under construction, and the bar and grill in that count of 154, but there also at least three other properties that have travel trailers on the property (which I did not include in the count). Several other lots are so wooded at lakeside that it is hard to tell if there is a house back there or not. If I could see any sign of a building between the trees I counted it. I wasn't sure if I should count the house way back in the corner by the weir because I can't tell if it has lake access or not. I did not include vacant lots.

4. **Shoreline Living Guide**. The steering team talked about starting to hand them out as opportunities to meet people and share info. Stephanie thought it was a little too focused on salt water shorelines so she is going to investigate other tools.
    a. Stephanie to research other tools

5. **FACEBOOK Page:** Anyone can add info. Please do. Thought was we needed another FB Page for other activities we want to communicate, like a boat parade on July 4th!
    a. Stephanie to create that page.
6. **Fish and Wildlife:** They have done fish surveys again this year. We need to figure out how to get their info.
    a. Pat will make some inquiries

7. **Weed Survey:** Pat has been able to just hire 2 people. She is hoping the weed surveys can begin by the end of June.

8. **General:** Lots of discussion about what can and can't be done in the interim. We are supposed to be in possession of a lake guide for pulling weeds, which many of you got last meeting, but Pat will post a copy on FB so folks can print it out. A weed mower is being investigated by one neighbor on the south end. We would like to have more info. Info was shared on how we can get permits as small group areas, but it still takes a qualified applicator for say herbicides. But bottom line, we need the plan to get permits.
    a. Pat to follow up on weed mower

9. **Next Meeting**: We agreed that because of a near term public meeting, we will do our business by email and meet only as necessary. Summer is here!

Spencer Lake Integrated Aquatic Vegetation Management Plan

DRAFT Steering Team Meeting, March 24, 2018

Attendees: Pat Grover, John Tolton, Doris & Gerry Zacher, Steve Evander, Jack Urstadt, Braden O'Neil (AquaTechnex)

Next Meeting: April 14, 2018 9:30-12:00, Zacher's residence

Administrative/Financial Update: The amendment to extend the contract was lost in "cyberspace" so a second amendment has been signed by the Mason County Board of County Commissioners and is awaiting signature by an Ecology program manager. Year-end invoices for work completed have not yet been paid, however Pat said that we have about $14,400.00 remaining to complete the plan by June 30, 2018.

Draft Plan review: Pages 1-35 and Section 6 of the "Draft" Integrated Aquatic Vegetation Management Plan were emailed to the Steering Committee prior to the meeting. There were a few minor comments to materials and members were encouraged to send comments directly to Pat. Page 21 of the "Draft" includes a table from the recently updated and approved Mason County Shoreline Management Plan. No information available to residents, nor WDFW, suggest this to be the case. Pat will follow up with Mason County Community Development Planning Staff. Salmon are known to migrate into Malaney Creek.

Pat plans to have a draft completed by April 07, 2018. She can make copies for those who would prefer a hard copy and don't want to tax their printers. Doris is willing to have them available for pickup at her home.

Funding Options: John investigated Lake Limerick, which has an HOA. They estimate their annual Lake Management activities cost $45-60,000 per year. Based on these costs and the number of property owners at Spencer Lake, John very loosely estimated costs per resident at $200 per year.

The resolution establishing a Lake Management District for Mason Lake will expire in September 2018. The Mason County Board of Commissioners has set a public hearing for Tuesday, April 17, 2018 at 0930 to hear public testimony for the establishment of Lake Management District No. 2 for Mason Lake. Committee members were encouraged to attend to learn more about their plan and what to expect for developing a similar plan for Spencer Lake. John also commented that he had tried to contact our County Commissioner on several occasions and never received a call back. Pat suggested that she should start including them in her communications about the development of our plan.

Public Meeting for Plan Review – The steering team all agreed the sooner the better for our next public meeting. We are looking at May 4, 11,18 (Friday evening) depending on when a meeting room at PUD3 can be reserved. Pat will confirm with PUD. Good discussion was held as to speakers etc. for this meeting and anticipating what questions and comments will be made to anticipate required answers. This can be developed further at the next steering meeting.

Braden O'Neil with AquaTechnex provided an informal overview of his experience treating lake noxious weeds for Mason and Lake Limerick. We can secure one overall Lake Permit for treatment valid over 5 years for a cost of $750. The process does include submitting an application to Washington State Department of Ecology, posting public notices in the paper etc. so it could take a couple months to get a permit. Once again it was brought out that we don't need a Lake Management Plan to do this but it is helpful and we DO need the plan to apply for DOE Treatment Funds (which may or may not be granted). We discussed safety of the chemicals used (safe) and many lakes have used them without issue. We asked Braden if his company could give us an estimate for the cost of treating Spencer Lake over a multi -year process.

Meeting adjourned!

Spencer Lake Integrated Aquatic Vegetation Management Plan

DRAFT Steering Team Meeting, April 14, 2018

Attendees: Pat Grover, John Tolton, Doris Zacher, Steve Evander, Jack Urstadt, Diane Cox

Next Meeting: May 04, 2018, Time yet to be confirmed, Zacher's residence

May 11 Public Meeting Plans Pat asked, "How does the Steering Committee envision the format for this meeting?", i.e. stand up presentation, stations with experts, hybrid of the two, panel discussion or ?????

Various pros and cons of each were discussed. The group agreed to a concept to include:

- Slide presentation for an overview of the project
- Be prepared with a Q & A sheet of potential questions and answers.
- Key questions identified included:
    - For the "not my problem" attendees. Portray visually a before and after scenario. In lieu of an available model to show expansion, the pond along Hwy 3 may be a good visual for the "do nothing" alternative.
    - What's it going to cost?
        - Estimate for herbicide application
        - Estimate for diver pulling
    - How will control measures be paid for
        - Grant from Department of Ecology
        - Formation of a Lake Management District
        - Individual property owners
    - How will this provide a "betterment" to the lake and it's residents
- Confirm: The scope of the project is to target the noxious weeds, and protect the native vegetation.
- An important element would be to have various "experts" in the audience to answer questions, i.e. Arline Fullerton, Aquatic Plant Specialist, Braden O'Neil, Aquatechnic, Max Folsom from Island Lake, individual from Department of Ecology for toxicology or compliance, diver from Hartstine.

Draft Plan review: The draft plan is still pretty messy. Pat has contacted the county IT department and once it is cleaned up, a link can be posted to the County website for Steering Committee, and others, review. Steve Evander was the only Steering Committee member that requested a hard copy of the current document.

Postcard Mailing Prep 160 "Save the Date" postcards were addressed and stamped and went out in the April 14 mail. The list contains addresses for all property owners who have property fronting Spencer Lake. The list is a couple of years old. If you know of a property which has transferred ownership, please let Pat know so she can update the mailing list.

Meeting adjourned!

Spencer Lake Integrated Aquatic Vegetation Management Plan

Steering Team Meeting, May 4, 2018

Spencer Lake Bar & Grill

Attendees: Pat Grover, John Tolton, Doris Zacher, Steve Evander, Jack Urstadt, Diane Cox, Tricey Krueger

Steve will follow up with Colby Swanson from the Mason Lake Lake Management District re: his willingness to attend the Public Meeting on May 11, 2018

Details for Meeting

Meeting room is reserved from 5:00 – 8:00. Arrive at 5:00 for setup, tables, chairs, handout materials and electronics

Introduction – Doris

Powerpoint – Pat Pat will send out to the Steering Committee by Wednesday for their review

Meeting cop – Jon

Open questions to the public, or complete and submit. Decision made to have attendees ask questions

Plan for 20-50 attendees

John provided a survey which he prepared. Great! Tricey will retype into a Word document and provide to Pat to make copies.

Letters, Public Notice, etc.

June 24, 2016

To: Spencer Lake Property Owners

Subject: Public Meeting for Spencer Lake Invasive Aquatic Vegetation Management Plan

Many lake residents are aware that we have received a grant through the Mason County Noxious Weed Control Board to develop a plan on what we can do to control the non-native weeds in our lake. Non-natives have now spread from the north and south end of the lake to the main lake body. We want to make sure all lake landowners are aware of this grant.

The grant covers only the development of a plan with control options. We need a plan in place in order to obtain permits to do anything outside of manual means. Work within the grant includes a survey to identify and document the noxious and non-native water plants which then allows for the identification of options on how to control these plants safely in our environment. After the plan is complete, property owners around the lake can decide what we want to do.

This past year, for the first time, Spencer Lake experienced some severe algae blooms during the winter. Samples were tested three times and found to be within acceptable health limits. This illustrates water quality changes that concern us all. This plan will NOT address the algae, but it must be considered as changes in one area can affect others. However, this is a good time to bring awareness of how our individual actions can also impact lake water quality. These can be actions such as lack of septic system maintenance and fertilizer usage.

The grant requires a public meeting to inform interested stakeholders about this plan. This is not an action, but an informational meeting. We invite you to come! It is a great chance to meet your neighbors!

Date: Friday July 22, 2016
Time: 6-7 p.m.
Place: Mason PUD 3
2621 E Johns Prairie Rd., Shelton, WA 98584

From: Spencer Lake Noxious Weed Steering Team: Stephanie Brooks, Diane Cox, Steve Evander, Bill Estep, Lois Hoffman, Carol Lindahl & Dave Mortensen

Co-Chairmen: John Tolton & Doris Zacher

You're Invited to a Public Meeting

Regarding the Integrated Aquatic Vegetation Management Plan (IAVMP) at Spencer Lake

Join your Spencer Lake neighbors at a meeting to learn about the IAVMP process and what has been accomplished.

Information about aquatic plants, shoreline living and water quality will be available for review.

Friday, July 22

6-7 pm

Mason PUD 3

2621 E Johns Prairie Rd.

Shelton, WA 98584

To RSVP or for more information, please contact Patricia Grover, Mason County Noxious Weed Control Board at:

360-427-9670 ext. 592

PatriciaG@co.mason.wa.us


Save the Date!
Public Meeting
Spencer Lake Integrated Aquatic Vegetation Management Plan
May 11, 2018 @ 6 PM

SAVE THE DATE

Public Meeting

Spencer Lake Integrated Aquatic Vegetation Management Plan (IAVMP)

Friday, May 11, 2018

6-8 pm

Mason PUD 3

2621 E Johns Prairie Rd.

Shelton, WA 98584

For more information, please contact Patricia Grover, Mason County Noxious Weed Control Board at:

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Spencer Lake Aquatic Invasive Species Meeting

Post Meeting Survey

May 11, 2018 6:00 p.m.

1. Is this the first Aquatic Invasive Species meeting you have attended? Yes No

2. Are you a waterfront property owner on Spencer Lake? Yes No

3. Do you have water lilies or other invasive species on your waterfront? Yes No

4. If so, what is your level of concern (1=minimal, 10=great)

   1 2 3 4 5 6 7 8 9 10

5. What is your level of concern for the current infestation on the entire lake?

   1 2 3 4 5 6 7 8 9 10

6. What plan do you think is appropriate?
   a. Do nothing, let nature take its course
   b. Take immediate action (Circle preferred action: herbicide, mechanical, manual)
   c. Go with the consensus of the other property owners
   d. Oppose any action taken (i.e. chemicals, dredging, etc.)

7. If action is implemented, how do feel it should be funded?
   a. Each property owner is on their own
   b. Through the creation of a taxation district
   c. Public funding
   d. Donations and fundraising
   e. Combination of_____

8. Would you like more information or wish to be involved? Yes No

Name*_____

Address*_____

Phone_____

Email_____

Comments on the Meeting:

Summary of Survey Results

Here are the results for the surveys turned in tonight.

33 surveys turned in.
#1 16 people attended for first time. 17 attended before.

#2 All were Spencer Lake property owners.

#3 95% have invasive species on their property.

#4 level of concern was an average of 8.636 out of a possible 10.

#5 level of concern for entire lake was 8.727 out of a possible 10.

#6 90% said take immediate action. Difficult to determine between 3 choices because some picked 1 some 2 and some all 3.
10% said go with consensus.
Basically that means 100% are in favor of moving forward.

#7 for the funding question some people picked more than one option.
1 person picked everyone on their own
21 picked taxation district
11 wanted public funding
10 picked donations and fund raising
8 picked combination.

Taxation district has 63.6 %

#8 16 people wanted more information or to be involved.

Appendix B

Noxious Weed Best Management Practices

Fragrant Water Lily

Nymphaea odorata
Nymphaeaceae

Class C Noxious Weed
Control Recommended

Legal Status in King County: Fragrant water lily is a Class C noxious weed (non-native species that can be designated for control based on local priorities) according to Washington State Noxious Weed Law, RCW 17.10. The State Weed Board has not designated this species for control in King County. The King County Weed Control Board recommends control of this species where feasible, but does not require it.

BACKGROUND INFORMATION

History and Impacts

- *Nymphaea odorata* is native to the eastern half of North America, including southern Canada. It has been introduced as an ornamental in many parts of the world and is now found throughout North America. Although found throughout Washington, fragrant water lily is especially prevalent in western Washington lakes where it has been intentionally planted by property owners who admired the showy flowers.
- It is believed that fragrant water lily was originally introduced into Washington during the Alaska Pacific Yukon Exposition held in Seattle in the late 1800s.
- Left unmanaged, water lilies can restrict lake-front access and hinder recreation.
- Drownings in King County have been attributed to swimmers getting tangled in dense water lily stems.
- Water lilies foul boat motors and restrict passage for non-motorized boats.
- When allowed to grow in dense stands, the floating leaves prevent wind mixing and extensive areas of low oxygen can develop under water lily beds during the summer.
- Aggressive water lily mats can outcompete native plants, reduce biodiversity, change the predator/prey relationships in the lake and adversely impact the food web.
- Stagnant mats create mosquito breeding areas and increase the water temperature underneath by absorbing sunlight.
- Water lilies die back in the fall, and the resulting decay uses up dissolved oxygen and adds nutrients to the water, potentially increasing algal growth and related water quality problems.

Description

- Perennial floating leaved rooted aquatic plant, growing in about three to six feet of water. Blooms June to October.
- **Round, green leathery leaves** up to 10 inches across have a basal slit. The flexible leaf stalk is attached at the base of the slit. The leaves float on the surface of the water, rarely sticking up above it as water level drops.
- **Many-petaled Flowers** are showy and range from white to pink (rarely yellow). They are borne on an individual stalk which curls like a corkscrew after the flower has been fertilized and pulls the flower under water. Seeds are leathery capsules with numerous small seeds.
- Both flower and leaf stalks arise from **thick fleshy rhizomes**.
- Adventitious roots attach the horizontal creeping and branching rhizomes.

Habitat

- Fragrant water lily occurs in shallow freshwater ponds and lake margins 3-6 feet deep.
- It will also grow in slow moving water.
- It can tolerate a wide range of pH, and it prefers substrates from mucky to silty.

Reproduction and Spread

- Spreads by floating seed and by rhizomes.
- Seeds disperse through the water by wind and wave action.
- Rhizome pieces can also break off and move through the water before establishing in a new location.
- A planted rhizome will spread to cover about a 15-foot diameter circle in five years.
- Primary source of distribution to new water bodies is deliberate planting. Many cultivars of *Nymphaea odorata* are available in the nursery trade. However, waterfowl can also spread the plant between water bodies.

Local Distribution

- While fragrant water lily is widely present in western Washington, it is less so in eastern Washington and uncommon to absent in western Oregon lakes.
- *Nymphaea odorata* was found in 27 of 36 surveyed lakes in the developed areas of King County in 1996. The number of ponds and smaller wetlands containing the plant is considerably larger.
- Requests for water lily control represent a high percentage of the herbicide permit requests received by the Washington State Department of Ecology.

CONTROL INFORMATION

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.
- Use a multifaceted and adaptive approach. Select control methods which reflect the available time, funding, and labor of the participants, the land use goals, and the values of the community and landowners. Management will require dedication over a number of years, and should allow for flexibility in method as appropriate.

Planning Considerations

- Survey area for weeds, set priorities and select best control method(s) for the site conditions and regulatory compliance issues **(refer to the King County Noxious Weed Regulatory Guidelines)**.
- Small infestations may be effectively removed using manual methods or hand tools.
- For many lake and wetland infestations, the whole community will need to be engaged. Any control actions taken will necessarily affect all landowners adjacent to the water body and will require their approval and participation in order to succeed. In addition, many control options will be expensive.
- Commit to monitoring. Once initial control has been achieved, be sure to conduct follow up monitoring in subsequent years in order to catch any overlooked patches or returning infestations before they can spread. Without this, your control efforts can be wiped out within a few years.

Early Detection and Prevention

- Look for new plants. Get a positive plant identification from an authority such as King County Noxious Weed Control Program staff.
- Look for plants along lake shorelines and in stagnant or slow-moving water in wetlands and streams.
- The best time to begin surveys is late spring when new leaves arise, and they can continue into early fall when the plants senesce.
- Dig up small isolated patches.
- Don't plant fragrant water lily in natural water bodies. It is legal to buy and plant water lilies, but their use as an ornamental should be restricted to small self-contained ponds and other man-made water features with no hydrologic connection to any natural body of water.

Manual

- Hand pulling or cutting can be successful for a small area if repeated on a regular basis. Impractical for large infestations. Must remove all pulled or cut plants and plant parts from the water. HPA pamphlet permit required.
- Carbohydrate depletion is a technique whereby during each growing season, all emerging leaves are consistently removed. Reports indicate that it takes about two to three seasons to kill the plants. This method is difficult to sustain and impractical for large infestations.
- To completely remove plants by hand you must dig up the entire rhizome. HPA pamphlet permit required.
- All manual control sites should be monitored for several years for signs of plants growing from root fragments and from the seed bank.
- Hand pulling and the use of hand mechanical tools is allowable in all critical areas.
- Fragrant water lily can be composted on land or placed in yard waste bins.

Mechanical

- Permits are required for all mechanical control methods.
- An opaque bottom barrier can be used to suppress 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. Not practical for large-scale infestations.
- Cutting and Harvesting using boat-mounted cutters or in-lake harvesting barges is a reasonable long-term control solution. These must be done on a regular basis to maintain control. Neither method will eradicate an infestation.
- Rotovation (underwater rototilling) dislodges the large, fleshy waterlily rhizomes which can then be removed from the water. This process results in the permanent removal of waterlily rhizomes. Rotovation results in significant short term turbidity and loss of water clarity and quality.
- Other mechanical solutions that have been tried include mounting a backhoe to a barge and digging the plants out.

Chemical

- Herbicides may be the most reasonable option for eradication of large fragrant water lily infestations. Professional licensed contractors are available for hire to perform this task.
- Herbicides can only be applied to aquatic systems in Washington State by a licensed pesticide applicator. Aquatic formulations of herbicides are not available for sale over the counter to anyone without an aquatic pesticide license. NEVER **apply non-aquatic herbicide formulations to water since most of them include ingredients that are toxic to aquatic organisms**.
- For several years following treatment, monitor areas for new plants germinating from the seed bank. Eradicate any new growth using one of the manual control methods above.

Specific Herbicide Information

Glyphosate (e.g. Rodeo™ or Aquamaster™) Apply to actively growing foliage. Avoid runoff. Caution: Glyphosate is non-selective: it will injure or kill other vegetation contacted by the spray. NEVER substitute Round-up™ or other landscape formulations of Glyphosate: these have additives that can devastate aquatic systems.

Imazapyr (Habitat®) Apply to actively growing foliage. Caution: Imazapyr is non-selective: it will injure or kill other vegetation contacted by the spray.

Triclopyr (Renovate†3). Apply to actively growing foliage. Triclopyr is selective: it will injure other broadleaved plants but not grasses or other monocots such as cattails, rushes, or most native aquatic plants.

All the above listed herbicides require the addition of an approved surfactant. Follow label directions for selecting the correct type of surfactant. Be sure that the selected surfactant is approved for aquatic use.

The mention of a specific product brand name in this document is not, and should not be construed as an endorsement or as a recommendation for the use of that product. Chemical control options may differ for private, commercial and government agency users. **For questions about herbicide use, contact the King County Noxious Weed Control Program at 206-296-0290.**

Biological

- There is currently no biological control approved for fragrant water lily.
- Although a number of organisms have been studied in the past, there is no current plan to pursue biological control for fragrant water lily due to the widespread use of the plant as an ornamental in private, isolated water features.

SUMMARY OF BEST MANAGEMENT PRACTICES

- At all times at minimum a pamphlet HPA permit is required to do any activity that disturbs a lake bottom or wetland or streambed. For more extensive work, more specific permits will be required.
- Hand pulling, cutting or digging is recommended for small populations.
- Where this is not practical, cutting or harvesting can keep a large population under control when done consistently.
- Bottom barriers can maintain small areas of open water around boat launches, swimming areas or docks.
- To remove large areas of water lilies, mechanical methods (such as rotovation) or herbicides can be used.
- **Do not apply any herbicide to water without the proper licenses**. Hire a contractor to complete the work.

Disposal Methods

- Fragrant water lily can be left on land to dry out and/or decompose in an area where it will not move into a waterway.
- Fragrant water lily can also be composted away from water or placed in yard waste bins.
- Never dispose of fragrant water lily into waterways, wetlands, or other wet sites where it might grow and spread.

References

Brayshaw, C.T. 1989. Buttercups, Waterlilies, and Their Relatives: (The Order Ranales) in British Columbia. Royal British Columbia Museum Memoir No.1. Royal British Columbia Museum

Hotchkiss, N. 1972. Common marsh, underwater and floating-leaved plants of the United States and Canada. Dover Publications, Inc., New York.

Washington Department of Ecology, 2003. Non-native freshwater plants, webpage: http://www.ecy.wa.gov/programs/wq/plants/weeds/

Westerdahl, H.E. and K.D. Getsinger, eds. 1988. Aquatic plant identification and herbicide use guide, volume II: Aquatic plants and susceptibility to herbicides. Technical report A-88-9. Department of the Army, Waterways Experiment Station, Corps of Engineers, Vicksburg, MS.

Whitley, J.E., B. Basset, J.G. Dillard, and R.A. Haefner. 1990. Water Plants for Missouri Ponds. Missouri Department of Conservation, P.O. Box 180, Jefferson City, MO 65102.

King County
Department of
Natural Resources and Parks
Water and Land Resources Division
Noxious Weed Control Program

BEST MANAGEMENT PRACTICES

Yellow-flag iris (*Iris pseudacorus*) Iridaceae

Class C Noxious Weed; Not Designated for Control

Legal Status in King County: Class C Noxious Weed (non-native species that can be designated for control under State Law RCW 17.10 based on local priorities.) The King County Noxious Weed Control Board does not require property owners to control yellow-flag iris, but control is recommended.

BACKGROUND INFORMATION

Impacts and History

- Alternate common names include yellow flag, paleyellow iris and yellow iris.
- On state weed lists in Connecticut, Massachusetts, Montana and New Hampshire in addition to Washington. Also on the USDA Natural Resources Conservation Service invasive plants list and on the Exotic Plant Pest List of the California Exotic Pest Plant Council.
- Yellow-flag iris displaces native vegetation along streambanks, wetlands, ponds and shorelines and reduces habitat needed by waterfowl and fish, including several important salmon species.
- It clogs small streams and irrigation systems, and it dominates shallow wetlands, wet pastures and ditches. Its seeds clog up water control structures and pipes.
- Rhizome mats can prevent the germination and seedling growth of other plant species. These mats can also alter the habitat to favor yellow-flag iris by compacting the soil as well as increasing elevation by trapping sediments.
- Studies in Montana show that yellow-flag iris can reduce stream width by up to 10 inches per year by trapping sediment, creating a new bank and then dominating the new substrate with its seedlings, creating still more sediment retention (Tyron 2006).
- Even when dry, yellow-flag iris causes gastroenteritis in cattle (Sutherland 1990), although livestock tend to avoid it. All plant parts also cause gastric distress in humans when ingested, and the sap can cause skin irritation in susceptible individuals.
- Native to Europe and the Mediterranean region, including North Africa and Asia Minor. Found as far north as 68 degrees North in Scandinavia.

- The earliest North American record comes from Newfoundland in 1911, and it was established in British Columbia by 1931. By 1961 yellow-flag iris was reported to be naturalized in Canada (Cody 1961). It was established in California by 1957 and in Montana by 1958 (Tyron 2006). It is now naturalized in parts of most states and provinces throughout North America except in the Rocky Mountains. (NRCS Plants Database).

Description

- A perennial, emergent iris that creates dense stands along freshwater margins. It is the only naturalized, emergent yellow iris in King County.
- Grows to 5 feet (1.5 m) tall.
- Has numerous thick, fleshy rhizomes.
- Flowers are yellow, showy, and sometimes have brown to purple veins at the base of the petals. Several flowers can occur on each stem.
- Can bloom from April to August; in western Washington usually blooms May into July. It will remain green all winter in mild years.
- Broad, flat, pointed leaves are folded and overlap one another at the base. They are generally longer in the center of the plant and fan out in a single plane toward the edges of the plant. The leaves are dark green to blue-green.
- Fruits are large capsules to 3 inches (8 cm) long. They are 3-angled, glossy green and contain rows of many flattened brown seeds.
- Seeds are corky, large - about ¼ inch (7 mm) across, and float. Seed pods grow in clusters that resemble little bunches of bananas. Seeds spread by water and usually germinate after the water recedes along the edges of the shore. They do not usually germinate under water.
- When not in flower or seed, can be confused with cattails (*Typha sp.*), which are round at the base and taller than yellow-flag iris, while iris are flattened along one plane and shorter. Can also be mistaken for native bur-reeds (*Sparganium sp.*), which have thick, spongy leaves that are somewhat narrower than iris leaves.

Habitat

- Occurs in freshwater wetlands, fens, ponds, lake shores, river and stream banks, wet pastures and ditches.
- Grows in standing water or next to it on saturated soils. Prefers silty, sandy or rocky soil.
- Generally grows in shallow water, but can create extensive mats over deeper water.
- Sometimes cultivated as a garden ornamental or used for landscaping purposes.

Reproduction and Spread

- Spreads by seed and vegetatively (rhizomes).
- Produces extensive thick, fleshy rhizomes, forming dense mats that exclude native wetland species. Up to several hundred flowering plants may be connected rhizomatously. Rhizome fragments can form new plants if they break off and drift to suitable habitat. Rhizomes that dry out remain viable and will re-infest an area if they are re-moistened.

- Flat spongy seeds disperse through water and germinate after the water recedes along shorelines. Submersed seeds will generally not germinate.
- Plants take three years to mature before flowering (Tyron 2006).
- The flowers are pollinated by bumble-bees and long-tongued flies.

Local Distribution

- Widespread throughout King County.
- Present along most lake shores and many stream banks in the developed areas of the county.
- A few shallow wetlands significantly impacted.

CONTROL INFORMATION

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.
- Use a multifaceted and adaptive approach. Select control methods that reflect the available time, funding, and labor of the participants, the land use goals, and the values of the community and landowners. Management may require dedication over a number of years, and should allow for flexibility in method as appropriate.

Planning Considerations

- Survey area for weeds, set priorities and select best control method(s) for the site conditions and regulatory compliance issues **(refer to the King County Noxious Weed Regulatory Guidelines or local jurisdictions)**.
- Isolated plants can be effectively dug up. Take care to remove all of the rhizomes, in order to stop them from infesting a larger area.
- For larger infestations, the strategy will depend on the site. Generally work first in least infested areas, moving towards more heavily infested areas. On rivers and streams, begin at the infestation furthest upstream and work your way downstream.
- If conducting manual control, be sure to collect any rhizome fragments that may float free.
- Minimize disturbance to avoid creating more opportunities for seed germination.

Early Detection and Prevention

- Look for new plants. Get a positive plant identification by contacting your local noxious weed control program or extension service.
- Look for plants along river and lake shorelines, wetlands, ditches and wet pastures.
- The best time to survey is in April to June when the plants are in flower.
- Look for seedlings starting in late winter.
- Dig up small isolated patches, being sure to remove all the rhizome.
- Don't buy, move or plant yellow-flag iris.

- Clean any tools and machinery that were used in an infested area before moving to another site.

Manual

- Hand removal with the use of hand tools is allowable in all critical areas in unincorporated King County. Check with the local jurisdiction for regulations in other areas.
- When removing manually, care should be taken to protect the skin, as resins in the leaves and rhizomes can cause irritation.
- Manual control is feasible for individual plants or small stands. You can easily pull seedlings in damp or wet soil.
- Dig out mature plants, taking care to remove all the rhizome. The rhizome is tough and may require heavier tools, such as pickaxes, pulaskis or saws. If you do not get all the rhizome, more plants will be produced. Keep watching the location after you have removed the plants, and new leaves will show you where you missed any sections of rhizome. Continue to remove the rhizome, and in this way you can eradicate a small patch.
- Simon (2008) found that 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.
- Be sure to dispose of any removed pieces of rhizome 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 (Sutherland 1990).

Mechanical

- Removal of yellow-flag iris with hand held mechanical tools is allowable in critical areas and their buffers in unincorporated King County. Check with the local jurisdiction for regulations in other areas.
- In unincorporated King County, riding mowers and light mechanical cultivating equipment may be used in critical areas if conducted in accordance with an approved forest management plan, farm management plan, or rural management plan, or if prescribed by the King County Noxious Weed Control Program.
- Repeated mowing or cutting may keep yellow-flag iris contained and can potentially kill it by depleting the energy in the rhizomes after several years of intensive mowing (Tu 2003).

Cultural

- Small patches can be covered with a heavy tarp weighted at the edges for several years (Simon 2008). Be sure to extend the tarp well beyond the edges of the infestation and check periodically to ensure that plants are not growing up around the tarp. Other materials (heavy plastic, landscape cloth) are not as effective.
- Burning is not recommended. Seeds germinate and grow well after late summer burning (Sutherland 1990), and plants have a strong tendency to resprout from rhizomes after burning (Clark et al. 1998).

Biological

- Although a number of insects and pathogens are known to attack yellow-flag iris

(Tu 2003), no biological control agents are presently known, and no research is currently being conducted.

Chemical

- Herbicides should only be applied at the rates and for the site conditions and/or land usage specified on the label. **Follow all label directions**.
- Herbicides can only be purchased and applied to aquatic systems in Washington State by a licensed pesticide applicator (contact Washington State Department of Agriculture for more information on pesticide licenses).
- There are federal, state and local restrictions on herbicide use in critical areas and their buffers. Refer to the **King County Noxious Weed Regulatory Guidelines** for a summary of current restrictions and regulatory compliance issues.
- For control of large infestations, herbicide use may be necessary. Infested areas should not be mowed until after the herbicide has had a chance to work, which may take several weeks, depending on the herbicide used.
- Due to dense growth, re-application a few weeks after initial treatment will probably be needed to get complete coverage (Tyron 2006).
- For several years following treatment, monitor areas for new plants germinating from the seed bank or from rhizome fragments. In some cases several years of treatment may be necessary.

Specific Herbicide Information

Since yellow-flag iris is a monocot, only non-selective herbicides are effective. However, non-selective herbicides will injure or kill any plant they contact, so special care must be taken when using these chemicals. Both of the herbicides discussed below are non-selective.

Glyphosate (e.g. Rodeo™ or Aquamaster™). This is the most frequently used chemical for controlling yellow-flag iris. Apply to actively growing plants in late spring or early summer. Apply directly to foliage, or apply immediately to freshly cut leaf and stem surfaces. Avoid runoff. (Tu, 2003). Follow the label for recommended rates for yellow-flag iris since higher rates may provide better results. A study in Montana showed good results with 5% Rodeo plus Competitor (Tyron, 2006). Glyphosate at lower rates is not as effective as either imazapyr or imazapyr and glyphosate combined.

Imazapyr (e.g. Habitat®). Simon (2008) found that 1% imazapyr (with 1% non-ionic surfactant) sprayed in the fall resulted in good control. Imazapyr sprayed in the spring, or a combination of imazapyr (1%) and glyphosate (2.5%) sprayed in fall both result in good control, but slightly less effective than imazapyr alone. 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 do not replant the treated area for several months after application.

The above listed herbicides require the addition of an approved surfactant. Follow label directions for selecting the correct type of surfactant. Be sure that the selected surfactant is approved for aquatic use.

The mention of a specific product brand name in this document is not, and should not be construed as an endorsement or as a recommendation for the use of that product.

Chemical control options may differ for private, commercial and government agency users. **For questions about herbicide use, contact the King County Noxious Weed Control Program at 206-296-0290.**

Experimental

Preliminary trials indicate that injecting herbicide into the cut flowering stems of yellow-flag iris may provide a successful alternative treatment method with little or no non-target damage. Check with your local weed control agency for progress.

SUMMARY OF BEST MANAGEMENT PRACTICES

Small Infestations in Native and/or Desirable Vegetation

- Hand digging is recommended for very young plants not yet established.
- Larger plants from isolated small populations can be dug out from moist upland areas. This is difficult but possible with persistence.
- Replace any divots created when removing the plants to lessen the amount of disturbed soil.
- Plants emergent in standing water can be cut below the waterline.
- If manual control is not possible due to site conditions or available labor, apply appropriate herbicide by spot spray, stem-injection or wick-wiper to minimize off target injury.

Large Infestations

- Persistent mowing or cutting over several years may be effective. Cutting flowering plants will stop seed dispersal.
- Herbicide use may be necessary.
- If the infestation is in a pasture, combine control methods with ongoing good pasture management. Encourage healthy grassy areas by seeding and fertilizing. Use a mix of grass and clover species to improve resistance to weeds. Fertilize according to the soil needs.

Control in Riparian Areas or Lake Shores

- Survey area and document extent of infestation. Start eradication efforts at the headwaters and progress downstream whenever possible.
- Focus on manual removal for small infestations if possible.

- When removing vegetation near streams and wetlands use barriers to prevent sediment and vegetative debris from entering the water system.
- For larger areas where herbicide use is warranted, use the method that will cause the least amount of damage to desirable vegetation, such as spot spraying or wick wiping.
- When large areas of weeds are removed, the cleared area needs to be replanted with native or non-invasive vegetation and stabilized against erosion.
- Control of larger areas will need to incorporate a management plan lasting for several years to remove plants germinating from the seed bank and rhizome fragments.

Control on Road Rights-of-Way

- Dig up small infestations if possible.
- Spot spray if digging is not practical due to soil, site conditions or size of infestation.
- If plants are in grassy areas, re-seed after control is completed.
- If plants are sprayed, wait until the herbicide has had a chance to work (up to several weeks) before mowing.

References

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King County Noxious Weed Control Program
BEST MANAGEMENT PRACTICES

King County

Invasive Knotweeds

Bohemian Knotweed
Polygonum x *bohemicum* (*Fallopia* x *bohemica*)
Japanese Knotweed
Polygonum cuspidatum (*Fallopia japonica*)
Giant Knotweed
Polygonum sachalinense (*Fallopia sachalinense*)
Himalayan Knotweed
Polygonum polystachyum (*Persicaria wallichii*)
Polygonaceae – Knotweed/Buckwheat Family

Class B Noxious Weeds
Control Recommended
(required in selected areas)

Legal Status in King County: The species of knotweed listed above are classified as Class B noxious weeds (non-native species that can be designated for control based on local priorities) according to Washington State Noxious Weed Law, RCW 17.10. The Washington State Noxious Weed Control Board has not designated these species for required control in King County. The King County Noxious Weed Control Board recommends control of these species wherever feasible, and requires control in selected areas (see current King County Noxious Weed List for details). State quarantine laws prohibit transporting, buying, selling or offering these species for sale or distributing plants, plant parts or seeds.

BACKGROUND INFORMATION

Impacts and History

- Displaces native vegetation due to its fast-growing, dense, aggressive growth.
- Creates bank erosion problems and is considered a potential flood hazard. Despite knotweed's large rhizome mass, it provides poor erosion control.
- Lowers quality of riparian habitat for fish and wildlife. Changes nutrient cycling of rivers and lowers water quality.
- Thickets can completely clog small waterways.
- Forms dense stands that crowd out all other vegetation, degrading native plant and animal

habitat.

- Damages pavement, limits sight visibility along roads, and obscures guard rails and road signs.
- Roots interfere with drainage and septic systems.
- Invades turf and landscaped areas.
- Difficult to control because of extremely vigorous rhizomes and roots that form a deep, dense mat.
- Plants can re-sprout from very small root and rhizome fragments.
- Plant stems and rhizomes that fall into the water can create new infestations downstream.
- Japanese and giant knotweed are native to northeastern Asia. They hybridize to produce Bohemian knotweed. Himalayan knotweed is native to south and central Asia, including the Himalayas.
- All species were introduced into the U.S. and Canada starting in the late 1800s as ornamental plants and for erosion control and have since spreadwidely.

Description

- Large, clump-forming, herbaceous perennial with 4 to 12 feet tall, round canes with thin, papery sheaths and creeping roots. The hollow stems are jointed and swollen at the nodes, giving a bamboo-like appearance.
- Japanese, giant, Bohemian and Himalayan knotweed are members of the buckwheat family (Polygonaceae).
- Rhizomes can spread at least 23 feet (7 meters) from the parent plant and can penetrate more than 7 feet (2 meters) into the soil.
- Forms large, dense clones of either male or female plants.
- Stems are thick and hollow, resembling bamboo, green to reddish in color, often red-speckled. Young shoots look similar to red asparagus.
- Leaves are alternate, bright green with smooth edges. Leaf shape varies. : Himalayan knotweed leaves are like an elongated triangle, Japanese knotweed leaves are rounded with a flat base and short pointed tip Bohemian knotweed leaves vary from a heart-shaped base to a flat base and variable leaf tip shape, and giant knotweed leaves are huge, "elephant ear" type leaves with a distinctly heart-shaped base and elongated pointed tip. Leaf size also varies, however Japanese knotweed leaves are generally 4 to 6 inches long by 3 to 4 inches wide, hybrid Bohemian knotweed leaves are 7 to 9 inches long, and giant knotweed leaves often exceed 12 inches across, twice the size of Japanese knotweed leaves.
- Flowers are small, white/green on Japanese, Bohemian and giant knotweed and light pinkish-white on Himalayan knotweed and grow in showy plume-like branched clusters. Flowers form in July and August and grow in dense clusters

from the leaf joints. Flowers are either all female (form seeds) or all male (don't form seeds) on each plant.
- Flowers in late July, typically start to form seeds by mid-August.

Habitat

- Can grow in partial shade or full sun.
- Knotweed thrives in any moist soil or river cobble, but can also grow in dry areas.
- Most commonly found in the flood zone along rivers and creeks, it also grows in roadside ditches, railroad rights-of-way, unmanaged lands, wetlands, neglected gardens, and other moist areas.

Reproduction and Spread

- Knotweed typically starts growth in April, but can begin as late as June in higher elevations.
- Reproduces by seed and vegetatively from rhizomes and roots. Knotweed can spread rapidly due to its ability to reproduce vegetatively.
- Invasive knotweeds spread mainly by rhizomes. Rhizome and root fragments are dispersed by natural causes (flood, erosion) or man-made dispersal (roadside clearing, fill dirt).
- Root fragments, as small as ½ in (1 cm) can form new plant colonies and can also be spread in contaminated fill material.
- Cut or broken stems will sprout if left on moist soil or put directly into water, or if moved by beavers or earth-moving equipment. Each node on the plant stock is able to produce roots and new plants.
- Seeds can be viable for as long as 15 years. Seeds in the upper 1 inch (2 cm) of soil generally are viable for 4 to 5 years. Below 1 inch (2 cm), the seeds remain dormant longer. However, knotweed seedlings are not often found in the wild and most dispersal is by root and stem fragments.
- Knotweed canes die back with the first hard frost (Pridham and Bing 1975) and go dormant during the winter. The dead, brown stems may remain standing through the winter with new canes developing in the spring from the same rootstock.

Local Distribution

Found throughout King County. The heaviest concentrations of invasive knotweeds are found along riparian corridors and road rights-of-way. Infestations can also be found in residential gardens, wetlands, and upland areas.

CONTROL INFORMATION

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.

Use a multifaceted and adaptive approach. Select control methods that reflect the available time, funding, and labor of the participants, the land use goals, and the values of the community and landowners. Management will require dedication over a number of years, and should allow for flexibility in method as appropriate.

Planning Considerations

The key to controlling knotweed is controlling the rhizomes. What you see on the surface is only a fraction of the problem. "Control measures that fail to address the regenerative capacity of the rhizomes will not control this plant." (Gover et al 2005). Although there are potentially successful mechanical or manual control options for small patches, landscape level projects and large sites will likely require integrating herbicide into the control strategy.

Begin by surveying area for knotweed, setting priorities and selecting the best control method(s) for the site conditions and regulatory compliance issues **(refer to the King County Noxious Weed Regulatory Guidelines)**.

It is possible but not easy to control knotweed, and it is especially difficult on a landscape scale, such as along a river, or when spread over many properties. Because of knotweed's incredibly extensive root system and sprouting ability, landscape level control requires long-term planning and follow-up. Even on a patch-by-patch basis, successful eradication is likely to take several years and multiple treatments.

On rivers and streams, knotweed spreads easily downstream by water, so it is necessary to begin control from the furthest upstream infestation, including all tributaries and other upstream sources of possible re-infestation.

For large, landscape scale projects, outreach to all public and private landowners and the broader community, as well as volunteer recruitment and coordination, will improve the success of the project. Work with volunteers and other organizations in the community to expand the ability to physically get the work done. Landscape

level projects may have a greater chance of success under a coordinated effort such as a Cooperative Weed Management Area (CWMA). Grants are available for invasive vegetation removal, such as knotweed, that benefits public resources, especially for work done through non-profit organizations or government agencies.

Below, each method is first described individually, and then Best Management Method recommendations are provided for different types of infestations.

Early Detection and Prevention

- Monitor for new populations in May and June.
- Dig up isolated or small populations (50 stems or less). If there are more stems than you can remove manually, it may be necessary to treat the area with an appropriate herbicide in the late summer/early fall.
- Prevent plants from spreading away from existing populations by washing vehicles, machinery, and equipment that have been in infested areas.
- Prevent knotweed from entering waterways.
- Do not discard stems or root fragments in waterways or on moist soil.

Manual or Mechanical Control

- **When to use manual methods**: If there is easy access to the site and patches are reasonably small (50 stems or less), commit to following an intensive control regimen.
- **Variations**: Cutting, mowing, pulling, digging, covering.
- Cutting, mowing and pulling stimulates shoot growth and depletes the roots. The more shoots there are per linear foot of root, the more likely it will be to physically pull out the roots, exhaust them by depriving them of energy (i.e. by cutting the shoot off) or eradicating them with an herbicide treatment.
- When controlling knotweed manually, be sure to practice the four T's: timely, tenacious, tough and thorough (Soll 2004).
- Hand pulling and the use of hand mechanical tools to control noxious weeds are generally allowable in critical areas in unincorporated King County (refer to the **King County Noxious Weed Regulatory Guidelines** for details).
- Be aware that repeated cutting tends to produce numerous small stems that may make future treatment with stem injection more difficult.
- **CUT** stems close to the ground TWICE A MONTH OR MORE between at least April and August, and then once a month or more until the first frost, over 3 to 5 consecutive years (Soll 2004). This can vary depending on the growth of the plant. The important thing it to keep the plant from storing any new root energy.
    - Keep plants from growing taller than 6 inches.

- Using a machete, loppers or pruning shears, cut the stems to the ground surface. If using a mower/weed-eater is necessary, cut as low and as often as possible. Be sure not to scatter stems or root fragments.
- Rake and pile up the cut stems where they will dry out. Dried stems can be crushed and composted on site or discarded in yard waste.
- Stems or stem fragments left on moist soil or in water may sprout at the nodes, and the area (or adjacent areas) may become re-infested.
- Large piles of composting knotweed stems have been known to self-ignite, so take care not to create large piles and monitor regularly.
- Goats and chickens are reported to eat knotweed and in some circumstances, controlled grazing may be an option similar to intensive mowing. Be aware that goats will eat desirable vegetation as well as knotweed. Grazing should reduce the growth of knotweed, but is unlikely to completely kill the plants. For best results, maintain intense grazing pressure for at least 5 years over the entire knotweed patch or until plants stop growing back.
- Never allow cut, mowed or pulled knotweed vegetation to enter waterways.

- **DIG** up as much root as possible in August over at least three consecutive years; reported to work for small, isolated patches.
  - Roots of established plants may extend down 7 to 10 feet deep, and rhizomes are often very large and woody and difficult to dig up.
  - Be sure to carefully dispose of the roots in garbage. Do not put them in a compost pile because they remain viable for a very long time. Roots and rhizomes dry out very slowly, so burning isn't usually a feasible disposal option for rhizomes.
  - Each time you see new sprouts (start looking a week after you pull), uproot them as well, trying to pull out as much of the root as you can each time.
  - Be sure to search at least 20 feet away from the original patch center for new sprouts.
- **COVER** with heavy duty geo-textile fabric or black plastic.
  - Works better with isolated and smaller patches on open, undisturbed terrain.
  - Plan to leave the covering material in place throughout at least five growing seasons, longer if the soil is wet or the population large and well-established.
  - First, cut stems down to ground surface. Next, cover the area with geo-textile fabric or heavy duty black plastic extending beyond the plant base and stems at least 7 feet beyond the outside stems. Leave covering material loose and clean of debris, weighted down with heavy rocks or cement blocks. Watch for holes in the fabric and at the perimeters for any new growth. Every two to four weeks during the growing season, stomp down re-growth under covering material and clean debris.

- Install covering at the beginning of the year or after cutting the plant down several times during the growing season which will reduce some of the rapid plant growth.

Chemical Control

- Herbicides should only be applied at the rates and for the site conditions and/or land usage specified on the herbicide label. **Follow all label directions**.
- For your personal safety, at a minimum, wear gloves, long sleeves and pants, closed toe shoes, and appropriate eye protection. Follow label directions for any additional personal protection equipment needed.
- For herbicide use in critical areas and their buffers, certain restrictions apply depending on the site and jurisdiction. In unincorporated King County, refer to the **King County Noxious Weed Regulatory Guidelines** for a summary of current restrictions and regulatory compliance issues. Elsewhere, check with the local jurisdiction.
- Herbicides with the active ingredients glyphosate (e.g. Rodeo, Roundup, Aqua Neat among others), imazapyr (e.g. Habitat, Polaris, Arsenal), triclopyr (e.g. Garlon, Renovate, Element) and aminopyralid (e.g. Milestone) have shown to be variably effective in controlling or suppressing knotweed either separately or in combination. Results vary depending on the timing, rate and method of application. See below for detailed information.
- Aquatic herbicides are Restricted Use Pesticides in Washington and can only be purchased and used for aquatic applications by WSDA licensed pesticide applicators with an aquatic endorsement on their license. Also, state and sometimes local permits are generally required when applying pesticides in water or where herbicides are likely to drift into water.
- Aquatic herbicides that are also labeled for use in terrestrial areas, such as Roundup Custom, can be purchased and used by non-licensed individuals for treating knotweed, as long as the plants being treated are not growing in water and the herbicide is not likely to drift into water, such as with the stem injection method.

Types of Chemical Control Methods

Foliar Application

- Use a backpack sprayer or large volume sprayer.
- Easiest and fastest method, but potentially higher risk of drift onto desirable vegetation and into water and soil.
- Use a systemic herbicide that translocates from leaves to the roots.
- The most effective chemical on knotweed is imazapyr and the second most effective is glyphosate. These products can also be combined to produce

quicker visual signs of treatment, but does not increase the effectiveness of using imazapyr alone.

- The most effective time to spray knotweed with glyphosate or imazapyr is generally July to October, or between bud formation and when the plant dies back after the first frost, with later treatments in that time period generally being more effective than earlier. Early treatments may require a follow-up spray to control re-growth. This will vary with weather and water availability. Usually the most effective time for a single treatment is late August/early September.
- Non-selective herbicides such as glyphosate (e.g. Roundup) and imazapyr (e.g. Habitat, Polaris) kill both grass and broadleaf plants. Selective broadleaf herbicides will not harm most grasses if used according to label. However, there are currently no selective broadleaf herbicides that provide more than one season of knotweed control. Triclopyr and aminopyralid will provide short-term control of knotweed, but generally won't kill the plants. Metsulfuron and dicamba will also control top growth of knotweed although generally don't control the rhizomes. 2,4-D is not effective on knotweed.
- Where it is not possible to spray over the top of the plants due to height and access, spray the stems and the undersides of the leaves and get as much coverage of the plants as possible.
- Avoid spraying knotweed when bees and other pollinators are present on the flowers whenever feasible. When pollinators are present, consider spraying either before full-bloom or after petals begin to drop. You can also spray earlier or later in the day when bees are not as active. If necessary to spray when plants are in full flower, spray the stems and undersides of the leaves and avoid spraying the flowers as much as possible. You may also consider clipping and removing the flowers prior to foliar spray, or using a stem injection method. Alternately, beekeepers can be notified and asked to move bees away from areas being treated if there are concerns about exposure.
- If plants are cut back, allow them to re-grow for at least six weeks, or to about 3 to 6 feet tall, before spraying. If plants are bent over to make them shorter and easier to spray, allow them to recover for one to two weeks before spraying to make sure they are actively growing again. Typically, spraying re-growing or bent knotweed is not as effective as spraying full grown plants, but it is sometimes more efficient and necessary because of land use or visibility issues.
- If it is necessary to keep plants from growing tall for visibility or other reasons, a spring herbicide application or cutting will set back the plant so that it can be sprayed at an effective height and growth stage later in the year.
- Experience in Pennsylvania suggests June 1 as a good cutting date if follow up spraying is planned. They found that regrowth when cut June 1 is

vigorous, but limited in height (6 to 10 ft tall knotweed cut in June resulted in 2 to 4 foot tall re-growth). Cutting too early in the season can result in regrowth that reaches full height and waiting too late in the season can result in almost no regrowth and will limit the ability to spray and control next season's growth (Gover et al 2005).

- Continue to monitor and treat annually in the late summer as long as there is re-growth. Re-growth the following years will be much shorter and sparser, and can be sprayed with considerably less herbicide, although it will take more time to locate all the plants. Re-growing plants can also be dug up once they are very small, although it is still difficult to remove all the roots.
- Regardless of herbicide choice, rate or spray timing, large, established patches (hundreds or thousands of stems) will almost certainly require foliar treatments over at least three years, possibly many more. Similar to treating patches mechanically, be sure to search for new shoots up to 20 feet or more away from the central patch after herbicide treatment begins.

Specific Herbicide Information

Glyphosate: 2% to 5% solution plus surfactant (as recommended on label).

- Apply as coarse spray with complete, uniform coverage.
- Apply when knotweed is actively growing and most have reached the bud to early flowering stage until the first hard frost.
- Roundup Custom/AquaneatRodeo plus surfactant (e.g. Competitor, Agridex) are approved for aquatic sites.
- Roundup ProMax or other products containing glyphosate can be used on terrestrial sites. Add surfactant if advised on label. The concentration of active ingredients can vary by product so make sure to use the rate recommended on the label. The percent rate given here is based on a product such as Roundup ProMax that has 48% active ingredient.

Imazapyr : slow-acting and expensive but highly effective on knotweed.

- 1% solution with 0.25% to 1% surfactant or 0.5 to 1 lb per acre.
- Apply from midsummer after seed set until first killing frost.
- Habitat and Polaris are approved for aquatic sites.
- Arsenal and other imazapyr products are approved for various non-aquatic sites (see label for crop rotation and other restrictions).
- Imazapyr has some soil activity and may impact roots of other plants in the area being sprayed for several months after application. Follow label instructions before planting into treated area and use caution around tree roots and on permeable soils.

Wick Wipe

- Use an applicator wand with a sponge on the end of a reservoir for the herbicide. Wipe the sponge soaked with herbicide on the leaves and stem of the plants.
- Use glyphosate at 33 to 75 % concentration (or as directed on product label).
- Greatly reduces drift.
- Hard to get chemical on leaf surface and seems to increase personal contact with herbicide.
- May be appropriate for small re-growing plants growing near desirable vegetation.

Cut and Pour

- Not very effective and generally not recommended.
- Cut stems between lowest 2 nodes and put 3 ml undiluted (concentrated) glyphosate into stem cavity (can use a large needle with measured reservoir to be precise). Be very careful not to splash herbicide onto the ground.
- Timing best in late summer or early fall.
- Follow label directions on amount applied per acre (i.e. for the 7.5 quart per acre label rate, can only treat 2375 stems per acre at 3 ml per stem).
- Need to remove cut stems away from water where they can dry out and not spread off site.

Hollow Stem-Injection

- Timing is best from late July to end of September (or whenever the stems dry out and start splitting when injected).
- Use a stem injection gun or similar tool that can be calibrated to the required amount.
- Follow directions carefully especially on calibrating and cleaning the equipment.
- Highly effective; usually 95% or more controlled in first year.
- Greatly reduces drift, is highly selective and there are no cut stems to deal with.
- Need to inject every cane in the stand; very time and labor intensive compared with foliar spraying.
- Can only inject stems over ½ inch in diameter so there will always be small stems that can't be injected in a population, especially in the second year of treatment.
- Glyphosate is the only product labeled for hollow stem injection. Aquatic formulations of glyphosate such as Roundup Custom (formerly sold as Aquamaster), Rodeo, or Aqua Neat can be used on or near aquatic sites while Roundup ProMax and other non-aquatic formulations, can be used on non-aquatic sites.

- Inject the concentrated herbicide product into each stem between first and second nodes from the ground, or between second and third node if cane is too woody lower down.
- Most labels recommend 5 ml per cane for knotweed, but our experience and WSU Extension trials have shown that 3ml is just as effective as 5 ml, so we recommend using 3 ml.
- Mark stems immediately after injecting with spray paint or a grease pen to avoid missing stems or doubling up (once stems are injected they won't hold another dose and herbicide will spill out of the stem).
- Make sure to stay within the per acre label rate for the glyphosate product you are using. For example, with a label maximum of 7.5 quarts per acre, at 3ml per cane, you can only inject approximately 2,375 canes per acre.
- For two to three years following stem injection, plan on either spot-spraying or digging up any re-growing plants. Plants will be smaller and sparser, but follow up is essential to long term control.

Combination of Methods

- Using a combination of methods may work better for some site conditions, labor availability or land use needs. However, none of these methods are as effective as spraying full grown knotweed in late summer or using hollow stem injection.
- **Cut/Spray**: Cutting stems, followed by foliar spray 6 weeks later, instead of spraying twice, will reduce overall herbicide input into the watershed and is probably more labor efficient (can use volunteers or unlicensed crews to cut the infestation).
- **Bend/Spray**: Bend stems and then approximately 2 to 4 weeks later, spray plants. Volunteers or unlicensed crews can be used to bend the stems prior to foliar application.
- **Cut/Cover**: This method is moderately effective. Needs constant monitoring and controlling of plants around perimeter and scattered plants that grow through sheet mulch through holes/overlap areas. Every two to four weeks need to stomp down re-growth under covering material and clean off debris.
- **Spray/Spray**: Spring or summer spray followed by fall foliar spray; sets plants back so they can be sprayed at the appropriate growth stage and at the best (easiest) height. This method increases the amount of overall herbicide input into the watershed but takes the least time of the combination methods.

The mention of a specific product brand name in this document is not, and should not be construed as an endorsement or as a recommendation for the use of that product.
Chemical control options may differ for private, commercial and government

agency users. **For questions about herbicide use, contact the King County Noxious Weed Control Program or your local Weed Board or Extension Agent.**

Biological Control

- Biological control is the deliberate introduction of insects, mammals or other organisms which adversely affect the target weed species. Biological control is generally most effective when used in conjunction with other control techniques.
- There are currently no biological control agents approved for managing invasive knotweed in the United States, but it is likely that agents will be approved in the near future. In Washington, contact the WSU Integrated Weed Control Project at http://invasives.wsu.edu/aboutus.htm for current information.

SUMMARY OF BEST MANAGEMENT PRACTICES

Small Infestations in Native and/or Desirable Vegetation

- Dig up plants or apply appropriate herbicide with wick wiper or by spot spray to minimize off target injury (follow directions above for the method used).
- Monitor site throughout growing season and remove any new plants. Remember to search at least 20 feet from the original infestation.
- If using an herbicide in a grassy area, consider using a selective herbicide to avoid injury to the grass or a wick wiper or stem injector.
- Re-vegetate bare areas with appropriate vegetation or cover with mulch while desirable vegetation becomes established. Do not leave large areas of bare soil.

Large Infestations/Monocultures

- Mowing is not effective for controlling invasive knotweed infestations and can spread infestations further.
- Large infestations can be controlled with herbicides or a combination of methods (follow directions in the appropriate sections above).
- Eradication of knotweed with a single herbicide application is difficult. Typically it takes several treatments, over 4 to 6 years to get an infestation under control.
- If using the covering method, be sure to monitor for knotweed growth on the edges of sheet-mulched sites, at overlapped areas in the sheet-mulch, and where sheet-mulch has been staked. For sprayed sites, monitor annually around the edges of chemically treated areas.
- Use erosion control measures in areas subject to erosion, especially on steep slopes or riverbanks.
- Plan on re-vegetating with desirable vegetation after the initial 2-3 years of treatment, especially in areas likely to be re-infested with knotweed or other

invasive vegetation. Mulch bare areas until vegetation is re-established where feasible.
- Consider replanting with vegetation that is beneficial to bees and other pollinators when clearing large areas of knotweed. Use native or non-invasive plants only.

Control in Riparian Areas

- Additional permits may be required for control of infestations in riparian areas. See the **King County Noxious Weed Regulatory Guidelines** for more information or contact your local jurisdiction.
- Whenever large areas of vegetation are removed, the cleared area needs to be replanted with native or non-invasive vegetation and stabilized against erosion. Refer to the King County Surface Water Design Manual for further information about sediment and erosion control practices (call 206-477-4800 or go to http://www.kingcounty.gov/environment/waterandland/stormwater/documents/surface-water-design-manual.aspx for information).
- Survey area and document extent of infestation from the headwaters of waterways down.
- Consider manual removal or stem-injection for small (less than 50 stems) infestations if feasible.
- Target the knotweed, retaining and protecting native and beneficial plants.
- Use aquatic formulations where there is any risk of herbicide entering the water.
- Infested areas should incorporate a management plan lasting at least several years to control plants re-sprouting from the rhizome mass, skipped plants and any regrowth.

Control on Road Rights-of-Way

- Mowing is not an effective means of control and can spread knotweed infestations along road rights-of-way.
- Small plants should be dug up or spot sprayed with an appropriate herbicide. Large patches can be sprayed in late summer/early fall or controlled with a combination of cutting and spraying (see instructions above).
- Where necessary for visibility or other issues, plants can be cut down or sprayed in May or June and then sprayed again in late summer or early fall.

Knotweed Disposal Methods

- Knotweed crowns and rhizomes should be collected and discarded with the trash or taken to a transfer station for disposal. Composting crowns and rhizomes is not recommended.
- Knotweed stems can be composted, but they will root on moist soil so they need to be completely dried out and crushed before composting.

- Stems can be left on site to dry out and decompose if they are in a dry area where they will not move into waterways or onto moist soil. The area should be monitored for re-growth and stems should not be moved to an un-infested area.
- Large piles of composting knotweed stems have been known to self-ignite so monitor piles and avoid creating very large stacks. Knotweed stems burn when dry but the hollow compartments can burst and create small explosions when burned.
- Dried out stems may be broken up or chipped into pieces less than an inch long and then composted on site, disposed of in a city-provided yard waste container or in the green recycling at a transfer station.
- Stems of knotweed with seeds should be collected and put in the trash or taken to a transfer station. If removal is not feasible, these stems can be left on site. However, there is a risk of spread from the seeds, so the area should be monitored for several years for seedlings. Stems should be left well away from waterways, shorelines, roads and un-infested areas.
- Never dispose of knotweed plants or plant parts into waterways, wetlands, or other wet sites where they might take root or infest areas downstream.

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Purple Loosestrife

Lythrum salicaria
Lythraceae

Class B Noxious Weed
Control Required

Legal Status in King County: Purple loosestrife is a Class B Noxious Weed (non-native species harmful to environmental and economic resources that landowners may be required to control based on distribution in the county and local priorities) according to Washington State Noxious Weed Law, RCW 17.10. In accordance with state law, the King County Noxious Weed Control Board requires property owners to control purple loosestrife on private and public lands throughout the county (control means to prevent all seed production and to prevent the dispersal of all propagative parts capable of forming new plants). In addition, state quarantine laws prohibit transporting, buying, selling, or distributing plants, plant parts or seeds of purple loosestrife.

BACKGROUND INFORMATION

Impacts and History

- Purple loosestrife is an invasive and competitive noxious weed that alters wetland ecosystems by replacing native and beneficial plants. Water-dependent mammals and waterfowl and other birds leave wetlands when their food source, nesting material and shelter are displaced by purple loosestrife.
- Dense infestations of purple loosestrife also alter the landscape by trapping sediments and thereby raising the water table.
- Although young shoots of purple loosestrife are palatable to cattle (and to white-tailed deer), larger plants are not, and so cattle graze preferentially on pasture grasses, giving purple loosestrife a distinct advantage in grazed areas. Over time, mature purple loosestrife plants will dominate, removing the use of the land as pasture. Similar processes can lead to destruction of hay meadows. Occasionally, deer browse the tops of mature plants in wetlands, but this doesn't appear to reduce the overall density of purple loosestrife.
- Purple loosestrife was introduced to the United States in the early 1800's at northeastern port cities, in ship ballast obtained from European tidal flats. Over the next 100 years it spread through canals and other waterways as far as the Midwest. It arrived in marine

estuaries in the Pacific Northwest in the early 1900s, suggesting that it was spread by maritime commerce.

- Purple loosestrife has also been commonly cultivated for the horticultural trade and became prized by bee-keepers in the mid 1900s. Deliberate planting and escapes from cultivation undoubtedly aided in the spread of infestations across the country.
- Purple loosestrife was first collected in Washington in 1929 from Lake Washington. The first eastern Washington collection was in the 1940s from the Spokane area, although there are reports that it escaped from a garden to the Spokane River ten years earlier.

Description

- Perennial emergent aquatic plant, reaching over 9 feet tall and 5 feet wide. As many as 30-50 herbaceous stems annually rise from a persistent perennial tap root and spreading rootstock.
- **Square stems** (usually 4-sided, sometimes 6-sided). Leaves are usually opposite. The leaves are linear in shape, 1.5 to 4 inches long, with smooth edges, and are sometimes covered with fine hairs.
- The showy **magenta or purple flowers appear from July to October** on flowering spikes. The flowers have 5 to 7 greenish sepals, 5 to 7 magenta petals and 12 stamens. Flowers will continue until frost.
- In winter months, dead, brown flower stalks remain with old seed capsules still visible.




Habitat

- Occurs in freshwater and brackish wetlands, lake and river shorelines, ponds, shallow streams and ditches, wet pastures and other wet places.
- Grows on moist or saturated soils or in shallow water. Can tolerate a range of soil pH and nutrients.
- Requires partial to full sunlight. Productivity is significantly reduced at 40% of full light.

Reproduction and Spread

- Spreads mainly by seed but also by stem and root fragmentation. A mature plant may have as many as thirty flowering stems capable of producing an estimated two to three million, pepper-sized seeds per year. Most seeds remain viable after two years in a natural water body, and stored in laboratory conditions they are viable for about three years.
- Dispersal is mainly by water, but seeds can also be transported on feathers and fur of waterfowl and other wetland animals as well as in mud on boots, tires, boats and pets. There is also some evidence of wind dispersal.
- Seedling densities sharply fall beyond 34 feet of the parent plant.
- Seed banks build for years, unnoticed until the right conditions of disturbance appear, resulting in a population explosion. Mature plants can live for 20 years.
- Vegetative spread is also possible. Buried stems harbor adventitious buds with the ability to produce shoots or roots. Breaking off stems or roots during incomplete plant removal initiates bud growth. Removed stems left on moist soil will also grow roots and sprout.

Local Distribution

- Found on lakes and waterways in many areas of King County.

CONTROL INFORMATION

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.
- Use a multifaceted and adaptive approach. Select control methods that reflect the available time, funding, and labor of the participants, the land use goals, and the values of the community and landowners. Management will require dedication over a number of years, and should allow for flexibility in method as appropriate.

Planning Considerations

- Survey area for weeds, set priorities and select best control method(s) for the site conditions and regulatory compliance issues **(refer to the King County Noxious Weed Regulatory Guidelines or local jurisdictions)**.
- Control practices in critical areas should be selected to minimize soil disturbance or efforts should be taken to mitigate or reduce impacts of disturbance. Any disturbed areas need to be stabilized for erosion and sediment control.
- Erosion and sediment control (ESC) means any temporary or permanent measures taken to reduce erosion, control siltation and sedimentation, and ensure that sediment-laden water does not leave the site or enter into wetlands or aquatic areas. Refer to the **King**

County Surface Water Design Manual, Appendix D for ESC Standards (http://www.kingcounty.gov/environment/waterandland/stormwater/documents/surface-water-design-manual).

- Minimizing soil disturbance also reduces germination of weed seeds.
- Small infestations can be effectively hand-pulled or dug up if conditions allow (see section on Manual Control for more information). Isolated plants should be carefully removed in order to stop them from infesting a larger area.
- For larger infestations, the strategy will depend on the site. Generally work first in least infested areas, moving towards more heavily infested areas. On rivers, begin at the infestation furthest upriver and work your way downstream.
- Minimize disturbance to avoid creating more opportunities for seed germination.
- Properly dispose of all parts of the plant (see **Disposal Methods** section below).

Early Detection and Prevention

- Look for new plants. Get a positive plant identification by contacting your local noxious weed control program or extension service.
- Look for plants along river and lake shorelines, in ponds, wetlands, ditches and wet pastures.
- The best time to survey is in July and August when the plants are flowering; however, seedlings may not flower in the first year.
- Look for seedlings starting in June.
- Dig up or pull small isolated patches.
- Prevent plants spreading from existing infestations by cleaning off equipment, boots, clothing and animals that have been in infested areas.
- Don't buy or plant purple loosestrife. According to state quarantine laws it is illegal to buy, sell or offer purple loosestrife or any of its cultivars for sale.

Manual

- Hand pulling and the use of hand mechanical tools is allowable in unincorporated King County critical areas. Check with the local jurisdiction for regulations in other areas.
- If the plants are in flower or seed, **cut off and bag all flower stalks and seed heads**. It is very difficult to pull the plants without dispersing the small, lightweight seeds. Brush off boots, clothes and animals before leaving the infested area.
- Hand pulling is recommended when plants are rooted in mucky, sandy or other loose, wet soil. Grasp the base of the plant and pull slowly with steady pressure to release the roots from the soil. Pulling purple loosestrife by hand is easiest when plants are young. Older plants have larger roots that

can be eased out with a garden fork. Remove as much of the root system as possible, because broken roots may sprout new plants.

- Cutting plants at the base when in flower may prevent seeding, but cut plants may continue to produce flowers. Sites should be consistently and regularly monitored until frost to cut and remove any subsequent flowers. Cutting will not kill the plants, and they will need to be controlled every year. Do not leave cut plant parts on site, because root and stem fragments can take root and form new plants.
- All manual control sites should be monitored for several years for plants growing from root fragments and from the seed bank.
- DISPOSAL: All purple loosestrife plant parts, including flowers, seed heads, stems, leaves and roots must be securely bagged, and discarded in the trash or taken to a transfer station. **Do not compost or place in yard waste. Plants may regenerate in compost. If you have the ability to burn plants, following all local regulations and restrictions, burning vegetative material is an acceptable disposal method. Do not burn flowering stems or seed heads.**
- NOTE: Under the Washington State Lythrum quarantine (WAC 16.752.400-415), it is illegal to transport, buy, sell, offer to sell, or to distribute plants, plant parts or seeds of purple loosestrife into or within the state of Washington. However, by following the recommendations in this Best Management Practices document you are covered under the King County Noxious Weed Control Program's permit to transport purple loosestrife for the purpose of taking it to a transfer station or landfill.

Mechanical

- Removal of purple loosestrife with hand held mechanical tools is allowable in critical areas and their buffers within unincorporated King County. Check with the local jurisdiction for regulations in other areas.
- Mowing is not recommended. Since plant fragments can produce new shoots, mowing may facilitate spread rather than control.
- Cutting alone is not a control option for purple loosestrife. New plants will grow from the roots. Cutting late in the season but before seed set reduces shoot production more than mid-summer cutting.
- Sheet mulching or covering using black plastic, landscape fabric, or cardboard and six inches of mulch is an interim option for dense seedling infestations. It does not kill the roots of mature plants, but it does slow down growth and seed dispersal. The covering must extend several feet beyond the edges of the infestation and be weighted so the plants cannot push it up. The edges of the covered area must be monitored for plants coming up from rhizomes extending beyond the sheet. Covering materials should also be monitored for damage or gaps and repaired or re-installed as needed.

Chemical

- **Precautions**:
  - Herbicides should only be applied at the rates and for the site conditions and/or land usage specified on the label of the product being used. **Follow all label directions.**

- For herbicide use in critical areas and their buffers, certain restrictions apply depending on the site and jurisdiction. In unincorporated King County, refer to the **King County Noxious Weed Regulatory Guidelines** for a summary of current restrictions and regulatory compliance issues. Elsewhere, check with the local jurisdiction.
- For your personal safety, at a minimum wear gloves, long sleeves, long pants, closed toe shoes, and appropriate eye protection. Follow label directions for any additional personal protection equipment needed.
- A Washington State pesticide license with an aquatic endorsement is required for the purchase of aquatic herbicides. NEVER **apply non-aquatic herbicide formulations to water since many include ingredients toxic to aquatic organisms**.

- For large infestations of purple loosestrife, herbicide use may be necessary for effective control.
- Cutting after spraying is not necessary. If cutting is desired, infested areas should not be cut until after the herbicide has had a chance to work, which may take several weeks.
- In sensitive areas or areas prone to erosion, careful spot-spraying will create less disturbance than manual or mechanical control.
- For several years following treatment, monitor areas for new plants germinating from the seed bank. In some cases several years of treatment may be necessary.
- When treating an area intermixed with native monocots (cattails, grasses, sedges, etc), using a selective broadleaf herbicide is recommended. The monocots will not be harmed by the herbicide and will be able to help suppress new plants emerging from the seed bank.

Specific Herbicide Information

Glyphosate (e.g. Rodeo®, AquaMaster® or Aqua Neat®): Apply to actively growing plants at early flowering stage. Application to pre-flowering plants or seedlings may also be effective, but unless the extent of the infestation is well known, plants can be difficult to locate when not in flower. Glyphosate works slowly, so plants may not appear to be affected for a couple of weeks. A second application a few weeks after the first may be helpful to control plants not in flower or otherwise skipped during the first application. Apply to foliage but avoid runoff. Caution: Glyphosate is non-selective and it will injure or kill other vegetation contacted by the spray including grasses, cattails and other monocots.

Imazapyr (Habitat®, Polaris®): Apply to foliage any time the plant is actively growing. Caution: Imazapyr is non-selective and highly effective even at low doses: it will injure or kill other vegetation contacted by the spray including trees, desirable vegetation, and grasses, cattails and other monocots. Also, imazapyr is soil-active and can harm trees and other plants rooted in the spray area or sometimes immediately downhill from the area being sprayed.

Triclopyr (Garlon 3A® and Renovate 3®). Apply when plants are in the mid to full-bloom stage. Application to pre-flowering plants or seedlings may also be effective, but unless the extent of the infestation is well known, plants can be difficult to locate when not in flower.

Triclopyr is a selective herbicide and will kill only dicots (broadleaf plants and trees). It will not harm monocots such as grasses, sedges, cattails and many native aquatic plants.

All the above listed herbicides require the addition of an approved surfactant. Follow label directions for selecting the correct type of surfactant. Be sure that the selected surfactant is approved for aquatic use in Washington State.

The mention of a specific product brand name in this document is not, and should not be construed as an endorsement or as a recommendation for the use of that product. Chemical control options may differ for private, commercial and government agency users. **For questions about herbicide use, contact the King County Noxious Weed Control Program at 206-477-9333.**

Biological

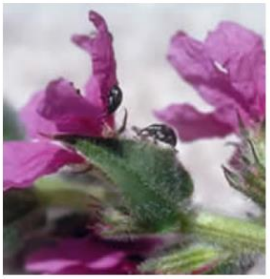
- Biological control can take up to six years to have a significant impact on the infestation. Purple loosestrife population density and the number of flowering plants can be reduced, but there will always be some plants remaining when using biological control agents. Releases should be made only at sites where loosestrife infestations are large and immediate eradication of the weed is not the primary objective.
- All biological control agents approved for use on purple loosestrife in Washington State will not feed on any plant species other than purple loosestrife in our area.
- Where feasible, biological control plans should incorporate another non-chemical control method to be able to prevent all seed production as required by state law. If the infestation is inaccessible, remove flowers at the edges of the infestation to the greatest extent possible. If *Galerucella* or *Hylobius* species are present, flower heads should be cut, bagged and properly disposed of by the time of flower drop in mid to late August. If *Nanophyes marmoratus* weevils are present, flower/seedheads should be cut very carefully in early September after emerging adult weevils have left the flowerheads for the season. If there is any chance of mature seeds being present in the seed heads, extreme care should be taken to avoid spread.
- Biological control is not recommended or prescribed for small infestations.
- Two species of *Galerucella* beetles were first released in Washington in 1992 and subsequently have been released in King County several times in many locations. These small golden-brown leaf-feeders defoliate plants and attack the terminal bud area, halting or drastically reducing seed production. The larvae feed constantly on the leaf underside. Loosestrife seedling mortality is high. These beetles are highly mobile and are often found in King County in locations far from release sites. *Galerucella* beetles do not do well near salt water.

Galerucella beetles feeding on purple loosestrife

- *Hylobius transversovittatus* is a root-mining weevil that also eats leaves. The adult beetle is reddish brown and ½ inch long. It eats from the leaf margins, working inward. Eggs are laid in the lower 2-3 inches of the stem, or sometimes in the soil near the root. The larvae then work their way to the root, where they eat the carbohydrate reserves. Evidence of larvae in the root is a zig-zag pattern. *Hylobius* tolerates coastal areas and is a better choice for infestations near salt water.

Hylobius transversovittatus

- *Nanophyes marmoratus* is a tiny seed weevil. Larvae and adults impact purple loosestrife by feeding on unopened flower buds. Flower buds with larval feeding damage usually abort and fail to produce seeds. Adults also feed on developing leaves, further weakening plants. *Nanophyes* can also be successful when used in conjunction with *Hylobius*.



Nanophyes weevil on purple loosestrife

SUMMARY OF BEST MANAGEMENT PRACTICES

Small Infestations in Native and/or Desirable Vegetation

- Hand pulling is recommended for young plants or older plants in loose, wet soil.
- Larger plants from isolated small populations can be dug out from moist upland areas. This may be impractical to impossible when trying to remove hardy, woody roots in compacted soils. Care should be taken to minimize erosion when digging in saturated soils on shorelines.
- If the plants are in flower or in seed, **cut off and bag all flower heads**. Pulling plants in seed will disperse the small, lightweight seeds. Cut plants may continue to produce flowers, so these sites will have to be consistently and regularly monitored until frost to cut and remove any subsequent flowers.
- When digging or pulling on shorelines, take appropriate erosion control measures.
- If manual control is not possible due to site conditions or available labor, apply appropriate herbicide with wick wiper or spot spray to minimize off target injury.
- If using an herbicide in an area that has desirable grasses and other monocots, use a selective broadleaf herbicide to avoid injury to grasses and other monocots.

Large Infestations in Areas with Monocots

- Cutting alone is not a control option for purple loosestrife. Shoots and adventitious roots will develop. Cutting late in the season but before seed set reduces shoot production more than mid-summer cutting. Cut plants may continue to produce flowers, so these sites will have to be consistently and regularly monitored until frost to cut and remove any subsequent flowers.

- Sheet mulching using black plastic, landscape fabric, or cardboard and six inches of mulch is an interim option for dense seedling infestations. It does not kill the roots of mature plants, but it does slow down growth and seed dispersal. This method is also non-selective.
- If an area has desirable monocots present, use a selective herbicide and encourage the growth of the monocots.
- If the infestation is in a pasture, encourage healthy grassy areas by seeding and fertilizing. Use a mix of grass and clover species to improve resistance to purple loosestrife. Fertilize according to the soil needs.
- If using biological control, areas need to be monitored and any flowers removed and properly disposed of where feasible. If the infestation is inaccessible, remove flowers around the edges of the infestation to the greatest extent possible. If *Galerucella* or *Hylobius* insects are present, flower heads should be cut, bagged and properly disposed of by the time of flower drop in mid to late August. If *Nanophyes marmoratus* weevils are present, flower/seedheads should be cut very carefully in early September after emerging adult weevils have left the flowerheads for the season. If there is any chance of mature seeds being present in the seed heads, extreme care should be taken to avoid spread.

Control on Shorelines

- When large areas of weeds are removed, the cleared area should be replanted with native or non-invasive vegetation and/or stabilized against erosion. See the **King County Surface Water Design Manual, Appendix D** for more information on Erosion and Sediment Control Standards (http://www.kingcounty.gov/environment/waterandland/stormwater/documents/surface-water-design-manual).
- Survey area and document extent of infestation.
- Focus on manual removal for small infestations if possible.
- When removing vegetation on shorelines (by lakes, streams and wetlands) use barriers to prevent sediment and vegetative debris from entering the water system.
- Cutting will not control purple loosestrife but it can serve in the interim until more effective control measures can be accomplished.
- For larger areas where herbicide use is warranted, spray using low pressure and large droplet size to reduce drift. If herbicide could potentially drift into the water or a wetland area, use only approved aquatic herbicides and surfactants after obtaining the necessary permits.
- Infested areas will need to be monitored for several years to control plants growing from root fragments and germinating from the extensive seed bank.

Control along Road Rights-of-Way

- Pull small infestations if possible.
- Spot spray larger infestations. Use a selective broadleaf herbicide in areas with desirable monocots such as grasses, sedges or cattails; if controlled with a non-selective herbicide, re-seed after control is completed.

- If plants are about to flower, they can be cut until a more effective control strategy can be used. Be sure to dispose of cut plant parts properly.
- If plants are sprayed, wait until the herbicide has had a chance to work before conducting any regular right-of-way mowing.

Disposal Methods

- All purple loosestrife plant parts, including flowers, seed heads, stems, leaves and roots must be securely bagged, and discarded in the trash or taken to a transfer station. **Do not compost or place in yard waste. Plants may regenerate in compost. If you have the ability to burn plants, following all local regulations and restrictions, burning vegetative material is an acceptable disposal method. Do not burn flowering stems or seed heads.**
- NOTE: Under the Washington State Lythrum quarantine (WAC 16.752.400-415), it is illegal to transport, buy, sell, offer to sell, or to distribute plants, plant parts or seeds of purple loosestrife into or within the state of Washington. However, by following the recommendations in this Best Management Practices document you are covered under the King County Noxious Weed Control Program's permit to transport purple loosestrife for the purpose of taking it to a transfer station or landfill.

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Appendix C

Control Method Options

Control Method Options

Contents

This appendix presents information about common methods used to control aquatic weeds. Much of the information in this section was obtained from the Citizen's Manual for Developing IAVMPs (Ecology 1994) and Washington State Department of Ecology (Ecology) Aquatic Plant Management website (Ecology 2017). Ecology has since revised their website and the associated link is no longer valid.

Additional information is derived from the field experience of the Coordinator for the Mason County Noxious Weed Control Program, Patricia Grover, a WSDA licensed aquatic herbicide applicator and valuable input from other noxious weed control practitioners.

Control/eradication methods discussed herein include Aquatic Herbicide, Manual Control Methods, Mechanical Control Methods, Environmental Manipulation, Biological Control, and the No Action Alternative.

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 objectives and requirements of each specific site. The goal is to maximize effective control and to minimize negative environmental, economic and social impacts.

Utilizing 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 will require commitment over a number of years, and should allow for flexibility in method as appropriate.

Permit Requirements for Aquatic Noxious Weed and Beneficial Plant Control

Control Method	Aquatic Noxious Weeds			Aquatic Beneficial Plants		
	Pamphlet HPA	Pamphlet HPA and WDFW Authorization	Individual HPA	Pamphlet HPA	Pamphlet HPA and WDFW Authorization	Individual HPA[a]
Chemical Herbicides	Requires Aquatic Plant and Algae Management General Permit from Ecology					
Hand Pulling or Other Hand Tools	✓			✓	✓[b]	
Mechanical Cutting and Harvesters	✓				✓	
Rotovators			✓			✓
Diver Dredges	✓	✓[b]			✓	
Mechanical Dredges			✓			✓
Bottom Barriers	✓	✓[b]		✓	✓[b]	
Water Level Drawdown			✓			✓

[a] Applicants may apply for Individual HPAs for projects that exceed pamphlet limitations.

[b] Prior authorization is needed from WDFW for projects that exceed specified thresholds

HPA = Hydraulic Project Approval

WDFW = Washington Department of Fish and Wildlife

Source: WDFW Aquatic Plants and Fish 2015.

No Action

One option for managing aquatic weeds in Spencer Lake is to let aquatic weeds continue to grow, and do nothing to control them. This “no action” alternative would acknowledge the presence of the aquatic weeds but would not outline any management plan or enact any planned control efforts. Effectively, a no action determination would preclude any integrated treatment and/or control effort, placing the choice and responsibility of aquatic weed control with lakefront property owners.

This management plan is focused on the control and eventual eradication of noxious weeds. Noxious weeds, especially fragrant waterlily, have impacted the beneficial uses of Spencer Lake and several alternatives to control these plants are presented in this plan. The “no action” alternative is provided as a reference for all other proposed control strategies.

It is likely that many beneficial uses of the lake will continue to be further degraded if no aquatic plant control methods are implemented. There is high likelihood of further plant growth, especially the fragrant waterlily. Therefore, the "no- action" alternative is not acceptable due to the further reduction of beneficial uses of the lake (boating, fishing, and swimming). Other negative environmental impacts include a definite degradation of the overall aesthetics. The fish communities may be impacted directly (e.g., lack of dissolved oxygen) or indirectly (i.e., changes in food web dynamics) with an overabundance of aquatic plants. Loss of open water may also restrict waterfowl use and habitat. Excessive aquatic plants also influence water quality by causing more pronounced temperature stratification and potentially a reduction in water circulation.

Chemical parameters such as pH, alkalinity, and dissolved oxygen may also be impacted through alteration of biological processes such as photosynthesis, respiration, and decomposition.

Advantages

- No treatment cost.
- No herbicide concerns.
- No need for permits.

Disadvantages

- Quality of the lake will continue to decline.
- Recreational opportunities will decline.
- Fish and wildlife habitat will be reduced or impaired.
- Property values will decline.

Suitability for Spencer Lake

The fragrant waterlily infestation is currently low to high coverage throughout the lake. Unless control measures are enacted, the coverage is likely to increase each future growing season until the entire littoral zone of the lake is dominated by fragrant waterlilies. It is likely that these plants would continue to increase in the future if no actions are taken, degrading water quality and reducing the diversity of native aquatic plants. During the second public meeting held on May 11, 2018, attendees were provided a survey (appendix B). Of 35 respondents, 90% selected “Take immediate action and 10% said “Go with consensus of the other property owners. No respondents

chose the "Do nothing, let nature take its course" or the "no action" alternative.

Aquatic Herbicides

The majority of the following text was taken from the Washington State Department of Ecology's website on chemical aquatic weed control http://www.ecy.wa.gov/programs/wq/plants/management/aqua028.html. This information is no longer available on the website.

Aquatic herbicides are chemicals specifically formulated for use in water to eradicate or control aquatic plants. Herbicides approved for aquatic use by the United States Environmental Protection Agency (EPA) have been reviewed and considered compatible with the aquatic environment when used according to label directions. However, individual states may also impose additional constraints on their use.

Aquatic herbicides are sprayed directly onto floating or emergent aquatic plants, or are applied to the water in either a liquid or pellet form.

- *Systemic* herbicides are capable of killing the entire plant by translocating from foliage or stems and killing the root.
- *Contact* herbicides cause the parts of the plant in contact with the herbicide to die back, leaving the roots alive and capable of re-growth.
- *Non-selective* herbicides will generally affect all plants that they come in contact with, both monocots and dicots.
- *Selective* herbicides will affect only some plants (usually dicots – broad leafed plants like Eurasian watermilfoil will be affected by selective herbicides whereas monocots like Brazilian elodea and our native pondweeds may not be affected). Most submersed aquatic plants are monocots.

Because of environmental risks from improper application, aquatic herbicide use in Washington State waters is regulated and has certain restrictions. The Washington State Department of Agriculture must license aquatic applicators.

- Coverage under a discharge permit called a National Pollutant Discharge Elimination System (NPDES) permit must be obtained before aquatic herbicides can be applied to waters of the state. The Washington Department of Agriculture holds an NPDES permit for the management of noxious weeds growing in wet areas such as lake shores, freshwater wetlands, river banks, and estuaries. Licensed applicators can obtain coverage under this permit free of charge. Information about this permit is available at: http://www.ecy.wa.gov/programs/wq/pesticides/final_pesticide_permits/noxious/noxious_index.html.

- For in-lake projects (floating or submersed weeds) applicators and/or the state or local government sponsoring the project must obtain coverage under Ecology's Aquatic Plant and Algae Management NPDES permit before applying herbicides. Information on this permit is available at: http://www.ecy.wa.gov/programs/wq/pesticides/final_pesticide_permits/aquatic_plants/aquatic_plant_permit_index.html.

The Washington Department of Ecology requires notification and posting before treatment. There are additional mitigations to protect rare plants or threatened and endangered species.

Although there are a number of EPA registered aquatic herbicides, the Department of Ecology currently issues permits for fifteen aquatic herbicides and algaecides (as of 2018 treatment season). Several other herbicides are undergoing review and it is likely that other chemicals may be approved for use in Washington in the future.

Only herbicides known to be effective on the target species and approved for use in Washington State were considered for this plan. A brief discussion of these herbicides from Ecology follows below:

- **Glyphosate** – (trade names for aquatic products with glyphosate as the active ingredient include Rodeo® and RoundUp Custom®). This systemic broad-spectrum herbicide is used to control floating-leaved plants like waterlilies and shoreline plants like purple loosestrife. It is generally applied as a liquid to the leaves. Glyphosate does not work on underwater plants such floating bladderwort. Although glyphosate is a broad spectrum, non-selective herbicide, a good applicator can selectively remove targeted plants by focusing the spray only on the plants to be removed. Plants can take several weeks to die and a repeat application is often necessary to remove plants that were missed during the first application.

- **Triclopyr** – (trade name Vastlan®). Triclopyr, applied as a liquid or in granular form, is a relatively fast-acting, systemic, selective herbicide. In Washington, it is most commonly used for used for the control of Eurasian watermilfoil. Triclopyr is very useful for purple loosestrife control since native grasses and sedges are unaffected by this herbicide. When applied directly to water, Ecology has imposed a 12-hour swimming restriction to minimize eye irritation. Triclopyr received its aquatic registration from the US EPA in 2003 and was allowed for use in Washington in 2004.

- **Imazapyr** – (trade name Polaris®). This systemic broad spectrum, slow-acting herbicide, applied as a liquid, is used to control emergent plants like spartina, reed canarygrass, and phragmites and floating-leaved plants like waterlilies. Imazapyr does not work on underwater plants such as Eurasian watermilfoil. Although imazapyr is a broad spectrum, non-selective herbicide, a good applicator can selectively remove targeted plants by focusing the spray only on the plants to be removed. Imazapyr was allowed for use in Washington in 2004.

Advantages

- Aquatic herbicide application can be less expensive than other aquatic plant control methods.
- Aquatic herbicides generally provide a high level of control.
- Aquatic herbicides are easily applied around docks and underwater obstructions.
- Many herbicides are fast acting.

Disadvantages

- Some herbicides have swimming, drinking, fishing, irrigation, and water use restrictions.
- Herbicide use may have unwanted impacts to people who use the water and to the environment.
- Non-targeted plants as well as nuisance plants may be controlled or killed by some herbicides.
- Depending on the herbicide used, it may take several days to weeks or several treatments during a growing season before the herbicide controls or kills treated plants.
- To be most effective, generally herbicides must be applied to rapidly growing plants.
- Some expertise in using herbicides is necessary to be successful and to avoid unwanted impacts.
- Many people have strong feelings against using chemicals in water.

Permits and Costs

An Aquatic Plant and Algae Management General Permit is needed for any herbicide application. The applicator must apply to Ecology for coverage under their permit every 5 years. In 2018, the cost of the permit is $585.00 and will be billed once the permit is approved. Ecology requires that a Discharge Management Plan and State Environmental Protection Act checklist be submitted with the permit application. An IAVMP may be submitted in lieu of a Discharge Management Plan.

Approximate costs derived from other recent IAVMPs for one acre of herbicide treatment (costs will vary from site to site):

- Glyphosate: $300-$600.00
- Triclopyr TEA: $1,000.00
- Imazapyr: $700-$800.00

Other Considerations

The US EPA conducts very thorough risk assessments of all pesticides approved for use in the United States. These tests evaluate human exposure risks as well as risks posed to the environment resulting from persistence, accumulation, and mobility in the environment. Complete assessments are available from US EPA or the pesticide manufacturers. The state of Washington sets more stringent standards than the US EPA when considering which pesticides to allow.

Suitability for Spencer Lake

Aquatic herbicides can provide an effective method for control and eventual eradication of noxious weeds at Spencer Lake. The primary herbicide treatment alternative for Spencer Lake is the use of a glyphosate application for control of the fragrant waterlily. Glyphosate has proven to be an effective treatment method in lakes for fragrant waterlily. Generally, glyphosate is the recommended herbicide for waterlily control because it can be applied directly to the floating leaves, unlike many other herbicides, which must be applied to the water. The application of glyphosate allows specific

plants or areas of plants to be targeted for removal. Generally, two applications of glyphosate are needed. The second application later in the summer controls the plants that were missed during the first herbicide application. The control effectiveness of fragrant waterlily is easy to measure through visual surveys due to the floating leaves. An experienced herbicide applicator can selectively target individual weed species and limit non target damage. This is especially true when infestations are small so that large areas with a diverse plant distribution don't have to be treated.

Follow-up control methods (hand pulling and/or cutting) will focus specifically on the target species and should leave beneficial plants intact. With these constraints in place, native plant communities will have an opportunity to re-establish in the treated areas.

A common drawback of using herbicides is the "uplifting" of mats of decomposing waterlily roots that can form large floating islands in the water body after the herbicides have killed the plants. Spencer lake residents report floating mats have developed in previous years. A plan for minimizing mat creation and dealing with these mats has been included in the implementation strategy.

The additional herbicides, triclopyr, and imazapyr can be used for emergent species, including purple loosestrife and imazapyr can be used for yellow flag iris and knotweed. All three herbicides are approved for aquatic use in Washington State based on environmental impact studies.

Success in using aquatic herbicides to control aquatic noxious weeds is contingent upon many factors: correct formulation, timing, application method, adjuvants (surfactants) used, weather conditions when applied, etc. Also, the application of aquatic herbicide to all aquatic plants (emergent, floating, or submerged) is required to be done by Washington State Department of Agriculture Certified Aquatic Herbicide Applicator and requires the obtaining of an Aquatic Plant and Algae Management Permit from Washington State Department of Ecology.

Manual Methods **(hand-pulling, diver hand-pulling, raking and cutting using hand tools)**

Hand-pulling aquatic plants is similar to pulling weeds out of a garden. It involves removing entire plants (leaves, stems, and roots) from the area of concern and disposing of them in an area away from the shoreline. In water less than 3 feet deep, no specialized equipment is required, although a spade, trowel, or long knife may be needed if the sediment is packed or heavy. In deeper water, hand pulling is best accomplished by divers with SCUBA equipment and mesh bags for the collection of plant fragments. Some sites may not be suitable for hand pulling such as areas where deep flocculent sediments may cause a person hand pulling to sink deeply into the sediment. Other areas where hand pulling may be ineffective are rocky areas (such as a rip-rap wall), areas with large amounts of fallen wood, or areas with dense vegetation (such as reed canarygrass) where weed root removal is very difficult.

Raking requires a sturdy rake for removing aquatic plants. Attaching a rope to the rake allows removal of a greater area of weeds. Raking literally tears plants from the sediment, breaking some plants off and removing some roots as well. Specially designed aquatic plant rakes are available. Rakes can be equipped with floats to allow easier plant and fragment collection. The operator should pull towards the shore

because a substantial amount of plant material can be collected in a short distance.

Cutting (using hand tools) differs from hand pulling in that plants are cut and the roots are not removed. Cutting is performed by standing on a dock or on shore and throwing a cutting tool out into the water. A non-mechanical aquatic weed cutter is commercially available. Two single-sided, razor-sharp stainless steel blades forming a "V" shape are connected to a handle, which is tied to a long rope. The cutter can be thrown about 20 to 30 feet into the water. As the cutter is pulled through the water, it cuts a 48-inch-wide swath. Cut plants rise to the surface where they can be removed. Washington State requires that cut plants be removed from the water. The stainless steel blades which form the "V" are extremely sharp, and great care must be taken with this implement. It should be stored in a secure area where children do not have access.

Advantages

- Small infestations can be eradicated.
- The equipment is inexpensive.
- Easy to use around docks and swimming areas.
- Many manual methods can be carried out by trained volunteers and shoreline residents.
- Manual methods don't require expensive permits, and can be performed on aquatic noxious weeds with Hydraulic Project Approval obtained by reading and following the Pamphlet HPA Aquatic Plants and Fish (July 2015) available free of charge from the Washington Department of Fish & Wildlife.
- Hand pulling allows the flexibility to remove undesirable aquatic plants while leaving desirable plants
- These methods minimize impacts to the environment

Disadvantages

- Hand-pulling can be a high-cost method. Volunteers can reduce this cost.
- Because these methods are labor intensive, they may not be practical for large areas or for thick weed beds.
- As plants regrow or fragments recolonize the cleared area, the treatment may need to be repeated several times each summer.
- Even with the best containment efforts, it is difficult to collect all plant fragments, leading to recolonization for some plants or spread of the infestation.
- Some plants, like waterlilies, which have extensive rhizomes, are difficult to remove by hand pulling.
- Pulling weeds and raking stirs up the sediment making it difficult to see remaining plants. Sediment re-suspension can also increase nutrient levels in lake water.
- Hand pulling and raking impacts bottom-dwelling animals.
- The V-shaped cutting tool is extremely sharp and can be dangerous to use.

Permits and Costs

Manual removal of aquatic plants in Washington requires compliance with the Aquatic Plants and Fish pamphlet (WDFW 2015) for control of noxious weeds, or an individual HPA permit for control of native plants in a large area. Hand-pulling, raking, and mechanical cutting are two methods commonly used by

residents that do not require an authorization or an individual HPA permit for control of aquatic noxious weeds.

Hand-pulling costs up to $130 for the average waterfront lot for a hired commercial puller. A commercial grade weed cutter costs about $130 with accessories. A commercial rake costs about $95 to $125. A homemade weed rake costs about $85 (asphalt rake is about $75 and the rope costs 35 to 75 cents per foot). Diver handpulling about $5,000/day for a "long day" with two divers and a boat. (Lake Sawyer IAVMP 2015)

Other Considerations

The community may need to invest money into buying the equipment and operation. Manual methods must include regular scheduled surveys to determine the extent of the remaining weeds and/or the appearance of new plants after eradication has been attained. This is a large time investment by lakeside residents.

Suitability for Spencer Lake

Diver hand-pulling is not recommended for floating leaved plants due to difficulties with root (rhizome) removal, and is not cost-effective for control of large areas.

Manual control is a great follow up to any chemical control, since detailed and careful removal of remaining plants is easily done this way.

Manual removal of purple loosestrife is possible, but may be difficult in harder soils. In some situations, the mature perennial plant is not killed, but the process does halt seed production and can contain the infestation at current levels. If done repeatedly over several seasons it may starve the roots and kill the plants.

Mechanical Methods (harvesting, cutting and rotovation)

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. 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.

Mechanical weed cutters cut aquatic plants several feet below the water's surface. Unlike harvesting, cut plants are not collected while the machinery operates.

Rotovators use underwater rototiller-like blades to uproot fragrant waterlily plants. The rotating blades churn 7 to 9 inches deep into the lake or river bottom to dislodge plant root crowns that are generally buoyant. The plants and roots may then be removed from the water using a weed rake attachment to the rototiller head or by harvester or manual collection.

Advantages

- Large areas can be treated.
- No chemical residue.
- Harvesters will collect plant fragments.
- Rotovators will negatively impact plant roots.
- Weed cutters have a low operation cost.

Disadvantages

- Increased fragment drift and difficulty in plant collection, which can create new plant populations elsewhere in the lake.
- These machines are difficult to navigate around docks and other obstacles.
- Difficult to maneuver in shallow water.
- Rotovators can stir up sediments and negatively impact water quality.

Permits and Costs

Mechanical methods may require an individual HPA permit from WDFW.

Other Considerations

None.

Suitability for Spencer Lake

None of these options are suitable for the level of infestation at Spencer Lake. They are not eradication tools, but rather are used to manage and control heavy, widespread infestations of aquatic weeds. Since the aim of this project is to control fragrant waterlily in the lake, these are not compatible control strategies. Harvesting and cutting do not remove root systems. Rotovation would cause damage to the lake sediments and associated animals in the lake.

Mechanical Method - Weed Rolling

Depends on frequent agitation and slight compaction of lake sediments. This method appears to offer the individual property owner a means of controlling weed growth within a small defined area. The method uses 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. When not in use, the equipment should be stored along-side a dock or in a place where people will not step on the roller and accidentally injure themselves. Little maintenance is required, but the unit must be removed from the water in winter in areas where lakes are expected to freeze. The life of the unit is predicted at a minimum of five years.

Advantages

- Rolling suppresses re-growth of plants in areas where it is regularly used.
- The treatment area can be modified by up to three, ten foot roller tube sections, as well as by adjusting the roller tube travel arc.
- Weed rolling creates and maintains areas of open water adjacent to docks.
- Operating costs are low – about the same as using an ordinary light bulb.

Disadvantages

- Weed rolling may disturb some bottom dwelling animals and may interfere with fish spawning.
- Weed rolling may cause plant fragmentation, which may increase the spread of some invasive weeds.
- When the cleared area is to be used for activities such as swimming or wading, the rollers should be unplugged from the power source, moved and stored under or along a dock.
- Never allow people in the water when the equipment is operating.
- Never allow water activity above or along side of the equipment to keep people from contacting the roller tube and accidentally injuring themselves.
- Weed rolling only clears a small area around a dock or other structure and is not suitable for larger control efforts.

Permits

Installation of weed rolling devices requires hydraulic approval obtained free from the Department of Fish and Wildlife. Check with your local jurisdiction to determine whether a shoreline permit is required.

Cost

Purchase cost is approximately $3,500. Installation is simple and requires only a 110 volt ground fault interrupter and an outdoor extension cord in addition to the equipment package supplied by the manufacturer. Operating costs are analogous to the cost of using a 75 watt light bulb.

Mechanical Method - Diver dredging

A method whereby SCUBA divers use hoses attached to small dredges (often dredges used by miners for mining gold from streams) to suck plant material from the sediment. The purpose of diver dredging is to remove all parts of the plant including the roots. A good operator can accurately remove target plants, like fragrant waterlily, while leaving native species untouched. The suction hose pumps the plant material and the sediments to the surface where they are deposited into a screened basket. The water and sediment are returned to the water column (if the permit allows this), and the plant material is retained. The turbid water is generally discharged to an area curtained off from the rest of the lake by a silt curtain. The plants are disposed of on shore.

Removal rates vary from approximately 0.25 acre to 1 acre per day, depending on plant density, sediment type, size of team, and diver efficiency. Diver dredging is more effective in areas where softer sediment allows easy removal of the entire plants, although water turbidity is increased with softer sediments. Harder sediment may require the use of a knife or tool to help loosen sediment from around the roots. In very hard sediments, some plants tend to break off leaving the roots behind and defeating the purpose of diver dredging.

Advantages

- Diver dredging can be a very selective technique for removing pioneer colonies of submersed noxious weeds.
- Divers can remove plants around docks and in other difficult to reach areas.
- Diver dredging can be used in situations where herbicide is not an option for aquatic plant management.

Disadvantages

- Diver dredging is very expensive.
- Dredging stirs up large amounts of sediment. This may lead to the release of nutrients and buried toxic materials into the water column.
- Only the tops of plants growing in rocks or hard sediments may be removed, leaving a viable root crown behind to initiate growth.
- In some states, acquisition of permits can take years.

Permits and Costs

Permits are required for many types of projects in lakes and streams. Diver dredging requires an HPA permit from WDFW. Diver dredging may also require a Section 404 permit from the US Army Corps of Engineers. Depending on the density of the plants, specific equipment used, number of divers and disposal requirements, costs can run about $3,000.00/day. (Lake Sawyer IAVMP)

Other Considerations

Diver dredging could be useful for spot control in subsequent years (coordinated with diver survey).

Suitability for Spencer Lake

Diver dredging removes the plant in its entirety. It removes the biomass above the sediment as well as roots and tubers in the sediment. This alternative is best used for a pioneering infestation of invasive submersed plants in soft sediments. Because diver dredging causes excessive stirring up of sediments, this method is not recommended.

Mechanical Dredging

Mechanical dredging uses large, barge-mounted excavation or suction equipment to remove sediment and associated plant material from the lake bottom. Mechanical dredging may be a suitable waterlily control strategy and a method for preventing problems with waterlily rhizome mats.

Advantages

- Increases lake depth.
- No chemical residue.
- Large areas can be treated.
- Eliminates problems with floating rhizome mats.

Disadvantages

- High cost: depending on the depth of material removed and area dredged, cost estimates range from about $30,000 to $200,000 per treatment.
- Material disposal: the material that is dredged needs to be disposed somewhere. Trucking and disposal at landfills or off-site facilities can potentially equal the cost of treatment as more heavy equipment is involved and time is consumed.

- Permits may be difficult to obtain.
- This method is slow (only about 100 cubic yards, or about 1/6 of an acre removing 1 foot of sediment, per day).
- Dredging can release nutrients from the sediment.

Permits and Costs

Mechanical dredging requires an individual HPA permit from WDFW. Dredging represents a significant disturbance to the lake substrate requiring a detailed environmental evaluation to obtain permits.

Other Considerations

Dredged material would need to be loaded onto trucks and taken off site for disposal. This would represent a significant cost. It also may be logistically difficult to maneuver heavy equipment to and from the lakeshore due to access restrictions.

Biological Methods

Biological control agents are only available for purple loosestrife. The infestation of purple loosestrife is limited in numbers and distribution and the lake would likely not be a suitable release site for the *Galerucella* spp beetles.

Environmental Manipulation- Water level drawdown

Lowering the water level of a lake or reservoir can have a dramatic impact on some aquatic weed problems. Water level drawdown can be used where there is a water control structure that allows the managers of lakes or reservoirs to drop the water level in the water body for extended periods of time.

Suitability for Spencer Lake

Drawdown is not a viable control strategy for Spencer Lake. The outlet from Spencer Lake is a natural stream that does not have a control structure installed. Not only would drawdown be difficult to achieve, it would also cause significant damage to the ecosystem and have many negative consequences for property owners around the lake. Without a surface inflow to the lake, returning the water level to a previous state would be both cost-and time-prohibitive.

Environmental Manipulation - Bottom barrier/screens

A bottom screen or benthic barrier covers the sediment like a blanket, compressing aquatic plants while reducing or blocking light. Materials such as burlap, plastics, perforated black Mylar, AquaScreen, and woven synthetics can all be used as bottom screens. An ideal bottom screen should be durable, heavier than water, reduce or block light, prevent plants from growing into and under the fabric, be easy to install and maintain, and should readily allow gases produced by rotting weeds to escape without “ballooning” the fabric upwards. Even the most porous materials, such as AquaScreen (plastic-coated glass fiber), will billow due to gas buildup. Therefore, it is very important to anchor the bottom barrier securely to the bottom. Unsecured screens can create navigation hazards and are dangerous to swimmers. Anchors must

be effective in keeping the material down and must be regularly checked. Natural materials such as rocks or sandbags are preferred as anchors.

The duration of weed control depends on the rate that weeds can grow through or on top of the bottom screen, the rate that new sediment is deposited on the barrier, and the durability and longevity of the material. For example, burlap may rot within 2 years, plants can grow on top of screen and fabric materials. Regular maintenance is essential and can extend the life of most bottom barriers. Bottom screens will control most aquatic plants; however, non-rooted species such as the bladderworts or coontail will not be controlled by bottom screens.

In addition to controlling nuisance weeds around docks and in swimming beaches, bottom screening has become an important tool to help eradicate and contain early infestations of noxious weeds such as Eurasian watermilfoil and Brazilian elodea. Pioneering colonies that are too extensive to be hand pulled can sometimes be covered with bottom screening material.

Bottom screens can be installed by the homeowner or by a commercial plant control specialist. Installation is easier in winter or early spring when plants have died back. In summer, cutting or hand pulling the plants first will facilitate bottom screen installation. Research has shown that much more gas is produced under bottom screens that are installed over the top of aquatic plants. The less plant material that is present before installing the screen, the more successful the screen will be in staying in place. Bottom screens may also be attached to frames rather than placed directly onto the sediment. The frames may then be moved for control of a larger area.

Advantages

- Installation of a bottom screen creates an immediate open area of water.
- Bottom screens are easily installed around docks and in swimming areas.
- Properly installed bottom screens can control up to 100 percent of aquatic plants.
- Screen materials are readily available and can be installed by homeowners or by divers.

Disadvantages

- Because bottom barrier screens reduce habitat by covering the sediment, they are suitable only for localized control.
- For safety and performance reasons, bottom screens must be regularly inspected and maintained.
- Harvesters, Rotovators, fishing gear, propeller backwash, or boat anchors may damage or dislodge bottom screens.
- Improperly anchored bottom screen may create safety hazards for boaters and swimmers.
- Swimmers may be injured by poorly maintained anchors used to pin bottom screens to the sediment.
- Some bottom screens are difficult to anchor on deep muck sediments.
- Bottom screens interfere with fish spawning and bottom-dwelling animals.
- Without regular maintenance, aquatic plants may quickly colonize the bottom screen.

Permits and Costs

Bottom screening in Washington requires an HPA in accordance with restrictions specified in the Aquatic Plants and Fish pamphlet (WDFW 2015) for control of noxious weeds, or an individual HPA permit for control of native plants in a large area. Barrier materials cost $0.22 to $1.25 per square foot. The cost of some commercial barriers includes an installation fee. Commercial installation costs vary depending on sediment characteristics and type of bottom screen selected. It costs up to about $750 to have 1,000 square feet of bottom screen installed. Maintenance costs for a waterfront lot are about $120 each year.

Suitability for Spencer Lake

Bottom barriers have been used in other lakes to control aquatic plants. Without constant upkeep and maintenance, the long-term benefits of bottom barriers are minimal. Currently, infested areas are too large to use a bottom barrier without becoming cost prohibitive.

Barriers could be effective in localized areas, such as in swimming areas and around docks, to prevent re-infestation after initial control. Installing a bottom barrier at a dock can provide these benefits.

Waterlily Root Mat Removal

Waterlily root mats often float to the surface in the years after waterlilies have been treated with herbicide. Waterlily root mats can impede water navigation and detract from the aesthetics of the lake. Waterlily root mat removal methods include moving them to a location where water navigation will not be impacted, and completely removing the root mats from the lake using heavy equipment.

- **Moving waterlily root mats** involves hauling the root mats into an area where water navigation will not be hindered, such as a conservation area. Boats or other vessels are used to haul the root mats into place. The root mats are then anchored to prevent them from floating into navigation areas.

- **Removal of waterlily root mats** requires heavy equipment. A boat or other vessel is used to haul the root mats to shore. Large root mats may need to be broken up using a high-pressured water jet for easier transport. Once the root mats are hauled to shore, an excavator is used to bring them to land and into a dump truck. The root mats are allowed to dewater in the dump truck before being taken to a landfill for disposal.

Advantages

- Improved navigation.
- Increased safety for boating and swimming.
- Improved aesthetics.

Disadvantages

- The methods for complete waterlily root mat removal are very expensive.
- Permits are required for complete waterlily root mat removal.

Permits and Costs

Moving Waterlily Root Mats

- No permit is needed if root mats are not removed from the lake.
- Hauling and anchoring costs are estimated to be approximately $1,000 per day.

Complete Removal of Waterlily Root Mats

An HPA is needed from WDFW to remove root mats from a lake. In the *Integrated Aquatic Vegetation Management Plan for Lake Washington and the Sammamish River within the City of Kenmore*, prepared by Herrera Environmental Consultants, it is estimated that each 1-acre waterlily root mat will be about 2 feet thick and have a volume of 3,227 cubic yards. At Spencer Lake, any waterlily root mats could be brought on shore at the boat launch, or private property, utilizing an excavator and allowed to dewater to remove excess weight. The *Lake Washington Plan* estimates the cost to be approximately $5,000 per day for boat and excavator equipment operators and machinery. It would require approximately 10 days to remove 1 acre of root mats. Disposal as yard waste at a Mason County transfer station is estimated to cost $70 per ton disposal rate; 1 acre of root mats, at 0.4 ton per cubic yard, would cost approximately $90,000.00 for disposal.

Suitability for Spencer Lake

The cost of completely removing and disposing of waterlily root mats from Spencer Lake could be very expensive. Alternative methods of removal and disposal will likely be developed.

Appendix D

Aquatic herbicide labels

ATTENTION:

This specimen label is provided for general information only.

- This pesticide product may not yet be available or approved for sale or use in your area.
- It is your responsibility to follow all Federal, state and local laws and regulations regarding the use of pesticides.
- Before using any pesticide, be sure the intended use is approved in your state or locality.
- Your state or locality may require additional precautions and instructions for use of this product that are not included here.
- Monsanto does not guarantee the completeness or accuracy of this specimen label. The information found in this label may differ from the information found on the product label. You must have the EPA approved labeling with you at the time of use and must read and follow all label directions.
- You should not base any use of a similar product on the precautions, instructions for use or other information you find here.
- Always follow the precautions and instructions for use on the label of the pesticide you are using.

21153L1-37

Roundup CUSTOM™

FOR AQUATIC & TERRESTRIAL USE

TRUEBLUE ADVANTAGE PROVEN | RELIABLE | SUPPORTED

Complete Directions for Use

Roundup Custom® for Aquatic and Terrestrial Use is a complete broad-spectrum postemergence herbicide for aquatic, crop, non-agricultural crop, industrial, turf, ornamental, forestry, roadside, and utility rights-of-way weed control.

EPA Reg. No. 524-343 2012-2

GROUP	9	HERBICIDE

AVOID CONTACT OF HERBICIDE WITH FOLIAGE, GREEN STEMS, EXPOSED NON-WOODY ROOTS OR FRUIT OF CROPS, DESIRABLE PLANTS AND TREES, BECAUSE SEVERE INJURY OR DESTRUCTION MAY RESULT.

Read the entire label before using this product.

Use only according to label instructions.

Not all products listed on this label are registered for use in California. Check the registration status of each product in California before using.

Read the "LIMIT OF WARRANTY AND LIABILITY" statement at the end of the label before buying or using. If terms are not acceptable, return at once unopened.

THIS IS AN END-USE PRODUCT. MONSANTO DOES NOT INTEND AND HAS NOT REGISTERED IT FOR REFORMULATION. SEE INDIVIDUAL CONTAINER LABEL FOR REPACKAGING LIMITATIONS.

PRODUCT INFORMATION

1.0 INGREDIENTS

ACTIVE INGREDIENT:

*Glyphosate, N-(phosphonomethyl)glycine, in the form of its isopropylamine salt	53.8%
OTHER INGREDIENTS:	46.2%
	100.0%

*Contains 648 grams per liter or 5.4 pounds per U.S. gallon of the active ingredient glyphosate, in the form of its isopropylamine salt. Equivalent to 480 grams per liter or 4.0 pounds per U.S. gallon of the acid, glyphosate.

No license granted under any non-U.S. patent(s).

2.0 IMPORTANT PHONE NUMBERS

FOR **PRODUCT INFORMATION** OR ASSISTANCE IN USING THIS PRODUCT, CALL TOLL-FREE, **1-800-332-3111.**

IN CASE OF AN **EMERGENCY** INVOLVING THIS PRODUCT, OR FOR **MEDICAL ASSISTANCE**, CALL COLLECT, DAY OR NIGHT, **(314)-694-4000.**

3.0 PRECAUTIONARY STATEMENTS

3.1 Hazards to Humans and Domestic Animals

Keep Out of Reach of Children.

CAUTION!

DOMESTIC ANIMALS: This product is considered to be relatively nontoxic to dogs and other domestic animals; however, ingestion of this product or large amounts of freshly sprayed vegetation may result in temporary gastrointestinal irritation (vomiting, diarrhea, colic, etc.). If such symptoms are observed, provide the animal with plenty of fluids to prevent dehydration. Call a veterinarian if symptoms persist for more than 24 hours.

Personal Protective Equipment (PPE)

Applicators and other handlers must wear: long-sleeved shirt and long pants, shoes plus socks. Follow manufacturer's instructions for cleaning/maintaining PPE (Personal Protective Equipment). If no such instructions for washables, use detergent and hot water. Keep and wash PPE separately from other laundry.

Engineering Control Statements: When handlers use closed systems, enclosed cabs, or aircraft in a manner that meets the requirements listed in Worker Protection Standard (WPS) for agricultural pesticides [40 CFR 170.240 (d) (4-6)], the handler PPE requirements may be reduced or modified as specified in the WPS.

User Safety Recommendations:

Users should:

- Wash hands before eating, drinking, chewing gum, using tobacco, or using the toilet.
- Remove contaminated clothing and wash clothing before reuse.

3.2 Environmental Hazards

Do not contaminate water when cleaning equipment or disposing of equipment washwaters. Treatment of aquatic weeds can result in oxygen depletion or loss due to decomposition of dead plants. This oxygen loss can cause fish suffocation.

In case of SPILL or LEAK, soak up and remove to a landfill.

3.3 Physical or Chemical Hazards

Spray solutions of this product should be mixed, stored and applied using only stainless steel, fiberglass, plastic or plastic-lined steel containers.

DO NOT MIX, STORE OR APPLY THIS PRODUCT OR SPRAY SOLUTIONS OF THIS PRODUCT IN GALVANIZED STEEL OR UNLINED STEEL (EXCEPT STAINLESS STEEL) CONTAINERS OR SPRAY TANKS. This product or spray solutions of this product react with such containers and tanks to produce hydrogen gas which may form a highly combustible gas mixture. This gas mixture could flash or explode, causing serious personal injury, if ignited by open flame, spark, welder's torch, lighted cigarette or other ignition source.

DIRECTIONS FOR USE

It is a violation of Federal law to use this product in any manner inconsistent with its labeling. This product can only be used in accordance with the Directions for Use on this label or in separately published Monsanto Supplemental Labeling or Fact Sheets. Supplemental labeling can be found on the Internet at www.cdms.net, www.agrian.com or www.greenbook.net websites but may not be approved for use in all states. Copies can also be obtained by contacting your Authorized Monsanto Retailer or Monsanto Company Representative.

Do not apply this product in a way that will contact workers or other persons, either directly or through drift. Only protected handlers may be in the area during application. For any

requirements specific to your State or Tribe, consult the agency responsible for pesticide regulations.

Agricultural Use Requirements

Use this product only in accordance with its labeling and with the Worker Protection Standard, 40 CFR Part 170. This Standard contains requirements for the protection of agricultural workers on farms, forests, nurseries, and greenhouses, and handlers of agricultural pesticides. It contains requirements for training, decontamination, notification, and emergency assistance. It also contains specific instructions and exceptions pertaining to the statements on this label about personal protective equipment (PPE) and restricted entry interval. The requirements in this box only apply to uses of this product that are covered by the Worker Protection Standard.

Do not enter or allow worker entry into treated areas during the restricted entry interval (REI) of 4 hours.

PPE required for early entry to treated areas that is permitted under the Worker Protection Standard and that involves contact with anything that has been treated, such as plants, soil, or water, are: coveralls, shoes plus socks, and chemical resistant gloves made of any waterproof material.

Non-Agricultural Use Requirements

The requirements in this box apply to uses of this product that are NOT within the scope of the Worker Protection Standard for agricultural pesticides (40 CFR Part 170). The WPS applies when this product is used to produce agricultural plants on farms, forests, nurseries or greenhouses.

Keep people and pets off treated areas until spray solution has dried.

4.0 STORAGE AND DISPOSAL

Proper pesticide storage and disposal are essential to protect against exposure to people and the environment due to leaks and spills, excess product or waste, and vandalism. Do not allow this product to contaminate water, foodstuffs, feed or seed by storage and disposal.

PESTICIDE STORAGE: STORE ABOVE 5°F (-15°C) TO KEEP PRODUCT FROM CRYSTALLIZING. Crystals will settle to the bottom. If allowed to crystallize, place in a warm room 68°F (20°C) for several days to redissolve and roll or shake container or recirculate in mini-bulk containers to mix well before using. Store pesticides away from food, pet food, feed, seed, fertilizers, and veterinary supplies. Keep container closed to prevent spills and contamination.

PESTICIDE DISPOSAL: To avoid wastes, use all material in this container, including rinsate, by application according to label directions. If wastes cannot be avoided, offer remaining product to a waste disposal facility or pesticide disposal program. Such programs are often run by state or local governments or by industry. All disposal must be in accordance with applicable federal, state and local regulations and procedures.

CONTAINER HANDLING AND DISPOSAL: See container label for container handling and disposal instructions and refilling limitations.

5.0 PRODUCT INFORMATION

Product Description: This product is a postemergent, systemic herbicide with no residual soil activity. It gives broad-spectrum control of many annual weeds, perennial weeds, woody brush and trees. It is formulated as a water-soluble liquid and may be applied through standard equipment after dilution and mixing with water or other carriers according to label instructions.

Time to Symptoms: This product moves through the plant from the point of foliage contact to and into the root system. Visible effects are a gradual wilting and yellowing of the plant which advances to complete browning of above-ground growth and deterioration of underground plant parts. Effects are visible on most annual weeds within 2 to 4 days, but on most perennial weeds may not occur for 7 days or more. Extremely cool or cloudy weather following treatment may slow activity of this product and delay development of visual symptoms.

Stage of Weeds: Annual weeds are easiest to control when they are small. Best control of most perennial weeds is obtained when treatment is made at late growth stages approaching maturity. See the **WEEDS CONTROLLED** section of this label for specific weed rates.

Always use the higher product application rate in the range when weed growth is heavy or dense, or when weeds are growing in an undisturbed (non-cultivated) area. Reduced weed control may result from treating weeds with disease or insect damage, weeds heavily covered with dust, or weeds under poor growing conditions.

Mode of Action in Plants: The active ingredient in this product inhibits production of an enzyme in plants and microorganisms that is essential to formation of specific amino acids.

Cultural Considerations: Reduced control could result when applications are made to annual or perennial weeds that have been mowed, grazed or cut, and have not been allowed to regrow to the specified stage for treatment.

Rainfastness: Heavy rainfall soon after application may wash this product off of the foliage and a repeat application may be required for adequate weed control.

Spray Coverage: For best results, spray coverage should be uniform and complete. Do not spray foliage to the point of run-off.

No Soil Activity: Weeds must be emerged at the time of application to be controlled by this product. Weeds germinating from seed after application will not be controlled. Unemerged plants arising from unattached underground rhizomes or rootstocks of perennials will not be affected by the herbicide and will continue to grow.

Maximum Application Rates: The maximum application or use rates stated throughout this label are given in units of volume (fluid ounces or quarts) of this product per acre. However, the maximum allowed application rates apply to this product combined with the use of any and all other herbicides containing the active ingredient glyphosate, whether applied separately or as tank mixtures, on a basis of total pounds of glyphosate (acid equivalents) per acre. If more than one glyphosate-containing product is applied to the same site within the same year, you must ensure that the total use of glyphosate (pounds acid equivalents) does not exceed the maximum allowed. The combined total of all treatments must not exceed 8 quarts of this product (8 pounds of glyphosate acid) per acre per year. See the **INGREDIENTS** section of this label for necessary product information.

ATTENTION

AVOID CONTACT OF HERBICIDE WITH FOLIAGE, STEMS, EXPOSED NON-WOODY ROOTS OR FRUIT OF CROPS, DESIRABLE PLANTS AND TREES, BECAUSE SEVERE INJURY OR DESTRUCTION MAY RESULT.

AVOID DRIFT. EXTREME CARE MUST BE USED WHEN APPLYING THIS PRODUCT TO PREVENT INJURY TO DESIRABLE PLANTS AND CROPS.

Do not allow the herbicide solution to mist, drip, drift or splash onto desirable vegetation since minute quantities of this product can cause severe damage or destruction to the crop, plants or other areas on which treatment was not intended. The likelihood of injury occurring from the use of this product increases when winds are gusty, as wind velocity increases, when wind direction is constantly changing or when there are other meteorological conditions that favor spray drift. When spraying, avoid combinations of pressure and nozzle type that will result in splatter or fine particles (mist) that are likely to drift. AVOID APPLYING AT EXCESSIVE SPEED OR PRESSURE.

NOTE: Use of this product in any manner not consistent with this label may result in injury to persons, animals or crops, or other unintended consequences.

5.1 Weed Resistance Management

GROUP	9	HERBICIDE

Glyphosate, the active ingredient in this product, is a Group 9 herbicide based on the mode of action classification system of the Weed Science Society of America. Any weed population may contain plants naturally resistant to Group 9 herbicides. Weed species resistant to Group 9 herbicides may be effectively managed utilizing another herbicide from a different Group or using other cultural or mechanical practices.

To minimize the occurrence of glyphosate-resistant biotypes observe the following general weed management recommendations:

- Scout your application site before and after herbicide applications.
- Control weeds early when they are relatively small.
- Incorporate other herbicides and cultural or mechanical practices as part of your weed control system where appropriate.
- Use the labeled rate for the most difficult to control weed in the site. Avoid tank-mixtures with other herbicides that reduce this product's efficacy through antagonism or with tank mixtures that encourage rates of this product below those specified on this label.
- Control weed escapes and prevent weeds from setting seeds.
- Clean equipment before moving from site to site to minimize spread of weed seed.
- Use new commercial seed as free of weed seed as possible.
- Report any incidence of repeated non-performance of this product on a particular weed to your Monsanto representative, local retailer, or county extension agent.

5.2 Management of Glyphosate Resistant Weed Biotypes

NOTE: Appropriate testing is critical in order to confirm weed resistance to glyphosate. Contact your Monsanto representative to determine if resistance has been confirmed to any particular weed biotype in your area. Directions for the control of biotypes confirmed to be resistant to glyphosate are made available on separately published supplemental labeling or Fact Sheets for this product and may be obtained from your local retailer or Monsanto representative.

Since the occurrence of new glyphosate resistant weeds cannot be determined until after product use and scientific confirmation, Monsanto Company is not responsible for any losses that may result from the failure of this product to control glyphosate-resistant weed biotypes.

The following good weed management practices are recommended to reduce the spread of confirmed glyphosate resistant biotypes:

- If a naturally occurring resistant biotype is present at your site, this product may be tank-mixed or applied sequentially with an appropriately labeled herbicide with a different mode of action to achieve control.

- Cultural and mechanical control practices may also be used as appropriate.
- Scout treated sites after herbicide applications and control escapes of resistant biotypes before they set seed.
- Thoroughly clean equipment before leaving sites known to contain resistant biotypes.

6.0 MIXING

Spray solutions of this product can be mixed, stored and applied using only clean stainless steel, fiberglass, plastic or plastic-lined steel containers.

DO NOT MIX, STORE OR APPLY THIS PRODUCT OR SPRAY SOLUTIONS OF THIS PRODUCT IN GALVANIZED STEEL OR UNLINED STEEL (EXCEPT STAINLESS STEEL) CONTAINERS OR SPRAY TANKS.

Use caution to avoid siphoning back into the carrier source. Use approved anti-back-siphoning devices where required by state or local regulations.

Clean sprayer parts promptly after using this product by thoroughly flushing with water.

NOTE: REDUCED PRODUCT PERFORMANCE CAN OCCUR IF WATER CONTAINING SOIL SEDIMENT IS USED AS CARRIER OR WATER THAT IS VISIBLY MUDDY OR MURKY FROM PONDS AND DITCHES.

6.1 Mixing with Water

This product mixes readily with water. Mix spray solutions of this product as follows: Fill the mixing or spray tank with the required amount of clean water. Add the labeled amount of this product near the end of the filling process and mix gently (well). During mixing and application, foaming of the spray solution may occur. To prevent or minimize foam, avoid the use of mechanical agitators, terminate by-pass and return lines at the bottom of the tank and, if needed, use an approved anti-foam or defoaming agent.

6.2 Tank Mixtures

This product does not provide residual weed control. This product can be tank-mixed with other herbicides to provide residual weed control, a broader weed control spectrum or an alternate mode of action. Always read and follow label directions for all products in the tank mixture.

When this product is tank-mixed with other products, refer to these product labels for approved sites and application rates. Read and carefully observe the cautionary statements and all other information appearing on the labels of all herbicides used. Use according to the most restrictive precautionary statements for each product in the mixture. Any labeled rate of this product may be used in a tank mix.

When this label lists a tank mixture with a generic active ingredient such as diuron, 2,4-D or dicamba, the user is responsible for ensuring the mixture product label allows the specific application.

Buyer and all users are responsible for all loss or damage in connection with the use or handling of mixtures of this product with herbicides or other materials that are not expressly listed in this label. Mixing this product with herbicides or other materials not specified on this label may result in reduced performance.

This product provides control of the emerged weeds listed on this label. When applied as a tank mixture, the following herbicides will provide preemergence and/or postemergence control of the weeds listed in the individual product labels.

This product can be tank-mixed with the following products. Any labeled rate of this product can be used in a tank mixture with these products. User is responsible for ensuring that the specific product is registered for use on the target site. Refer to these product labels for approved application sites and application rates. Read and carefully observe the cautionary statements and all other information on the labels of all the herbicides used. Use according to the most restrictive precautionary statements for each product in the mixture.

Tank-mix Products

Arsenal	Krovar I DF + 2,4-D
Banvel	Krovar I DF + Garlon 3A
2,4-D	Krovar I DF + Garlon 4
Garlon 3A	Oust XP
Garlon 4	Oust XP + 2,4-D
diuron	Oust XP + Garlon 3A
diuron + 2,4-D	Oust XP + Garlon 4
diuron + Garlon 3A	Ronstar
diuron + Garlon 4	Spike 80W
Hyvar X	Spike 80W + 2,4-D
Hyvar X + 2,4-D	Spike 80W + Garlon 3A
Hyvar X + Garlon 3A	Spike 80W + Garlon 4
Hyvar X + Garlon 4	Surflan
Krovar I DF	

When used in combination as recommended by Monsanto Company, the liability of Monsanto shall in no manner extend to any damage, loss or injury not solely and directly caused by the inclusion of the Monsanto product in such combination use.

6.3 Tank Mixing Procedure

When tank mixing, read and carefully observe label directions, cautionary statements and all information on the labels of all products used. Add the tank-mix product to the tank as directed by the label. Maintain agitation and add the specified amount of this product.

Maintain good agitation at all times during the mixing process. Ensure that the tank-mix products are well mixed with the spray solution before adding this product.

Mix only the quantity of spray solution that can be used during the same day. Tank mixtures allowed to stand overnight may result in reduced weed control.

Maintain good agitation at all times until the contents of the tank are sprayed. If the spray mixture is allowed to settle, thorough agitation is required to resuspend the mixture before spraying is resumed.

Keep by-pass line on or near the bottom of the tank to minimize foaming. Screen size in nozzle or line strainers should be no finer than 50 mesh.

Always predetermine the compatibility of labeled tank mixtures of this product with water carrier by mixing small proportional quantities in advance. Ensure that the specific tank mixture product is registered for application at the desired site.

6.4 Mixing Percent Solutions

Prepare the desired volume of spray solution by mixing the amount of this product in water as shown in the following table:

Spray Solution

Desired Volume	Amount of Roundup Custom for Aquatic and Terrestrial Use					
	0.5%	0.75%	1%	1.5%	4%	8%
1 gal	2/3 oz	1 oz	1.3 oz	2 oz	5 oz	10 oz
25 gal	1 pt	1.5 pt	1 qt	1.5 qt	4 qt	2 gal
100 gal	2 qt	3 qt	1 gal	1.5 gal	4 gal	8 gal

2 tablespoons = 1 fluid ounce

For use in backpack, knapsack or pump-up sprayers, it is suggested that the specified amount of this product be mixed with water in a larger container. Fill sprayer with the mixed solution.

6.5 Surfactant

This product requires the use of a nonionic surfactant unless otherwise specified. When using this product, unless otherwise specified, mix 2 or more quarts of a nonionic surfactant per 100 gallons of spray solution. Increasing the rate of surfactant may enhance performance. Examples of when to use the higher surfactant rate include, but are not limited to: hard to control woody brush, trees and vines, high water volumes, adverse environmental conditions, tough to control weeds, weeds under stress, surfactants with less than 70 percent active ingredient, tank mixes, etc.

Always read and follow the manufacturer's surfactant label for best results. Carefully observe all cautionary statements and other information appearing in the surfactant label.

6.6 Colorants or Dyes

Approved colorants or marking dyes may be added to this product. At lower rates or dilution, colorants or dyes used in spray solutions of this product may reduce performance. Use colorants or dyes according to the manufacturer's instructions.

6.7 Drift Reduction Additives

Drift reduction additives can be used with all equipment types, except wiper applicators and sponge bars. When a drift reduction additive is used, read and carefully observe precautionary statements and all other information appearing on the additive label. The use of drift reduction additives can affect spray coverage which may result in reduced performance.

7.0 APPLICATION EQUIPMENT AND TECHNIQUES

Do not apply this product through any type of irrigation system.

APPLY THESE SPRAY SOLUTIONS IN PROPERLY MAINTAINED AND CALIBRATED EQUIPMENT CAPABLE OF DELIVERING DESIRED VOLUMES.

SPRAY DRIFT MANAGEMENT

AVOID DRIFT. EXTREME CARE MUST BE USED WHEN APPLYING THIS PRODUCT TO PREVENT INJURY TO DESIRABLE PLANTS AND CROPS.

Do not allow the herbicide solution to mist, drip, drift or splash onto desirable vegetation since minute quantities of this product can cause severe damage or destruction to the crop, plants or other areas on which treatment was not intended.

Avoiding spray drift at the application site is the responsibility of the applicator. The interaction of many equipment- and weather-related factors determines the potential for spray drift. The applicator and/or the grower are responsible for considering all these factors when making decisions.

7.1 Aerial Equipment

DO NOT APPLY THIS PRODUCT USING AERIAL SPRAY EQUIPMENT EXCEPT UNDER CONDITIONS AS SPECIFIED WITHIN THIS LABEL.

FOR AERIAL APPLICATION IN CALIFORNIA, OR SPECIFIC COUNTIES THEREIN, REFER TO THE FEDERAL SUPPLEMENTAL LABELING FOR AERIAL APPLICATIONS OF THIS PRODUCT IN THAT STATE OR COUNTY FOR SPECIFIC INSTRUCTIONS, RESTRICTIONS AND REQUIREMENTS.

This product, tank-mixed with dicamba, may not be applied by air in California. Only 2,4-D amine formulations may be applied by air in California.

Use the labeled rates of this herbicide in 3 to 25 gallons of water per acre.

TO PREVENT INJURY TO ADJACENT DESIRABLE VEGETATION, APPROPRIATE BUFFER ZONES MUST BE MAINTAINED.

Avoid direct application to any body of water. Drift control reduction additives may be used. When a drift control reduction additive is used, read and carefully observe the cautionary statements and all other information appearing on the additive label.

Ensure uniform application. To avoid streaked, uneven or overlapped application, use appropriate marking devices.

Aircraft Maintenance

PROLONGED EXPOSURE OF THIS PRODUCT TO UNCOATED STEEL SURFACES MAY RESULT IN CORROSION AND POSSIBLE FAILURE OF THE PART. The maintenance of an organic coating (paint) which meets aerospace specification MIL-C-38413 may prevent corrosion. To prevent corrosion of exposed parts, thoroughly wash aircraft after each day of spraying to remove residues of this product accumulated during spraying or from spills. Landing gear is most susceptible.

AERIAL SPRAY DRIFT MANAGEMENT

The following drift management requirements must be followed to avoid off-target drift movement from aerial applications to agricultural field crops. These requirements do not apply to forestry applications or to public health uses.

1. The distance of the outermost nozzles on the boom must not exceed 3/4 the length of the wingspan or rotor.
2. Nozzles must always point backward parallel with the air stream and never be pointed downwards more than 45 degrees. Where states have more stringent regulations, they should be observed.

Importance of Droplet Size

The most effective way to reduce drift potential is to apply large droplets. The best drift management strategy is to apply the largest droplets that provide sufficient coverage and control. Applying larger droplets reduces drift potential, but will not prevent drift if applications are made improperly, or under unfavorable environmental conditions (see the Wind, Temperature and Humidity, and Temperature Inversions sections of this label).

Controlling Droplet Size

Volume: Use high flow rate nozzles to apply the highest practical spray volume. Nozzles with the higher rated flows produce larger droplets.

Pressure: Use the lower spray pressures recommended for the nozzle. Higher pressure reduces droplet size and does not improve canopy penetration. When higher flow rates are needed, use higher flow rate nozzles instead of increasing pressure.

Number of nozzles: Use the minimum number of nozzles that provide uniform coverage.

Nozzle orientation: Orienting nozzles so that the spray is released backwards, parallel to the air stream, will produce larger droplets than other orientations. Significant deflection from the horizontal will reduce droplet size and increase drift potential.

Nozzle type: Use a nozzle type that is designed for the intended application. With most nozzle types, narrower spray angles produce larger droplets. Consider using low-drift nozzles. Solid stream nozzles oriented straight back produce larger droplets than other nozzle types.

Boom length: For some use patterns, reducing the effective boom length to less than 3/4 of the wingspan or rotor length may further reduce drift without reducing swath width.

Application height: Applications must not be made at a height greater than 10 feet above the top of the largest plants unless a greater height is required for aircraft safety. Making applications at the lowest height that is safe reduces the exposure of the droplets to evaporation and wind.

Swath Adjustment

When applications are made with a crosswind, the swath will be displaced downwind. Therefore, on the up and downwind edges of the field, the applicator must compensate for this displacement by adjusting the path of the aircraft upwind. Swath adjustment distance should increase, with increasing drift potential (higher wind, smaller droplets, etc.).

Wind

Drift potential is lowest between wind speeds of 2 to 10 miles per hour. However, many factors, including droplet size and equipment type determine drift potential at any given speed. Application should be avoided below 2 miles per hour due to variable wind direction and high inversion potential. **NOTE:** Local terrain can influence wind patterns. Every applicator should be familiar with local wind patterns and how they affect drift.

Temperature and Humidity

Set up equipment to produce larger droplets when making applications in low relative humidity to compensate for evaporation. Droplet evaporation is most severe when conditions are both hot and dry.

Temperature Inversions

Applications must not occur during a temperature inversion because drift potential is high. Temperature inversions restrict vertical air mixing, which causes small suspended droplets to remain in a concentrated cloud. This cloud can move in unpredictable directions due to the light variable winds common during inversions. Temperature inversions are characterized by increasing temperatures with altitude and are common on nights with limited cloud cover and light to no wind. They begin to form as the sun sets and often continue into the morning. Their presence can be indicated by ground fog; however, if fog is not present, inversions can also be identified by the movement of smoke from a ground source or an aircraft smoke generator. Smoke that layers and moves laterally in a concentrated cloud (under low wind conditions) indicates an inversion, while smoke that moves upward and rapidly dissipates indicates good vertical air mixing.

Sensitive Areas

This product must only be applied when the potential for drift to adjacent sensitive areas (e.g., residential areas, bodies of water, known habitat for threatened or endangered species, non-target crops) is minimal (e.g., when wind is blowing away from the sensitive areas).

7.2 Ground Broadcast Equipment

For broadcast ground applications, unless otherwise specified in this label or in separate supplemental labeling or Fact Sheets published by Monsanto, use this product at the rate of 1.5 to 3 pints per acre for annual weeds, 3 to 7.5 pints per acre for perennial weeds and 3 to 7.5 pints per acre for woody brush and trees. When used according to label directions this product will give control or partial control of herbaceous weeds, woody brush and trees listed in the **WEEDS CONTROLLED** section of this label.

Use the labeled rates of this product in 3 to 40 gallons of water per acre as a broadcast spray unless otherwise specified in this label or in separate supplemental labeling or Fact Sheets published by Monsanto. As weed density increases, the spray volume should be increased toward the upper end of the specified range to ensure complete coverage. Carefully select proper nozzles to avoid spraying a fine mist. For best results with ground application equipment, use flat-fan nozzles. Check spray pattern for even distribution of spray droplets.

7.3 Hand-Held Equipment

Apply to foliage of vegetation to be controlled. For applications made on a spray-to-wet basis, spray coverage should be uniform and complete. Do not spray to the point of runoff. Use coarse sprays only.

For control of weeds listed in the **Annual Weeds** section of **WEEDS CONTROLLED**, apply a 0.5-percent solution of this product to weeds less than 6 inches in height or runner length. For annual weeds over 6 inches tall, or unless otherwise specified, use a 1-percent solution. Apply prior to seedhead formation in grass or bud formation in broadleaf weeds.

For best results, use a 1.5-percent solution on harder-to-control perennials, woody vines, brush and trees. Make applications to perennials after seedhead emergence in grasses or bud formation in broadleaf weeds, woody brush and trees for best results.

For low-volume directed spray applications, use a 4- to 8-percent solution of this product for control or partial control of annual weeds, perennial weeds, or woody brush and trees. Spray coverage should be uniform with at least 50 to 75 percent of the foliage contacted. Coverage of the top one half of the plant is important for best results. If a straight stream nozzle is used, start the application at the top of the targeted vegetation and spray from top to bottom in a lateral zig-zag motion. For flat-fan and cone nozzles and with hand-directed mist blowers, mist the application over the foliage of the targeted vegetation. To ensure adequate spray coverage, spray both sides of large or tall woody brush and trees, when foliage is thick and dense, or where there are multiple sprouts. For best results, apply to actively growing woody brush and trees after full leaf expansion and before fall color and leaf drop.

Unless otherwise specified, use the rates listed in the following table for various methods of foliar application using high-volume, backpack, knapsack and similar types of hand-held equipment. When used according to label directions this product will give control or partial control of herbaceous weeds, woody brush and trees listed in the **WEEDS CONTROLLED** section of this label.

APPLICATION RATES

APPLICATION		SPRAY VOLUME Gallons/Acre
SPRAY-TO-WET		
Handgun or Backpack	0.5 to 1.5% by volume	spray-to-wet*
LOW-VOLUME DIRECTED SPRAY		
Backpack	4 to 8% by volume	15 to 25**
Modified High-volume	1.5 to 3% by volume	40 to 60**

* For applications made on a spray-to-wet basis, spray coverage should be uniform and complete. Do not spray to the point of runoff.

**Low-volume directed applications with backpacks work best when treating weeds and brush less than 10 feet tall. For taller weeds and brush, high-volume handguns can be modified by reducing nozzle size and spray pressure to produce a low-volume directed spray.

7.4 Selective Equipment

This product can be applied through recirculating spray systems, shielded applicators, hooded sprayers, wiper applicators or sponge bars, after dilution and thorough mixing with water, to listed weeds growing in any aquatic or non-agricultural crop site specified on this label.

A recirculating spray system directs the spray solution onto weeds growing above desirable vegetation, while spray solution not intercepted by weeds is collected and returned to the spray tank for reuse.

AVOID CONTACT OF THIS HERBICIDE WITH DESIRABLE VEGETATION, AS SERIOUS INJURY OR DEATH TO DESIRABLE VEGETATION IS LIKELY TO OCCUR.

Applicators used above desired vegetation should be adjusted so that the lowest spray stream or wiper contact point is at least 2 inches above the desirable vegetation. Droplets, mist, foam or splatter of the herbicide solution settling on desirable vegetation is likely to result in discoloration, stunting or destruction.

Better results may be obtained when more of the weed is exposed to the herbicide solution. Weeds not contacted by the herbicide solution will not be affected. This may occur in dense clumps, severe infestations or when the height of the weeds varies so that not all weeds are contacted. In these instances, repeat treatment may be necessary.

Shielded and Hooded Applicators

A shielded or hooded applicator directs the herbicide solution onto weeds, while shielding desirable vegetation from the herbicide. Use nozzles that provide uniform coverage within the treated area. Keep shields on these sprayers adjusted to protect desirable vegetation. USE EXTREME CARE TO AVOID CONTACT OF HERBICIDE WITH DESIRABLE VEGETATION.

Wiper Applicators and Sponge Bars

Wiper applicators are devices that physically wipe this product directly onto the weed.

Equipment must be designed, maintained and operated to prevent the herbicide solution from contacting desirable vegetation. Operate this equipment at ground speeds no greater than 5 miles per hour. Performance may be improved by reducing speed in areas of heavy weed infestations to ensure adequate wiper saturation. Better results may be obtained if 2 applications are made in opposite directions.

Avoid leakage or dripping onto desirable vegetation. Adjust height of applicator to ensure adequate contact with weeds. Keep wiping surfaces clean. Be aware that, on sloping ground, the herbicide solution may migrate, causing dripping on the lower end and drying of the wicks on the upper end of a wiper applicator.

Do not use wiper equipment when weeds are wet.

Mix only the amount of solution to be used during a 1-day period, as reduced activity may result from the use of leftover solutions. Clean wiper parts immediately after using this product by thoroughly flushing with water.

Nonionic surfactant at a rate of 10 percent by volume of total herbicide solution is recommended with all wiper applications.

For Rope or Sponge Wick Applicators—Solutions ranging from 33 to 75 percent of this product in water may be used.

For Panel Applicators—Solutions ranging from 33 to 100 percent of this product in water may be used in panel wiper applicators.

7.5 Injection Systems

This product can be used in aerial or ground injection spray systems. It may be used as a liquid concentrate or diluted prior to injecting into the spray stream. Do not mix this product with the undiluted concentrate of other products when using injection systems unless specifically recommended.

7.6 CDA Equipment

The rate of this product applied per acre by controlled droplet application (CDA) equipment must not be less than the amount in this label when applied by conventional broadcast equipment. For vehicle-mounted CDA equipment, apply 2 to 15 gallons of water per acre.

For the control of annual weeds with hand-held CDA units — Apply a 15-percent solution of this product (19.25 oz of product per gallon) at a flow rate of 2 fluid ounces per minute and a walking speed of 1.5 miles per hour (1 quart per acre). For the control of perennial weeds, apply a 15- to 30-percent solution of this product at a flow rate of 2 fluid ounces per minute and a walking speed of 0.75 mile per hour (2 to 4 quarts per acre).

CDA equipment produces a spray pattern that is not easily visible. Extreme care must be exercised to avoid spray or drift contacting the foliage or any other tissue of desirable vegetation, as damage or destruction is likely to result.

8.0 SITE AND USE INSTRUCTIONS

This product can be used to control weeds, woody brush and trees in aquatic sites, non-agricultural crop sites and crop sites listed on this label.

Non-agricultural crop sites include airports, apartment complexes, commercial sites, ditch banks, dry ditches, dry canals, fence rows, forestry sites, golf courses, habitat restoration and management areas, industrial sites, lumber yards, manufacturing sites, municipal sites, natural areas, office complexes, public areas, parks, parking areas, pastures, petroleum tank farms and pumping installations, railroads, rangeland, recreational areas, residential areas, roadsides, schools, storage areas, substations, utility rights-of-way, utility sites, warehouse areas, and wildlife management areas.

Crop sites include citrus, sugarcane, turf, sod and vegetable fallow.

Unless otherwise specified on this label or in separate supplemental labeling or Fact Sheets published by Monsanto, applications may be made to control any weeds listed in the **Annual Weeds, Perennial Weeds** and **Woody Brush And Trees** rate tables. Refer also to the **Selective Equipment** section.

8.1 Aquatic Sites

This product can be applied to emerged weeds in all bodies of fresh and brackish water which may be flowing, non-flowing or transient. This includes lakes, rivers, streams, ponds, estuaries, rice levees, seeps, irrigation and drainage ditches, canals, reservoirs, wastewater treatment facilities, wildlife habitat restoration and management areas.

If aquatic sites are present in the area and are part of the intended treatment, read and observe the following directions:

This product does not control plants which are completely submerged or have a majority of their foliage under water.

There is no restriction on the use of treated water for irrigation, recreation or domestic purposes.

Consult your local state fish and game agency and water control authorities before applying this product to public water. Permits may be required to treat such water.

NOTE: Do not apply this product **directly to water** within 0.5 mile upstream of an active potable water intake in flowing water (i.e., river, stream, etc.) or within 0.5 mile of an active potable water intake in a standing body of water such as lake, pond or reservoir. To make aquatic applications around and within 0.5 mile of active potable water intakes, the water intake must be turned off for a minimum period of 48 hours after the application. The water intake may be turned on prior to 48 hours if the glyphosate level in the intake water is below 0.7 parts per million as determined by laboratory analysis. These aquatic applications may be made ONLY in those cases where there are alternative water sources or holding ponds which would permit the turning off of an active potable water intake for a minimum period of 48 hours after the applications. This restriction does **NOT** apply to intermittent inadvertent overspray of water in terrestrial use sites.

For treatments after drawdown of water or in dry ditches, allow 7 or more days after treatment before reintroduction of water to achieve maximum weed control. Apply this product within 1 day after drawdown to ensure application to actively growing weeds.

Floating mats of vegetation may require retreatment. Avoid wash-off of sprayed foliage by spray boat or recreational boat backwash or by rainfall within 6 hours of application. Do not retreat within 24 hours following the initial treatment.

Applications made to moving bodies of water must be made while traveling upstream to prevent concentration of this herbicide in water. When making any bankside applications, do not overlap more than 1 foot into open water. Do not spray in bodies of water where weeds do not exist. The maximum application rate of 7.5 pints per acre must not be exceeded in any single broadcast application that is being made over water except as follows, where any labeled rate may be applied:

- Stream crossings in utility rights-of-way.
- Where applications will result in less than 20 percent of the total water area being treated.

When emerged infestations require treatment of the total surface area of impounded water, treating the area in strips may avoid oxygen depletion due to decaying vegetation. Oxygen depletion may result in fish kill.

For Control of Cordgrass (*Spartina spp.*)

The presence of debris and silt on the surface of cordgrass plants will reduce product performance. It may be necessary to wash targeted plants prior to application to improve herbicide uptake. Where cordgrass has been cut or mowed prior to application, allow significant regrowth before application to ensure adequate interception and uptake of the herbicide solution. Rainfall within 2 hours or immersion within 4 hours after application may reduce effectiveness.

Prior to application, survey the areas to be treated to determine if shellfish beds exist within the intended treatment area. Wait either until shellfish have been harvested before application is made or do not harvest shellfish for 14 days following treatment.

Add 1 to 2 quarts or more of nonionic surfactant or other adjuvant approved for use on aquatic sites and compatible with this product per 100 gallons of spray solution for broadcast applications (ground or air) and when using optical sensing application equipment.

Do not apply this product through any type of irrigation system.

APPLICATION

Under ideal application conditions, that is, where silt and debris are not present on plant surfaces, good spray coverage is achievable, target plants are actively growing and labeled rates and application volumes are used, allow at least 4 hours drying time before plants are covered by tidewater. Where one or more of these conditions are not met, schedule applications to allow at lest 5 hours drying time before plants are covered by tidewater. Do not apply when wind speed at the application site exceed 10 miles per hour.

Broadcast Application (Ground): Apply 2 to 8 quarts of this herbicide in 5 to 100 gallons of spray solution per acre. For best results, complete coverage of cordgrass clumps is required.

Broadcast Application (Ground/Optical Sensing Application Equipment): Apply 2 to 8 quarts of this product in 5 to 100 gallons of spray solution per acre using equipment designed and calibrated to deliver spray solution only when cordgrass plants are present and detected by optical sensors. For best results, complete coverage of cordgrass clumps is required.

Hand-Held Backpack or High-volume Equipment: Apply a 5 to 8 percent solution of this product. Ensure that complete coverage of cordgrass clumps is achieved. Do not spray to the point of runoff.

Broadcast Application (Air): Apply 2 to 8 quarts of this product in 5 to 10 gallons of spray solution per acre. Maintain at least a 50-foot buffer between commercial shellfish beds and treated areas. The potential for spray drift is dependent upon weather- and equipment-related factors. The applicator must be familiar with local wind patterns and monitor and record temperature and wind speed prior to and periodically during application. Schedule application in order to allow at least 5 hours before treated plants are covered by tidewater.

For Foliar and Broadcast Treatment of Japanese Knotweed

For control of Japanese knotweed (*Polygonum cuspidatum*), this product may be applied as a 2.0% v/v spray-to-wet solution with 0.5 to 2.0% v/v of a nonionic surfactant containing at least 70 percent active ingredient. Ensure thorough coverage when using spray-to-wet treatments using hand-held equipment.

For broadcast applications, apply 3 quarts of this product with an aquatic approved surfactant system containing 0.1% v/v nonionic organosilicone and 0.25% v/v nonionic spreader sticker surfactant in 3 to 40 gallons per acre as a broadcast treatment.

Allow at least 3 days after application before disturbing treated vegetation. This product does not control plants which are completely submerged or have a majority of their foliage under water.

For Foliar and Broadcast Treatment of Oriental Bittersweet

For control of Oriental bittersweet (*Celastrus orbiculatus*), this product may be applied as a 2.0% v/v spray-to-wet solution with 0.5 to 2.0% v/v of a nonionic surfactant containing at least 70 percent active ingredient. Ensure thorough coverage when using spray-to-wet treatments using hand-held equipment.

For broadcast application, apply 2.25 quarts of this product with an aquatic approved surfactant system containing 0.1% v/v nonionic organosilicone and 0.25% v/v nonionic spreader sticker surfactant in 3 to 40 gallons per acre as a broadcast treatment.

Allow at least 3 days after application before disturbing treated vegetation. This product does not control plants which are completely submerged or have a majority of their foliage under water.

Tank Mixtures

Tank mixtures of this product plus 2,4-D amine may be used to increase the spectrum of vegetation controlled in aquatic sites. Use 1.5 to 2 pints of this product plus 1 to 2 quarts of 2,4-D amine (4 pounds active ingredient per gallon, labeled for aquatic sites) for control of annual weeds. Use 3 to 7.5 pints of this product plus 2 to 4 quarts of 2,4-D amine (4 pounds active ingredient per gallon, labeled for aquatic sites) for control or partial control of perennial weeds, woody brush and trees.

When tank mixing, read and carefully observe the label claims, cautionary statements and all information on the labels of all products used. Use according to the most restrictive precautionary statements for each product in the mixture. Mix in the following sequence: Fill sprayer tank one-half full with water, add Roundup Custom for Aquatic and Terrestrial Use, then 2,4-D amine and finally surfactant. Fill sprayer tank to final volume of water.

NOTE: DO NOT MIX ROUNDUP CUSTOM FOR AQUATIC AND TERRESTRIAL USE AND 2,4-D AMINE CONCENTRATES WITHOUT WATER CARRIER. DO NOT MIX ROUNDUP CUSTOM FOR AQUATIC AND TERRESTRIAL USE AND 2,4-D AMINE IN BYPASS INJECTOR-TYPE SPRAY EQUIPMENT.

8.2 Cut Stump

Cut stump treatments may be made on any site listed on this label. This product will control many types of woody brush and tree species. Apply this product using suitable equipment to ensure coverage of the entire cambium. Cut trees or resprouts close to the soil surface. Apply a 50- to 100-percent solution of this product to the freshly-cut surface **immediately after** cutting. Delays in application may result in reduced performance. For best results, applications should be made during periods of active growth and full leaf expansion.

For control of *Ailanthus altissima* (Tree-of-heaven) make a cut stump treatment according to the directions in this section using a spray mixture of 50% Roundup Custom for Aquatic and Terrestrial Use and 10% Arsenal.

DO NOT MAKE CUT STUMP APPLICATIONS WHEN THE ROOTS OF DESIRABLE WOODY BRUSH OR TREES MAY BE GRAFTED TO THE ROOTS OF THE CUT STUMP. Some sprouts, stems, or trees may share the same root system. Adjacent trees having a similar age, height and spacing may signal shared roots. Whether grafted or shared, injury is likely to occur to non-treated stems/trees when one or more trees sharing common roots are treated.

8.3 Conifer and Herbaceous Release Sites

This product can be used for conifer release as a broadcast spray for control, partial control or suppression of herbaceous weeds and hardwoods listed in the **WEEDS CONTROLLED** section of this label. Use only where conifers have been established for more than one year unless otherwise stated below. This product can be applied as a directed spray or by using selective equipment in forestry hardwood and conifer sites, including Christmas tree plantations and silvicultural nurseries.

Use a nonionic surfactant that is labeled for use in over-the-top conifer release applications. Refer to the surfactant manufacturer's label for surfactant use rates and other precautionary statements. Use of this product without a surfactant will result in reduced herbicide performance.

APPLICATION MUST BE MADE AFTER FORMATION OF FINAL CONIFER RESTING BUDS IN THE FALL OR PRIOR TO INITIAL BUD SWELLING IN THE SPRING.

Injury may occur to conifers treated for release, especially where spray patterns overlap or the higher rates are applied. Damage can be accentuated if applications are made when conifers are actively growing, or are under stress from drought, flood water, improper planting, insects, animal damage or diseases.

For release of the following conifer species outside the Southeastern United States:

Douglas fir, Fir, Hemlock, Pines*, California Redwood, Spruce

*Includes all species except loblolly pine, longleaf pine, shortleaf pine or slash pine.

Use 1.5 to 3 pints of this product per acre as a broadcast spray.

To release Douglas fir, and pine and spruce species at the end of the first growing season (except in California), this product can be used at the lower labeled rates of 1.5 to 2.5 pints per acre. Ensure that the conifers are well hardened off before application. Make sure that the nonionic surfactant has been adequately tested for safety to Douglas fir before use.

For release of Spruce (*Picea spp.*) in Maine, Michigan, Minnesota, New Hampshire and Wisconsin, up to 4.5 pints per acre of this product may be used for the control of difficult woody brush and tree species and application must be made after formation of final conifer resting buds in the fall.

Use of a surfactant is not recommended for release of hemlock species or California redwood. In mix conifer stands injury to these species may result if a surfactant is used.

For release of the following conifer species in the Southeastern United States:

Loblolly pine, Slash pine, Eastern white pine, Virginia pine, Shortleaf pine, Longleaf pine

Apply 2.25 to 3.75 pints of this product per acre as a broadcast spray during late summer or early fall after the pines have hardened off.

For applications made at the end of the first growing season, use 1.5 pints per acre of this product.

TANK MIXTURES: This product can be tank-mixed with the following products for conifer or herbaceous release. When tank mixing, read and carefully observe the label claims, cautionary statements and all information on the labels of all products used. Use according to the most restrictive precautionary statements and label uses for each product in the mixture.

When applied as directed, this product plus listed residual herbicides provides postemergence control of the annual weeds and control or suppression of the perennial weeds listed in this label, and residual control of the weeds listed in the residual herbicide label. Use only on conifer species that are labeled for over-the top sprays for both products.

atrazine
Arsenal Applicator Concentrate
Oust XP

Late Summer and Fall after Resting Bud Formation

For release of jack pine, white pine and white spruce, apply 1.5 to 3 pints of this product plus 1 to 3 ounces of Oust XP per acre. For white pine tank mix a maximum of 1 to 1.5 ounces of Oust XP per acre.

For conifer release of Douglas fir, use 1.5 to 2.25 pints of this product plus 2 to 6 ounces of Arsenal Applicator Concentrate per acre. For conifer release of balsam fir and red spruce, apply 3 pints of this product plus 1 to 2.5 ounces of Arsenal Applicator Concentrate per acre.

Herbaceous Release

For spring and early summer herbaceous release of loblolly pine, Virginia and longleaf pine apply 12 to 18 fluid ounces of this product with 2 to 4 ounces of Oust XP.

For early spring release of Douglas fir, prior to bud swell, apply 1.5 pints of this product plus 4 pounds active ingredient of atrazine per acre. Allow one full growing season before application. Do not add surfactant to this treatment.

8.4 Forestry Site Preparation

Use this product for the control or partial control of woody brush, trees and herbaceous weeds in forestry or for use in preparing or establishing wildlife openings within these sites and maintaining logging roads.

This product can also be used in site preparation prior to planting any tree species, including Christmas trees, eucalyptus, hybrid tree cultivars and silvicultural nursery sites.

For applications using different types of equipment, see **APPLICATION RATES** table in the **HAND-HELD EQUIPMENT** section of this label.

TANK MIXTURES: Tank mixtures of this product can be used to increase the spectrum of vegetation controlled in forestry site preparation. When tank mixing, read and carefully

observe the label claims, cautionary statements and all information on the labels of all products used. Use according to the most restrictive precautionary statements for each product in the mixture.

NOTE: For forestry site preparation, make sure the tank-mix product is approved for use prior to planting the desired species. Observe planting interval restrictions.

Any labeled rate of this product can be used in a tank mix with the following products for forestry site preparation.

Arsenal Applicators Concentrate	Garlon 3A
Chopper	Garlon 4
Chopper GEN2	Oust XP
Escort	

For control of herbaceous weeds, use the lower specified tank mixture rates. For control of dense stands or tough-to-control woody brush and trees, use the higher labeled rates.

Unless otherwise directed on this label or in separately published Monsanto supplemental labelling or Fact Sheet, do not apply this product as an over-the-top broadcast spray for forestry conifer or hardwood release.

8.5 Non-Crop Areas and Industrial Sites

Use in areas including airports, apartment complexes, commercial sites, ditch banks, dry ditches, dry canals, fencerows, forestry sites, golf courses, industrial sites, lumber yards, manufacturing sites, office complexes, parks, parking areas, petroleum tank farms and pumping installations, railroads, recreational areas, residential areas, roadsides, sod or turf seed farms, schools, storage areas, substations, utility sites, warehouse areas, and wildlife management areas.

Weed Control, Trim-and-Edge and Bare Ground

This product can be used in non-agricultural crop areas. It can be applied with any application equipment described in this label. This product can be used to trim-and-edge around objects for spot treatment of unwanted vegetation and to eliminate unwanted weeds growing in established shrub beds or ornamental plantings. This product can be used prior to planting an area to ornamentals, flowers, turfgrass (sod or seed), or prior to laying asphalt or beginning construction projects.

Repeat applications of this product as weeds emerge to maintain bare ground.

TANK MIXTURES: This product can be tank-mixed with the following products.

Arsenal	Garlon 3A	Ronstar 50WP
atrazine*	Garlon 4	simazine*
Barricade 65WG	Goal 2XL	Surflan AS
Certainty®	Krovar I DF	Surflan WDG
Crossbow L	Landmark II	Telar DF
dicamba*	Landmark II MP	Transline
diuron*	Outrider®	Velpar DF
Endurance	Oust XP	Velpar L
Escort XP	Plateau	2,4-D*
Gallery 75DF	Poast	

*User is responsible for ensuring that tank mixtures with products containing this generic active ingredient may be made provided the specific product is registered for this use.

Do not apply dicamba tank mixtures by air in California. Only 2,4-D amine formulations can be applied by air in California.

Brush Control Tank Mixtures

TANK MIXTURES: Tank mixtures of this product can be used to increase the spectrum of control for herbaceous weeds, woody brush and trees. When tank mixing, read and carefully observe the label claims, cautionary statements and all information on the labels of all products used. Use according to the most restrictive precautionary statements for each product in the mixture. Any labeled rate of this product can be used in a tank mix.

For control of herbaceous weeds, use the lower tank mixture rates. For control of dense stands or tough-to-control woody brush and trees, use the higher labeled rates.

NOTE: For side trimming treatments, this product can be used alone or in tank mixture with Garlon 4.

Arsenal	Garlon 3A
Escort XP	Garlon 4

Chemical mowing - Perennials

This product will suppress perennial grasses listed in this section to serve as a substitute for mowing. Use 6 fluid ounces of this product per acre when treating tall fescue, fine fescue, orchardgrass, quackgrass or reed canarygrass covers. Use 5 fluid ounces of this product per acre when treating Kentucky bluegrass. Apply treatments in 10 to 40 gallons of spray solution per acre. Apply after grasses have greened up to at least 75 percent green color in the spring, or 7 to 10 days after mowing when sufficient regrowth has occurred to provide a desirable height for growth regulation.

Use only in areas where some temporary injury or discoloration of perennial grasses can be tolerated.

Chemical mowing - Annuals

For growth suppression of some annual grasses, such as annual ryegrass, wild barley and wild oats growing in coarse turf on roadsides or other industrial areas, apply 3 to 4 fluid ounces of this product in 10 to 40 gallons of spray solution per acre. Applications should be made when annual grasses are actively growing and before the seedheads are in the boot stage of development. Treatments may cause injury to the desired grasses.

Dormant Turfgrass

Use this product to control or suppress many winter annual weeds and tall fescue for effective release of dormant bermudagrass and bahiagrass turf. Treat only when turf is dormant and prior to spring greenup.

Apply 6 to 48 fluid ounces of this product per acre. Apply the labeled rates in 10 to 40 gallons of water per acre. Use only in areas where bermudagrass or bahiagrass are desirable ground covers and where some temporary injury or discoloration can be tolerated.

Treatments in excess of 12 fluid ounces per acre may result in injury or delayed greenup in highly maintained areas, such as golf courses and lawns. DO NOT apply tank mixtures of this product plus Oust XP or Outrider in highly maintained turfgrass areas. For further uses, refer to the **ROADSIDES** section of this label, which gives rates for dormant bermudagrass and bahiagrass treatments.

Actively Growing Bermudagrass

This product can be used to control or partially control many annual and perennial weeds for effective release of actively growing bermudagrass. DO NOT apply more than 12 fluid ounces of this product per acre in highly maintained turfgrass areas. DO NOT apply tank mixtures of this product plus Oust XP or Outrider in highly maintained turfgrass areas. For further uses, refer to the **ROADSIDES** section of this label, which gives rates for actively growing bermudagrass treatments. Use only in areas where some temporary injury or discoloration can be tolerated.

Turfgrass Renovation, Seed, or Sod Production

This product controls most existing vegetation prior to renovating turfgrass areas or establishing turfgrass grown for seed or sod. For maximum control of existing vegetation, delay planting or sodding to determine if any regrowth from escaped underground plant parts occurs. Where repeat treatments are necessary, sufficient regrowth must be attained prior to application. For warm-season grasses such as bermudagrass, summer or fall applications provide the best control. Where existing vegetation is growing under mowed turfgrass management, apply this product after omitting at least one regular mowing to allow sufficient growth for good interception of the spray.

Do not disturb soil or underground plant parts before treatment. Tillage or renovation techniques such as vertical mowing, coring or slicing should be delayed for 7 days after application to allow translocation into underground plant parts.

Desirable turfgrasses can be planted following the above procedures.

Hand-held equipment can be used for spot treatment of unwanted vegetation growing in existing turfgrass. Broadcast or hand-held equipment can be used to control sod remnants or other unwanted vegetation after sod is harvested.

Do not feed or graze turfgrass grown for seed or sod production for 8 weeks following application.

8.6 Habitat Management

Habitat Restoration and Management

Use this product to control exotic and other undesirable vegetation in habitat management and natural areas, including riparian and estuarine areas, rangeland and wildlife refuges. Applications can be made to allow recovery of native plant species, prior to planting desirable native species, and for similar broad-spectrum vegetation control requirements. Spot treatments can be made to selectively remove unwanted plants for habitat management and enhancement.

Wildlife Food Plots

Use this product as a site preparation treatment prior to planting wildlife food plots. Any wildlife food species may be planted after applying this product, or native species may be allowed to repopulate the area. If tillage is needed to prepare a seedbed, wait 7 days after application before tillage to allow translocation into underground plant parts.

8.7 Hollow Stem Injection

Apply this product through hand-held injection devices that deliver specified amounts of this product into targeted hollow-stem plants growing in any aquatic or non-crop site specified on this label. For control of the following hollow-stem plants, follow the use instructions below:

Castorbean (*Ricinus communis*)
Inject 4 mL/plant of this product into the lower portion of the main stem.

Hemlock, Poison (*Conium maculatum*)
Inject one leaf cane per plant 10 to 12 inches above root crown with 5 mL of a 5% v/v solution of this product.

Hogweed, Giant (*Heracleum mantegazzianum*)
Inject one leaf cane per plant 12 inches above root crown with 5 mL of a 5% v/v solution of this product.

Horsetail, Field (*Equisetum arvense*)
Inject one segment above the root crown with 0.5 mL/stem of this product. Use a small syringe that calibrates to this rate.

Iris, Yellow Flag (*Iris Pseudocorus*)

Cut flower stems with clippers 8 to 9 inches above the root crown. Use a cavity needle that is pushed into the stem center and then slowly removed as 0.5 mL/stem of this product is injected into the stem.

Knotweed, Bohemian (*Polygonum bohemicum*), **Knotweed, Giant** (*Polygonum sachalinense*), and **Knotweed, Japanese** (*Polygonum cuspidatum*)
Inject 5 mL/stem of this product into the second or third internode.

Reed, Common (*Phragmites australis*)
Inject 5 mL per stem of a 50% solution of this product into the second or third internode or into freshly cut stems.

Reed, Giant (*Arundo donax*)
Inject 6 mL/stem of this product into the second or third internode.

Thistle, Canada (*Cirsium arvense*)
Cut 8 to 9 of the tallest plants at bud stage in a clump with clippers. Use a cavity needle that is pushed into the stem center and then slowly removed as 0.5 mL/stem of this product is injected into the stem.

NOTE: Based on the maximum annual use rate of glyphosate for these non-crop sites, the combined total for all treatments must not exceed 8 quarts of this product per acre. At 5 mL per stem, 8 quarts should treat approximately 1500 stems.

8.8 Injection and Frill (Woody Brush and Trees)

This product can be used to control woody brush and trees by injection or frill applications. Apply using suitable equipment that must penetrate into the living tissue. Apply the equivalent of 1 mL of this product per each 2 to 3 inches of trunk diameter at breast height (DBH). This is best achieved by applying a 50- to 100-percent concentration of this product either to a continuous frill around the tree or as cuts evenly spaced around the tree below all branches. As tree diameter increases in size, better results are achieved by applying diluted material to a continuous frill or more closely spaced cuttings. Avoid application techniques that allow runoff to occur from frilled or cut areas in species that exude sap freely. In species such as this, make the frill or cuts at an oblique angle to produce a cupping effect and use a 100-percent (undiluted) concentration of this product. For best results, application should be made during periods of active growth and after full leaf expansion.

8.9 Ornamentals, Plant Nurseries, and Christmas Trees

Post-directed, Trim-and-edge

This product can be used as a post-directed spray around established woody ornamental species such as arborvitae, azalea, boxwood, crabapple, eucalyptus, euonymus, fir, douglas fir, jojoba, hollies, lilac, magnolia, maple, oak, poplar, privet, pine, spruce and yew. This product can also be used to trim and edge around trees, buildings, sidewalks and roads, potted plants and other objects in a nursery setting.

Desirable plants may be protected from the spray solution by using shields or coverings made of cardboard or other impermeable material. THIS PRODUCT IS NOT TO BE USED AS AN OVER-THE-TOP BROADCAST SPRAY IN ORNAMENTALS AND CHRISTMAS TREES. Care must be exercised to avoid contact of spray, drift or mist with foliage or bark of established ornamental species.

Site Preparation

This product can be used prior to planting any ornamental, nursery or Christmas tree species.

Wiper Applications

This product can be used through wick or other suitable wiper applicators to control or partially control undesirable vegetation around established eucalyptus or poplar trees. See the **Selective Equipment** section of this label for further information about the proper use of wiper applicators.

Greenhouse/Shadehouse

This product can be used to control weeds growing in and around greenhouses and shadehouses. Desirable vegetation must not be present during application and air circulation fans must be turned off.

8.10 Parks, Recreational and Residential Areas

All of the instructions in the **Non- Crop Areas and Industrial Sites** section apply to park and recreational areas.

This product can be used in parks, recreational and residential areas. It may be applied with any application equipment described in this label to trim-and-edge around trees, fences, and paths, around buildings, sidewalks, and other objects in these areas. This product can be used for spot treatment of unwanted vegetation and to eliminate unwanted weeds growing in established shrub beds or ornamental plantings. This product can be used prior to planting an area to ornamentals, flowers, turfgrass (sod or seed), or prior to laying asphalt or beginning construction projects.

8.11 Railroads

All of the instructions in the **Non-crop Areas and Industrial Sites** section apply to railroads.

Bare ground, Ballast and Shoulders, Crossings, and Spot Treatment

This product can be used to maintain bare ground on railroad ballast and shoulders. Repeat applications can be made as weeds emerge to maintain bare ground. This product can be used to control tall-growing weeds to improve line-of-sight at railroad crossings and reduce the need for mowing along rights-of-way. For crossing applications, up to 80 gallons of spray solution per acre may be used.

TANK MIXTURES: This product can be tank-mixed with the following products for ballast, shoulder, spot, bare ground and crossing treatments provided that the specific product is registered for use on such sites.

Arsenal	Hyvar X-L	Spike 80DF
atrazine*	Krovar I DF	Telar DF
dicamba*	Oust XP	Transline
Escort XP	Outrider	Velpar DF
Garlon 3A	Sahara DG	Velpar L
Garlon 4	simazine*	2,4-D*
Hyvar X		

*Tank mixtures with products containing this active ingredient can be made provided the specific product is registered for this use. User is responsible for ensuring that the mixture product labels allow the specific applications when tank mixing with a generic active ingradient.

Brush Control

This product can be used to control woody brush and trees on railroad rights-of-way. Apply 3 to 8 quarts of this product per acre as a broadcast spray, using boom-type or boomless nozzles. Up to 80 gallons of spray solution per acre may be used. Apply a 0.75- to 1.5-percent solution of this product when using high-volume spray-to-wet applications. Apply a 4- to 8-percent solution of this product when using low-volume directed sprays for spot treatment.

TANK MIXTURES: This product can be mixed with the following products for enhanced control of woody brush and trees provided that the specific product is registered for use on such sites.

Arsenal	Krenite	Transline
Escort XP	Telar DF	Vanquish
Garlon 3A	Tordon K	Velpar DF
Garlon 4	Tordon 22K	Velpar L

Additional instructions are located in the **Non-Crop Areas and Industrial Sites** section under **Brush Control Tank Mixtures.**

Bermudagrass Release

This product can be used to control or partially control many annual and perennial weeds for effective release of actively growing bermudagrass. Apply 12 to 36 fluid ounces of this product in up to 80 gallons of spray solution per acre. Use the lower rate when treating annual weeds below 6 inches in height (or runner length). Use the higher rate as weeds increase in size or as they approach flower or seedhead formation. These rates will also provide partial control of the following perennial species:

Bahiagrass	Fescue, tall	Trumpetcreeper
Bluestem, silver	Johnsongrass	Vaseygrass

TANK MIXTURES: This product can be tank-mixed with Oust XP. If tank-mixed, use no more than 12 to 36 fluid ounces of this product with 1 to 2 ounces of Oust XP per acre. Use the lower rates of each product to control annual weeds less than 6 inches in height (or runner length) that are listed in this label and the Oust XP label. Use the higher rates as annual weeds increase in size and approach the flower or seedhead stages. These rates will also provide partial control of the following perennial weeds:

Bahiagrass	Dock, curly	Trumpetcreeper
Blackberry	Dogfennel	Vaseygrass
Bluestem, silver	Fescue, tall	Vervain, blue
Broomsedge	Johnsongrass	
Dallisgrass	Poorjoe	
Dewberry	Raspberry	

Use only on well-established bermudagrass. Bermudagrass injury may result from the treatment, but regrowth will occur under moist conditions. Do not make repeat applications in the same season since severe injury may occur.

8.12 Roadsides

All of the instructions in the **Non-Crop Areas and Industrial Sites** section apply to roadsides.

Shoulder Treatments

Use this product on road shoulders and applied with boom sprayers, shielded boom sprayers, high-volume off-center nozzles, hand-held equipment, and similar equipment.

Guardrails and Other Obstacles to Mowing

This product can be used to control weeds growing under guardrails and around signposts and other objects along the roadside.

Spot Treatment

This product can be used as a spot treatment to control unwanted vegetation growing along roadsides.

TANK MIXTURES: This product can be tank-mixed with the following products for shoulder, guardrail, spot and bare ground treatments, provided that the specific tank mixture product is registered for use on such sites. Refer to these product labels and observe the cautionary statements and all other information appearing on the labels of all herbicides used. Use according to the most restrictive precautionary statements for each product in the mixture.

atrazine*	Landmark MP	Sahara DG
Crossbow L	Landmark XP	simazine*
dicamba*	Oust XP	Surflan AS
diuron*	Outrider	Surflan WDG
Escort XP	pendimethalin*	Telar DF
Endurance	Plateau	Velpar DF
Gallery 75 DF	Plateau DG	Velpar L
Krovar I DF	Poast	2,4-D*
Landmark II MP	Ronstar 50 WSP	

* Tank mixtures with products containing this generic active ingredient can be made provided the specific product is registered for this use. User is responsible for ensuring the mixture product allows the specific application.

Release of Bermudagrass or Bahiagrass

Dormant Applications

This product can be used to control or partially control many winter annual weeds and tall fescue for effective release of dormant bermudagrass or bahiagrass. Treat only when turf is dormant and prior to spring greenup. This product can also be tank-mixed with Outrider or Oust XP for residual control. Tank mixtures of this product with Oust XP may delay greenup.

For best results on winter annuals, treat when plants are in an early growth stage (below 6 inches in height) after most have germinated. For best results on tall fescue, treat when fescue is at or beyond the 4- to 6-leaf stage.

Apply 6 to 48 ounces of this product in a tank mixture with 0.75 to 1.33 ounces Outrider herbicide per acre. Read and follow all label directions for Outrider herbicide.

TANK MIXTURES: Apply 6 to 48 fluid ounces of this product per acre alone or in a tank mixture with 0.25 to 1 ounce per acre of Oust XP. Apply the labeled rates in 10 to 40 gallons of water per acre. Use only in areas where bermudagrass or bahiagrass are desirable ground covers and where some temporary injury or discoloration can be tolerated. To avoid delays in greenup and minimize injury, add no more than 1 ounce of Oust XP per acre on bermudagrass and no more than 0.5 ounce of Oust XP per acre on bahiagrass and avoid treatments when these grasses are in a semi-dormant condition.

Actively Growing Bermudagrass

This product can be used to control or partially control many annual and perennial weeds for effective release of actively growing bermudagrass. Apply 12 to 36 fluid ounces of this product in 10 to 40 gallons of spray solution per acre. Use the lower rate when treating annual weeds below 6 inches in height (or runner length). Use the higher rate as weeds increase in size or as they approach flower or seedhead formation. These rates will also provide partial control of the following perennial species:

Bahiagrass	Fescue, tall	Trumpetcreeper
Bluestem, silver	Johnsongrass	Vaseygrass

TANK MIXTURES: This product can be tank-mixed with Outrider for control or partial control of Johnsongrass and other weeds listed in the Outrider label. Use 6 to 24 ounces of this product with 0.75 to 1.33 ounces of Outrider. Use the higher rates of both products for control of perennial weeds or annual weeds greater than 6 inches in height.

This product can be tank-mixed with Oust XP. If tank-mixed, use no more than 12 to 24 fluid ounces of this product with 1 to 2 ounces of Oust XP per acre. Use the lower rates of each product to control annual weeds less than 6 inches in height (or runner length) that are listed in this label and the Oust XP label. Use the higher rates as annual weeds increase in size and approach the flower or seedhead stages. These rates will also provide partial control of the following perennial weeds:

Bahiagrass	Dock, curly	Poorjoe
Bluestem, silver	Dogfennel	Trumpetcreeper
Broomsedge	Fescue, tall	Vaseygrass
Dallisgrass	Johnsongrass	Vervain, blue

Use only on well-established bermudagrass. Bermudagrass injury may result from the treatment, but regrowth will occur under moist conditions. Do not make repeat applications of the tank mix in the same season since severe injury may occur.

Actively Growing Bahiagrass

For suppression of vegetative growth and seedhead inhibition of bahiagrass for approximately 45 days, apply 4 fluid ounces of this product in 10 to 40 gallons of water per acre. Apply 1 to 2 weeks after full greenup or after mowing to a uniform height of 3 to 4 inches. This application must be made prior to seedhead emergence.

For suppression up to 120 days, apply 3 fluid ounces of this product per acre, followed by an application of 2 to 3 fluid ounces per acre about 45 days later. Make no more than 2 applications per year.

This product can be used for control or partial control of Johnsongrass and other weeds listed on the Outrider label in actively growing bahiagrass. Apply 1.5 to 3.5 fluid ounces of this product with 0.75 to 1.33 ounces of Outrider per acre. Use the higher rates for control of perennial weeds or annual weeds greater than 6 inches in height. Use only on well established bahiagrass.

A tank mixture of this product plus Oust XP may be used. Apply 4 fluid ounces of this product plus 1/4 ounce of Oust XP per acre 1 to 2 weeks following an initial spring mowing. Make only one application per year.

8.13 Utility Sites

In utilities, use this product along electrical power, pipeline and telephone rights-of-way, and in other sites associated with these rights-of-way, such as substations, roadsides, railroads or similar rights-of-way that run in conjunction with utilities. Use in preparing or establishing wildlife openings within these sites, maintaining access roads and for side trimming along utility rights-of-way.

TANK MIXTURES: Tank mixtures of this product can be used to increase the spectrum of control for herbaceous weeds, woody brush and trees. Any labeled rate of this product can be used in a tank mix.

For control of herbaceous weeds, use the lower tank mixture rates. For control of dense stands or tough-to-control woody brush and trees, use the higher rates.

NOTE: For side trimming treatments, this product may be used alone or in tank mixture with Garlon 4.

Arsenal	Krenite	Surflan AS
atrazine*	Krovar I DF	Surflan WDG
dicamba*	Oust XP	Telar DF
diuron*	Outrider	Transline
Endurance	pendimethalin*	Vanquish
Escort XP	Plateau	Velpar DF
Garlon 3A**	Sahara DG	Velpar L
Garlon 4	simazine*	2,4-D*

* Tank mixtures with products containing this generic active ingredient can be made provided the specific product is registered for this use. User is responsible for ensuring the mixture product allows the specific application.

** Ensure that Garlon 3A is thoroughly mixed with water according to label directions before adding this product. Have spray mixture agitating at the time this product is added to avoid spray compatibility problems.

Bare Ground and Trim-and-Edge

Use this product in and around utility sites and substations for bare ground, trim-and-edge around objects, spot treatment of unwanted vegetation and to eliminate unwanted weeds growing in established shrub beds or ornamental plantings. This product can be used prior to planting a utility site to ornamentals, flowers, turfgrass (sod or seed), or beginning construction projects.

Repeat applications of this product as weeds emerge to maintain bare ground.

TANK MIXTURES: Tank mix with the following products. Refer to the specific product labels for approved sites and application rates. Read and carefully observe the cautionary statements and all other information appearing on the labels of all herbicides used. Use according to the most restrictive precautionary statements for each product in the mixture.

Arsenal	Garlon 3A	Poast
atrazine*	Garlon 4	Ronstar 50WP
Barricade 65WG	Goal 2XL	simazine*
Certainty	Krovar I DF	Surflan AS
Crossbow L	Landmark II MP	Surflan WDG
dicamba *	Landmark II	Telar DF
diuron*	Outrider	Transline
Endurance	Oust XP	Velpar DF
Escort XP	pendimethalin*	Velpar L
Gallery 75DF	Plateau	2,4-D*

*Tank mixtures with products containing this generic active ingredient may be made provided the specific product is registered for this use. User is responsible for ensuring the mixture product label allows the specific application.

9.0 PASTURE AND RANGELANDS

9.1 Pastures

LABELED GRASSES: Bahiagrass, Bermudagrass, Bluegrass, Brome, Fescue, Guineagrass, Kikuyugrass, Orchardgrass, Pangola grass, Ryegrass, Timothy, Wheatgrass.

Preplant, Preemergence, Pasture Renovation

This product can be applied prior to planting or emergence of forage grasses. In addition, this product can be used to control perennial pasture species listed on this label prior to re-planting.

If application rates total 4.5 pints per acre or less, no waiting period between treatment and feeding or livestock grazing is required. If the rate is greater than 4.5 pints per acre, remove domestic livestock before application and wait 8 weeks after application before grazing or harvesting.

Spot Treatment, Over-the-Top Wiper Applications

This product can be applied as a spot treatment or with wiper applicators in pastures. Applications may be made in the same area at 30-day intervals.

For spot treatments or wiper application methods using rates of 4.5 pints per acre or less, the entire field or any portion of it may be treated. When spot treatments or wiper application are made using rates above 4.5 pints per acre, no more than 10 percent of the total pasture may be treated at any one time. To achieve maximum performance, remove domestic livestock before application and wait 7 days after application before grazing livestock or harvesting.

Postemergent Weed Control (Broadcast Treatments)

This product can be used to suppress competitive growth and seed production of annual weeds and undesirable vegetation in pastures. For selective applications with broadcast spray equipment, apply 9 to 12 fluid ounces of this product per acre in early spring before desirable perennial grasses break dormancy and initiate green growth. Late fall applications can be made after desirable perennial grasses have reached dormancy.

Some stunting of perennial grasses will occur if broadcast applications are made when plants are not dormant. No waiting period is required between application and grazing or harvesting for feed. Use of higher application rates will cause stand reductions. Do not apply more than 4.5 pints per acre per year onto pasture grasses except for renovation uses. If replanting is needed due to severe stand reduction, applications must be made at least 30 days prior to planting any grass not listed for treatment in this label.

9.2 Rangelands

Postemergence application of this product will control or suppress many annual weeds growing in perennial cool- and warm-season grass rangelands.

Preventing viable seed production is key to the successful control and invasion of annual grassy weeds in rangelands. Follow-up applications in sequential years should eliminate most of the viable seeds.

Grazing of treated areas should be delayed to encourage growth of desirable perennials. Allowing desirable perennials to flower and reseed in the treated area will encourage successful transition.

Apply 9 to 12 fluid ounces of this product per acre to control or suppress many weeds, including downy brome, cheatgrass, cereal rye and jointed goatgrass in rangelands. Apply when most brome plants are in early flower and before the plants, including seedheads, turn color. Allowing for secondary weed flushes to occur in the spring following rain events further depletes the seed reserve and encourages perennial grass conversion on weedy sites. Fall applications are possible and recommended, where spring moisture is usually limited and fall germination allows for good weed growth.

For medusahead, apply 12 fluid ounces of this product per acre at the 3-leaf stage. Delaying applications beyond this stage will result in reduced or unacceptable control. Controlled burning may be useful in eliminating the thatch layer produced by slowly decaying culms prior to application. Allow new growth to occur before spraying after a burn. Repeat applications in subsequent years may be necessary to eliminate the seedbank before reestablishing desirable perennial grasses in medusahead-dominated rangelands.

Slight discoloration of the desirable grasses may occur, but they will regreen and regrow under moist soil conditions as effects of this product wear off. Do not use ammonium sulfate when spraying rangeland grasses with this product. No waiting period between treatment and feeding of livestock grazing is required.

10.0 CROP USES

10.1 Citrus

For use in Florida and Texas on Calamondin, Chironja, Citron, Citrus Hybrids, Grapefruit, Kumquat, Lemon, Lime, Mandarin (tangerine), Orange (all), Pummelo, Satsuma Mandarin, Tangelo (ugli), Tangor.

This product can be applied preplant (site preparation) broadcast spray, middles (between rows of trees, vines or bushes), strips (within rows of trees, vines or bushes), shielded sprayers, wiper applications, directed spray, or as spot treatment.

Applications may be made with boom equipment, CDA equipment, shielded sprayers, hand-held and high-volume wands, lances, orchard guns or with wiper applicator equipment, except as directed.

The following instructions pertain to Florida and Texas.

For burndown or control of the weeds listed below, apply the labeled rates of this product in 3 to 30 gallons of water per acre. Where weed foliage is dense, use 10 to 30 gallons of water per acre.

For goatweed, apply 3 to 4.5 pints of this product per acre. Apply in 20 to 30 gallons of water per acre when plants are actively growing. Use 3 pints per acre when plants are less than 8 inches tall and 4.5 pints per acre when plants are greater than 8 inches tall. If goatweed is greater than 8 inches tall, the addition of Krovar I or Karmex may improve control. Refer to the individual product labels for specific crops, rates, geographic restrictions and precautionary statements.

Perennial weeds:

S = Suppression B = Burndown PC = Partial control C = Control

ROUNDUP CUSTOM FOR AQUATIC AND TERRESTRIAL USE RATE PER ACRE

WEED SPECIES	1.5 PT	3 PT	4.5 PT	7.5 PT
Bermudagrass	B	--	PC	C
Guineagrass				
Texas and Florida Ridge	B	C	C	C
Florida Flatwoods	--	B	C	C
Paragrass	B	C	C	C
Torpedograss	S	--	PC	C

Allow a minimum of 1 day between last application and harvest in citrus crops. For citron groves, apply as directed sprays only.

10.2 Sugarcane

This product can be applied fallow, preplant, preemergence or at-planting using hooded sprayers, shielded sprayers, or by wiper application in row-middles, as a post-harvest treatment, as a spot treatment or as foliar treatment for plant growth regulation.

Preplant, Preemergence, At-Planting

Apply this product in or around sugarcane fields or in fields prior to the emergence of plant cane. Do not apply to vegetation in or around ditches, canals or ponds containing water to be used for irrigation.

Spot Treatment

Apply this product as a spot treatment in sugarcane. For control of volunteer or diseased sugarcane, make a 0.75-percent solution of this product in water and spray-to-wet the foliage of vegetation to be controlled. Volunteer or diseased sugarcane should have at least 7 new leaves. Avoid spray contact with healthy cane plants since severe damage or destruction may result. Do not feed or graze treated sugarcane foliage following application.

Fallow Treatments

Apply this product as a replacement for tillage in fields that are lying fallow between sugarcane crops. This product can also be used to remove the last stubble of ratoon cane. For removal of last stubble of ratoon cane, apply 6 to 7.5 pints of this product in 10 to 40 gallons of water per acre to new growth having at least 7 new leaves. Allow 7 or more days after application before tillage. Ground or aerial application equipment may be used. Applications up to 4.5 pints per acre may be made by aerial application in fallow sites where there is sufficient buffer to prevent injury due to drift onto adjacent crops. Tank mixtures with 2,4-D and dicamba can be used.

Hooded Sprayers

Apply this product through hooded sprayers for weed control between the rows of sugarcane. See the **APPLICATION EQUIPMENT AND TECHNIQUES** section of this label for additional use instructions.

Do not allow treated weeds to come into contact with the crop. Droplets, mist, foam or splatter of the herbicide solution settling on the crop can result in discoloration, stunting or destruction. Such damage shall be the sole responsibility of the applicator.

Foliar Treatment for Plant Growth Regulation

Do not plant to subsequent crops other than the following for 30 days after application: Corn (All), Soybean, Sorghum (Milo), Cotton, Alfalfa, Beans (All), Forage Grasses, Potatoes (Irish, Sweet), Wheat.

When applied as directed under the conditions described, this product will hasten ripening and extend the period of high sucrose level in sugarcane. It is effective in both low- and high-tonnage sugarcane. As a result of leaf desiccation, improved trash burn can be expected. Within 2 to 3 weeks after application, this product can produce a slight yellowing to pronounced browning and drying of leaves, and a shortening of upper internodes; spindle death may occur. Most of the sucrose increase is concentrated in the top nodes of the treated cane stalk. In order to recover the maximum sugar where topping is practiced, during harvest, top at the base of the fourth leaf. Prior to application, consult your state sugarcane authority or local Monsanto representative regarding the degree of sucrose response anticipated from the variety of sugarcane to be treated.

See the following for rates and time of application for the State in which applications are to be made. **NOTE:** Use the higher rate within the specified range when treating sugarcane under adverse ripening conditions or when less responsive varieties are to be treated.

FLORIDA—Apply 6 to 14 fluid ounces of this product per acre 3 to 5 weeks before harvest of LAST RATOON CANE ONLY.

HAWAII—Apply 10 to 24 fluid ounces of this product per acre 4 to 10 weeks before harvest.

LOUISIANA—Apply 4 to 14 fluid ounces of this product per acre 3 to 7 weeks before harvest of RATOON CANE ONLY.

PUERTO RICO—Apply 6 fluid ounces of this product per acre 3 to 5 weeks before harvest of RATOON CANE ONLY.

TEXAS—Apply 6 to 14 fluid ounces of this product per acre 3 to 5 weeks before harvest of RATOON CANE ONLY.

Application of this product can initiate development of shooting eyes. This product can not increase the sucrose content of sugarcane under conditions of good natural ripening. Do not apply to sugarcane to be harvested for seed purposes. Do not feed or graze treated sugarcane forage following application.

10.3 Chemical Fallow Treatments

Apply this product during fallow intervals preceding planting, prior to planting or transplanting, at-planting, or preemergent to vegetable crops.

When applying this product prior to transplanting or direct-seeding vegetable crops into plastic mulch, care must be taken to remove residues of this product, which could cause crop injury, from the plastic prior to planting. Residues can be removed by a single 0.5-inch application of water, either by natural rainfall or via a sprinkler system. Ensure that the wash water flushes off the plastic mulch and does not enter the transplant holes. Applications made at emergence will result in injury or death to emerged seedlings.

Avoid contact of herbicide with foliage, shoots or stems, green bark, exposed roots (including those emerging from plastic mulch), or fruit of crops because severe injury or

destruction may result. Post-harvest or fallow applications must be made at least 30 days prior to planting any non-labeled crop.

10.4 Sod or Commercial Sod Production

Preplant, Preemergence, At-Planting, Renovation, Site Preparation

This product controls most existing vegetation prior to renovating turf or forage grass seed areas or establishing turf grass grown for sod. Make applications before, during, or after planting or for renovation. For maximum control of existing vegetation, delay planting to determine if any regrowth from escaped underground plant parts occurs. Where existing vegetation is growing under mowed turfgrass management, apply this product after omitting at least one regular mowing to allow sufficient growth for good interception of the spray. Where repeat treatments are necessary, sufficient regrowth must be attained prior to application. For warm-season grasses, such as Bermudagrass, summer or fall applications provide best control. Broadcast equipment may be used to control sod remnants or other unwanted vegetation after sod is harvested.

Do not disturb soil or underground plant parts before treatment. Tillage or renovation techniques such as vertical mowing, coring or slicing should be delayed for 7 days after application to allow proper translocation into underground plant parts. If application rates total 72 fluid ounces per acre or less, no waiting period between treatment and feeding or livestock grazing is required. If the rate is greater than 4.5 pints per acre, remove domestic livestock before application and wait 8 weeks after application before grazing or harvesting. For any crop not listed for treatment in this label, applications must be made at least 30 days prior to planting. Applications must be made prior to the emergence of the crop to avoid crop injury.

Shielded Sprayers

Apply 1.5 to 4.5 pints of this product in 10 to 20 gallons of water per acre to control weeds between grass seed rows. Uniform planting in straight rows aid in shielded sprayer applications. Best results are obtained when the grass seed crop is small enough to easily pass by the protective shields. For additional instructions, see **Hooded and Shielded Applicators** in the **Selective Equipment** section.

Contact of this product in any manner to any vegetation to which treatment is not intended can cause damage. Such damage shall be the sole responsibility of the applicator.

Over-the-Top Wiper Applications

Adjust applicators so that the wiper contact point is at least 2 inches above the desirable vegetation. Weeds should be a minimum of 6 inches above the desirable vegetation. Better results may be obtained when more of the weed is exposed to the herbicide solution. Weeds not contacted by the herbicide solution will not be affected. This may occur in dense clumps, severe infestations, or when height of weeds varies so that not all weeds are contacted. In these instances, repeat treatments may be necessary. For additional instructions, see **Wiper Applicators** in the **Selective Equipment** section.

Contact of the herbicide solution with desirable vegetation can result in damage or destruction.

Spot Treatment

Apply this product as a 1-percent solution prior to heading of grasses grown for seed. The crop receiving the spray in the treated area will be killed. Take care to avoid drift or spray outside the target area for the same reason. Use hand-held equipment to control sod remnants or other unwanted vegetation after sod is harvested.

Creating Rows in Annual Ryegrass

Use 12 to 24 fluid ounces of this product per acre. Use the higher rate when the ryegrass is greater than 6 inches tall. Best results are obtained when applications are made before the ryegrass reaches 6 inches in height.

Set nozzle heights to allow the establishment of the desired row spacing while preventing spray droplets, spray fines, or drift to contact the ryegrass plants not treated. Use of low-pressure nozzles, or drop nozzles designed to target the application over a narrow band are recommended.

Grower assumes all responsibility for crop losses from misapplication.

11.0 USES AROUND THE FARMSTEAD

11.1 Weed Control and Trim-And-Edge

This product can be used to control annual weeds, perennial weeds and woody brush which are found in any part of the farmstead, including building foundations, along and in fences, in dry ditches and canals, along ditchbanks, farm roads, shelterbelts, prior to landscape plantings and equipment storage areas.

This product can be tank-mixed with the following products, provided that the specific product is registered for use on such non-agricultural crop sites. Refer to these product labels for approved farmstead sites and application rates. For annual weeds, use 1.5 pints per acre of this product when weeds are less than 6 inches tall, 2.25 pints per acre when weeds are 6 to 12 inches tall and 3 pints per acre when weeds are greater than 12 inches tall. For perennial weeds, apply 3 to 7.5 pints per acre in these tank mixes. For tank mixtures with these products through backpack sprayers, handguns or other high-volume spray-to-wet applications, see the **ANNUAL WEEDS** section for hand-held or high-volume equipment of this label for specific rates.

Arsenal	Krovar I DF	Ronstar 50 WP
Banvel/Clarity	Oust XP	Sahara
Barricade 65WG	Pendulum 3.3 EC	simazine
diuron	Pendulum WDG	Surflan
Endurance	Plateau	Telar
Escort	Princep DF	Vanquish
Karmex DF	Princep Liquid	2,4-D

This product plus dicamba tank mixtures may not be applied by air in California.

11.2 Greenhouse/Shadehouse

This product can be used to control weeds in and around greenhouses and shadehouses. Desirable vegetation must not be present during application and air circulation fans must be turned off.

11.3 Chemical Mowing

This product will suppress perennial grasses listed in this section to serve as a substitute for mowing. Use 4.5 fluid ounces of this product per acre when treating Kentucky bluegrass. Use 6 fluid ounces of this product per acre when treating tall fescue, fine fescue, orchardgrass, bahiagrass or quackgrass covers. Use 12 fluid ounces of this product per acre when treating bermudagrass. Use 48 fluid ounces of this product per acre when treating torpedograss or paragrass. Apply treatments in 10 to 20 gallons of spray solution per acre. Chemical mowing applications may be made along farm ditches and other parts of farmsteads.

Use only in areas where some temporary injury or discoloration of perennial grasses can be tolerated.

12.0 WEEDS CONTROLLED

Always use the higher rate of this product per acre within the labeled range when weed growth is heavy or dense or weeds are growing in an undisturbed (non-cultivated) area.

Reduced results can occur when treating weeds heavily covered with dust. For weeds that have been mowed, grazed or cut, allow regrowth to occur prior to treatment.

Refer to the following label sections for application rates for the control of annual and perennial weeds and woody brush and trees. For difficult to control perennial weeds and woody brush and trees, where plants are growing under stressed conditions, or where infestations are dense, use this product at 4.5 to 8 quarts per acre for enhanced results.

12.1 Annual Weeds

Apply to actively growing annual grasses and broadleaf weeds.

Allow at least 3 days after application before disturbing treated vegetation. After this period the weeds may be mowed, tilled or burned. See **DIRECTIONS FOR USE, PRODUCT INFORMATION** and **MIXING** and **APPLICATION INSTRUCTIONS** for labeled uses and specific application instructions.

Use 1.5 pints per acre if weeds are less than 6 inches in height or runner length and 1 to 4 quarts per acre if weeds are over 6 inches in height or runner length or where weeds are growing under stressed conditions.

For spray-to-wet applications, apply a 0.5-percent solution of this product to weeds less than 6 inches in height or runner length. Apply prior to seedhead formation in grass or bud formation in broadleaf weeds. For annual weeds over 6 inches tall, or for smaller weeds growing under stressed conditions, use a 0.75- to 1.5-percent solution. Use the higher labeled rate for tough-to-control species or for weeds over 24 inches tall.

WEED SPECIES

Anoda, spurred	Copperleaf, Virginia
Balsamapple**	Coreopsis, plains/tickseed*
Barley*	Corn*
Barley, little*	Crabgrass*
Barnyardgrass*	Cupgrass, woolly*
Bassia, fivehook	Dwarfdandelion*
Bittercress*	Eclipta*
Bluegrass, annual*	Falsedandelion*
Bluegrass, bulbous*	Falseflax, smallseed*
Brome, downy*	Fiddleneck
Brome, Japanese*	Filaree
Broomsedge	Fleabane, annual*
Buttercup*	Fleabane, hairy (*Conyza bonariensis*)*
Carpetweed	Fleabane, rough*
Cheatgrass*	Foxtail*
Cheeseweed (*Malva parviflora*)	Foxtail, Carolina*
Chervil*	Geranium, Carolina
Chickweed*	Goatgrass, jointed*
Cocklebur*	Goosegrass
Copperleaf, hophornbeam	Groundsel, common*

Henbit	Rocket, London*
Horseweed/Marestail (*Conyza canadensis*)	Rocket, Yellow
Itchgrass*	Rye*
Johnsongrass, seedling	Ryegrass*
Junglerice	Sandbur, field*
Knotweed	Sesbania, hemp
Kochia	Shattercane*
Lamb's-quarters*	Shepherd's-purse*
Lettuce, prickly*	Sicklepod
Mannagrass, eastern*	Signalgrass, broadleaf*
Mayweed	Smartweed, ladysthumb*
Medusahead*	Smartweed, Pennsylvania*
Morningglory (*Ipomoea* spp)	Sorghum, grain (milo)*
Mustard, blue*	Sowthistle, annual
Mustard, tansy*	Spanishneedles***
Mustard, tumble*	Speedwell, Corn*
Mustard, wild*	Speedwell, purslane*
Nightshade, black*	Spangletop*
Oats	Spurge, annual
Panicum, browntop*	Spurge, prostrate*
Panicum, fall*	Spurge, spotted*
Panicum, Texas*	Spurry, umbrella*
Pennycress, field*	Starthistle, yellow
Pepperweed, Virginia*	Stinkgrass*
Pigweed*	Sunflower*
Puncturevine	Teaweed / Prickly sida
Purslane, common	Thistle, Russian
Pusley, Florida	Velvetleaf
Ragweed, common*	Wheat*
Ragweed, giant	Wild oats*
Rice, red	Witchgrass*

* When using field broadcast equipment (aerial applications or boom sprayers using flat-fan nozzles) these species will be controlled or partially controlled using 12 fluid ounces of this product per acre. Applications must be made using 3 to 10 gallons of carrier volume per acre. Use nozzles that ensure thorough coverage of foliage and treat when weeds are in an early growth stage.

** Apply with hand-held equipment only.

*** Apply 3 pints of this product per acre.

12.2 Perennial Weeds

Best results are obtained when perennial weeds are treated after they reach the reproductive stage of growth (seedhead initiation in grasses and bud formation in broadleaves). For non-flowering plants, best results are obtained when the plants reach a mature stage of growth. In many situations, treatments are required prior to these growth stages. Under these conditions, use the higher application rate within the labeled range.

- Apply when target plants are actively growing. Do not treat when target plants are under drought stress.
- Ensure thorough coverage when using spray-to-wet treatments using hand-held equipment.
- When using hand-held equipment for low-volume directed spot treatments, apply a 4- to 8-percent solution of this product.
- Allow 7 or more days after application before tillage or mowing. If weeds have been mowed or tilled, do not treat until regrowth has reached the specified stages.
- Fall treatments must be applied before a killing frost.
- Repeat treatments may be necessary to control weeds regenerating from underground parts or seed.

Weed Species	Rate (QT/A)	Hand-Held % Solution
Alfalfa*	0.7	1.5
Alligatorweed*	3	1.3
Apply when most of the target plants are in bloom. Repeat applications will be required to maintain such control.		
Anise (fennel)	1.5 – 3	1 – 1.5
Bahiagrass	2.3 – 3.75	1.5
Beachgrass, European (*Ammophila arenaria*)	–	3.5
Apply an 8-percent solution of this product plus 0.5- to 1.5-percent nonionic surfactant on a low-volume spray-to-wet basis. Best results are obtained when applications are made when European beachgrass is actively growing through the boot to the full heading stages of growth. Make applications prior to the loss of more than 50% green leaf color in the fall. Repeat applications may be necessary to treat skips. Monitor treated areas prior to reseeding of desirable vegetation. For selective control of European beachgrass with wiper application, apply a 33.3-percent solution of this product plus 1 to 2.5 percent nonionic surfactant during active growth. Avoid contact of herbicide solution with desirable vegetation. Wiping the plants in opposite directions may improve performance. Maximizing the amount of individual leaf tissue contacted with the wiping equipment will result in optimal performance.		
Benlgrass*	1	1.5
Bermudagrass	4	1.5
Apply to target plants when seed heads appear.		
Bermudagrass, water (knotgrass)	1	1.5
Bindweed, field	2.3 – 3.75	1.5
Apply 3 to 3.75 quarts of this product per acre as a broadcast spray west of the Mississippi River and 2.3 to 3 quarts of this product per acre east of the Mississippi River. Apply when most target plants are at or beyond full bloom. New leaf development indicates active growth. For best results apply in late summer or fall.		
Bluegrass, Kentucky	1.5 – 2.3	0.75
Apply when most target plants have reached the boot-to-head stage of growth. When applied prior to the boot stage, less desirable control may be obtained. In the fall, apply before plants have turned brown.		
Blueweed, Texas	2.3 – 3.75	1.5
Apply 3 to 3.75 quarts of this product per acre as a broadcast spray west of the Mississippi River and 2.3 to 3 quarts of this product per acre east of the Mississippi River. Apply when most target plants are at or beyond full bloom. New leaf development indicates active growth. For best results apply in late summer or fall.		
Brackenfern	2.3 – 3	0.75 – 1
Apply to fully expanded fronds which are at least 18 inches long.		
Bromegrass, smooth	1.5 – 2.3	0.75
Apply when most target plants have reached the boot-to-head stage of growth. When applied prior to the boot stage, less desirable control may be obtained. In the fall, apply before plants have turned brown.		
Bursage, woolly-leaf	–	1.5
Canarygrass, reed	1.5 – 2.3	0.75
Apply when most target plants have reached the boot-to-head stage of growth. When applied prior to the boot stage, less desirable control may be obtained. In the fall, apply before plants have turned brown.		
Cattail	2.3 – 3.75	0.75
Apply when target plants are actively growing and are at or beyond the early-to-full bloom stage of growth. Best results are achieved when application is made during the summer or fall months.		
Clover, red, white	2.3 – 3.75	1.5
Cogongrass	2.3 – 3.75	1.5
Apply when cogongrass is at least 18 inches tall and actively growing in late summer or fall. Due to uneven stages of growth and the dense nature of vegetation preventing good spray coverage, repeat treatments may be necessary to maintain control.		
Cordgrass	See Sect 8.1	2–8
Schedule applications in order to allow 6 hours before treated plants are covered by tidewater. When applying spray to wet with hand-held equipment, use a 2 to 8 percent solution of this product. Ensure complete coverage of clumps but do not spray to the point of run-off. Follow specific application instructions in Section 8.1 **Aquatic Sites**.		
Cutgrass, giant*	3	1
Repeat applications will be required to maintain such control, especially where vegetation is partially submerged in water. Allow for substantial regrowth to the 7- to 10-leaf stage prior to retreatment.		
Dallisgrass	2.3 – 3.75	1.5
Dandelion	2.3 – 3.75	1.5
Dock, curly	2.3 – 3.75	1.5
Dogbane, hemp	3	1.5
Apply when most target plants have reached the late bud-to-flower stage of growth. For best results, apply in late summer or fall.		
Fescue (except tall)	2.3 – 3.75	1.5
Fescue, tall	2.3	1
Apply when most target plants have reached the boot-to-head stage of growth. When applied prior to the boot stage, less desirable control may be obtained.		
Guineagrass	2.3	0.75
Apply when most target plants have reached at least the 7-leaf stage of growth.		
Hemlock, poison	1.5 – 3	0.75 – 1.5
Also see Hollow Stem Injection section of this label.		
Horsenettle	2.3 – 3.75	1.5
Horseradish	3	1.5
Apply when most target plants have reached the late bud-to-flower stage of growth. For best results, apply in late summer or fall.		
Iceplant	1.5	1.5
Ivy, German, cape	1.5 – 3	0.75 – 1.5
Jerusalem artichoke	2.3 – 3.75	1.5
Johnsongrass	1.5 – 2.3	0.75
Apply when most target plants have reached the boot-to-head stage of growth. When applied prior to the boot stage, less desirable control may be obtained. In the fall, apply before plants have turned brown.		
Kikuyugrass	1.5 – 2.3	0.75
Knapweed	3	1.5
Apply when most target plants have reached the late bud-to-flower stage of growth. For best results, apply in late summer or fall.		
Knotweed; Bohemian, Giant, Japanese (*Polygonum bohemicum, P. sachalinense and P. cuspidatum*)		
Stem Injection: See the Hollow Stem Injection section of this label.		
Cut Stem: Cut stems cleanly just below the 2nd or 3rd node above the ground. Immediately apply 0.36 fluid ounce (10 mLs) of a 50-percent solution of this product into the "well" or remaining internode. Ensure that removed upper plant material is carefully gathered and discarded so that it will not contact soil and regenerate plants from sprouting buds. Use of a bio-barrier such as cardboard, plywood or plastic sheeting is recommended.		
The combined total for all treatments must not exceed 8 quarts per acre. At 10 mL of a 50-percent solution, approximately 1,500 stems per acre may be treated.		

Lantana	–	0.75 – 1
Apply when most target plants are at or beyond the bloom stage of growth. Use the higher application rate for plants that have reached the woody stage of growth.		
Lespedeza	2.3 – 3.75	1.5
Loosestrife, purple	2	1 – 1.5
Treat when most target plants are at or beyond the bloom stage of growth. Best results are achieved when application is made during summer or fall months. Fall treatments must be applied before a killing frost.		
Lotus, American	2	0.75
Treat when most target plants are at or beyond the bloom stage of growth. Best results are achieved when application is made during summer or fall months. Fall treatments must be applied before a killing frost. Repeat treatment may be necessary to control regrowth from underground parts and seeds.		
Maidencane	3	0.75
Repeat treatments will be required, especially to vegetation partially submerged in water. Under these conditions, allow for regrowth to the 7- to 10-leaf stage prior to retreatment.		
Milkweed, common	2.3	1.5
Apply when most target plants have reached the late bud-to-flower stage of growth.		
Muhly, wirestem	1.5 – 2.3	0.75
Apply when most target plants are at least 8 inches in height (3 to 4-leaf stage of growth) and actively growing.		
Mullein, common	2.3 – 3.75	1.5
Naplesgrass	2.3 – 3.75	1.5
Nightshade, silverleaf	2.3 – 3.75	1.5
Apply 3 to 3.75 quarts of this product per acre as a broadcast spray west of the Mississippi River and 2.3 to 3 quarts of this product per acre east of the Mississippi River. Apply when most target plants are at or beyond full bloom. Best results can be obtained when application is made after berries are formed. New leaf development indicates active growth. For best results apply in late summer or fall.		
Nutsedge; purple, yellow	2.3	0.75
Apply this product to control existing nutsedge plants and immature nutlets attached to treated plants. Apply when target plants are in flower or when new nutlets can be found at rhizome tips. Nutlets which have not germinated will not be controlled and may germinate following treatment. Repeat treatments will be required for long-term control.		
Orchardgrass	1.5 – 2.3	0.75
Apply when most target plants have reached the boot-to-head stage of growth. When applied prior to the boot stage, less desirable control may be obtained. In the fall, apply before plants have turned brown.		
Pampasgrass	2.3 – 3.75	1.5
Para grass	3	0.75
Repeat treatments may be required. Allow for regrowth to the 7- to 10-leaf stage prior to retreatment.		
Pepperweed, perennial	3	1.5
Phragmites*	2 – 3.75	0.75 – 1.5
For partial control of phragmites in Florida and the counties of other states bordering the Gulf of Mexico, apply 3.75 quarts per acre as a broadcast spray or apply a 1.5-percent solution with hand-held equipment. In other areas of the U.S., apply 2 to 3 quarts per acre as a broadcast spray or apply a 0.75-percent solution with hand-held equipment for partial control. For best results, treat during late summer or fall months when plants are actively growing and in full bloom. Due to the dense nature of the vegetation, which may prevent good spray coverage and uneven stages of growth, repeat treatments may be necessary to maintain control. Visual control symptoms will be slow to develop.		
Quackgrass	1.5 – 2.3	0.75
Apply when most target plants are at least 8 inches in height (3 to 4-leaf stage of growth) and actively growing.		
Redvine*	1.5	1.5
Reed, giant	3 – 3.75	1.5
Best results are obtained when applications are made in late summer to fall. Also see Hollow Stem Injection section of this label.		
Ryegrass, perennial	1.5 – 2.3	0.75
Apply when most target plants have reached the boot-to-head stage of growth. When applied prior to the boot stage, less desirable control may be obtained. In the fall, apply before plants have turned brown.		
Salvinia, giant	3 – 3.75	2
Apply as a 2.0% v/v spray-to-wet solution with 0.5 to 2.0% v/v of a nonionic surfactant containing at least 70% active ingredient. For broadcast applications, apply 3 to 3.75 quarts of this product with an aquatic approved surfactant system containing 0.1% v/v nonionic organosilicone and 0.25% v/v nonionic spreader sticker surfactant in 3 to 40 gallons per acre as a broadcast treatment. Allow at least 3 days after application before disturbing treated vegetation. This product does not control plants which are completely submerged or have a majority of their foliage under water.		
Smartweed, swamp	2.3 – 3.75	1.5
Spatterdock	3	0.75
Apply when most plants are in full bloom. For best results, apply during the summer or fall months.		
Spurge, leafy*	–	1.5
Starthistle, yellow	–	1.5
Sweetpotato, wild*	–	1.5
Apply when most target plants are at or beyond the bloom stage of growth. Repeat applications will be required. Allow the plant to reach the specified stage of growth before retreatment.		
Thistle, artichoke	1.5 – 2.3	2
Apply when target plants are at or beyond the bud stage of growth.		
Thistle, Canada	1.5 – 2.3	1.5
Apply when target plants are at or beyond the bud stage of growth. Also see Hollow Stem Injection section of this label.		
Timothy	1.5 – 2.3	1.5
Apply when most target plants have reached the boot-to-head stage of growth. When applied prior to the boot stage, less desirable control may be obtained. In the fall, apply before plants have turned brown.		
Torpedograss*	3 – 3.75	0.75 – 1.5
Use the lower recommended rates under terrestrial conditions and the higher rates under partially submerged or a floating mat conditions. Repeat treatments will be required to maintain such control.		
Trumpetcreeper*	1.5 – 2.3	1.5
Tules, common	–	1.5
Apply to target plants at or beyond the seedhead stage of growth. After application, visual symptoms will be slow to appear and may not occur for 3 or more weeks.		
Vaseygrass	2.3 – 3.75	1.5
Velvetgrass	2.3 – 3.75	1.5
Waterhyacinth	2.5 – 3	0.75 – 1
Apply when target plants are at or beyond the early bloom stage of growth. After application, visual symptoms may require 3 or more weeks to appear with complete necrosis and decomposition usually occurring within 60 to 90 days. Use the higher recommended rates when more rapid visual effects are desired.		
Waterlettuce	–	0.75 – 1
Use higher recommended rates where infestations are heavy. Best results are obtained from mid-summer through winter applications. Spring applications may require retreatment.		
Waterprimrose	–	0.75
Apply to plants that are at or beyond the bloom stage of growth, but before fall color changes occur. Thorough coverage is necessary for best control.		
Wheatgrass, western	1.5 – 2.3	0.75
Apply when most target plants have reached the boot-to-head stage of growth. When applied prior to the boot stage, less desirable control may be obtained. In the fall, apply before plants have turned brown.		

*Partial control

Other perennials listed on this label – Apply 2.3 to 3.75 quarts of this product per acre as a broadcast spray or as a 0.75- to 1.5-percent solution with hand-held equipment. Apply when target plants are actively growing and most have reached early head or early bud stage of growth.

12.3 Woody Brush and Trees

Apply this product after full leaf expansion, unless otherwise directed. Use the higher rate for larger plants and/or dense areas of growth. On vines, use the higher rate for plants that have reached the woody stage of growth. Best results are obtained when application is made in late summer or fall after fruit formation. Apply when plants are actively growing. Thorough coverage of foliage is necessary for best results. Avoid application to drought-stressed plants.

In arid areas, best results are obtained when applications are made in the spring to early summer when brush species are at high moisture content and are flowering.

Ensure thorough coverage when using spray-to-wet treatments using hand-held equipment.

When using hand-held equipment for low-volume directed-spray spot treatments, apply a 4- to 8-percent solution of this product.

Symptoms may not appear prior to frost or senescence with fall treatments.

Allow 7 or more days after application before tillage, mowing or removal. Repeat treatments may be necessary to control plants regenerating from underground parts or seed. Some autumn colors on undesirable deciduous species are acceptable provided no major leaf drop has occurred. Reduced performance may result if fall treatments are made following a frost.

Weed Species	Broadcast Rate (QT/A)	Hand-Held Spray-To-Wet % Solution
Alder	2.3 – 3	0.75 – 1.2
Ash*	1.5 – 3.75	0.75 – 1.5
Aspen, quaking	1.5 – 2.3	0.75 – 1.2
Bearclover (Beanmat)*	1.5 – 3.75	0.75 – 1.5
Beech*	1.5 – 3.75	0.75 – 1.5
Birch	1.5	0.75
Blackberry	2.3 – 3	0.75 – 1.2
Blackgum	1.5 – 3.75	0.75 – 1.5
Bracken	1.5 – 3.75	0.75 – 1.5
Broom; French, Scotch	1.5 – 3.75	1.2 – 1.5
Buckwheat, California*	1.5 – 3	0.75 – 1.5
Cascara*	1.5 – 3.75	0.75 – 1.5
Castorbean	1.5 – 3.75	1.5
Also see Hollow Stem Injection section of this label.		
Catsclaw*	–	1.2 – 1.5
For partial control, apply this product when at least 50 percent of the new leaves are fully developed.		

Ceanothus*	1.5 – 3.75	0.75 – 1.5
Chamise*	1.5 – 3.75	0.75
Cherry; bitter, black, pin	1.5 – 3.75	1 – 1.5
Cottonwood, eastern	1.5 – 3.75	0.75 – 1.5
Coyote brush	2.3 – 3	1.2 – 1.5
For control, apply when at least 50 percent of the new leaves are fully developed.		
Cypress; swamp, bald	1.5 – 3.75	0.75 – 1.5
Deerweed	1.5 – 3.75	0.75 – 1.5
Dewberry	2.3 – 3	0.75 – 1.2
Dogwood*	3 – 3.75	1 – 2
Elderberry	1.5	0.75
Elm*	1.5 – 3.75	0.75 – 1.5
Eucalyptus, bluegum	–	1.5
For control of eucalyptus resprouts, apply this product with hand-held equipment when resprouts are 6- to 12-feet tall. Ensure complete coverage.		
Gallberry	1.5 – 3.75	0.75 – 1.5
Gorse*	1.5 – 3.75	0.75 – 1.5
Hackberry, western	1.5 – 3.75	0.75 – 1.5
Hasardia*	1.5 – 3	0.75 – 1.5
Hawthorn	1.5 – 2.3	0.75 – 1.2
Hazel	1.5	0.75
Hickory*	3 – 3.75	1 – 2
Honeysuckle	2.3 – 3	0.75 – 1.2
Hornbeam, American*	1.5 – 3.75	0.75 – 1.5
Huckleberry	1.5 – 3.75	0.75 – 1.5
Ivy, poison	3 – 3.75	1.5
Kudzu	3	1.5
Locust, black*	1.5 – 3	0.75 – 1.5
Madrone resprouts*	–	1.5
Magnolia, sweetbay	1.5 – 3.75	0.75 – 1.5
Manzanita*	1.5 – 3.75	0.75 – 1.5
Maple, red	1 – 3.75	0.75 – 1.2
For control, apply as a 0.75- to 1.2-percent solution with hand-held equipment when leaves are fully developed. For partial control, apply 1 to 3.75 quarts of this product per acre as a broadcast spray.		
Maple, sugar	–	0.75 – 1.2
For control, apply as a 0.75- to 1.2-percent solution with hand-held equipment when at least 50 percent of the new leaves are fully developed.		
Maple, vine*	1.5 – 3.75	0.75 – 1.5
Monkey flower*	1.5 – 3	0.75 – 1.5
Oak; black, white*	1.5 – 3	0.75 – 1.5
Oak; northern pin	1.5 – 3	0.75 – 1.2
For control, apply when at least 50 percent of the new leaves are fully developed.		
Oak, poison	3 – 3.75	1.5
Repeat applications may be required to maintain control. Fall treatments must be applied before leaves lose green color.		
Oak, post	2.3 – 3	0.75 – 1.2
Oak, red	–	0.75 – 1.2
For control, apply as a 0.75- to 1.2-percent solution with hand-held equipment when at least 50 percent of the new leaves are fully developed.		
Oak, scrub*	1.5 – 3	0.75 – 1.5
Oak, southern red	1.5 – 3.75	1 – 1.5
Orange, Osage	1.5 – 3.75	0.75 – 1.5
Pepperbee, Brazilian (Florida holly)*	1.5 – 3.75	1.5
Persimmon*	1.5 – 3.75	0.75 – 1.5
Pine	1.5 – 3.75	0.75 – 1.5
Poplar, yellow*	1.5 – 3.75	0.75 – 1.5
Prunus	1.5 – 3.75	1 – 1.5
Raspberry	2.3 – 3	0.75 – 1.2
Redbud, eastern	1.5 – 3.75	0.75 – 1.5
Redcedar, eastern	1.5 – 3.75	0.75 – 1.5
Rose, multiflora	1.5	0.75
Treatments should be made prior to leaf deterioration by leaf-feeding insects.		
Russian olive*	1.5 – 3.75	0.75 – 1.5
Sage, black	1.5 – 3	0.75
Sage, white*	1.5 – 3	0.75 – 1.5
Sagebrush, California	1.5 – 3	0.75
Salmonberry	1.5	0.75
Saltbush	–	1
Saltcedar	3 – 3.75	1 – 2
For partial control, apply a 1- to 2-percent solution of this product with hand-held equipment or 3 to 3.75 quarts per acre as a broadcast spray. For control, apply a 1- to 2-percent solution of this product mixed with 0.25-percent Arsenal with hand-held equipment. For control using broadcast applications, apply 1.5 quarts of this product in a tank-mix with 1 pint of Arsenal to plants less than 6 feet tall. To control saltcedar greater than 6 feet tall using broadcast applications, apply 3 quarts of this product in a tank-mix with 2 pints of Arsenal.		
Sassafras*	1.5 – 3.75	0.75 – 1.5
Sea Myrtle	–	1
Sourwood*	1.5 – 3.75	0.75 – 1.5
Sumac; laurel, poison, smooth, sugarbush, winged*	1.5 – 3	0.75 – 1.5
Sweetgum	1.5 – 2.3	0.75 – 1.5
Swordfern*	1.5 – 3.75	0.75 – 1.5
Tallowtree, Chinese	–	0.75
Tanoak resprouts*	–	1.5
Thimbleberry	1.5	0.75
Tobacco, tree*	1.5 – 3	0.75 – 1.5
Toyon*	–	1.5
Trumpetcreeper	1.5 – 2.3	0.75 – 1.2
Vine maple*	1.5 – 3.75	0.75 – 1.5
Virginia creeper	1.5 – 3.75	0.75 – 1.5
Waxmyrtle, southern*	1.5 – 3.75	1.5
Willow	2.3	0.75
Yerba Santa, California*	–	1.5

* Partial control

Other woody brush and trees listed in this label – For partial control, apply 1.5 to 3.75 quarts of this product per acre as a broadcast spray or as a 0.75- to 1.5-percent solution with hand-held equipment.

13.0 LIMIT OF WARRANTY AND LIABILITY

Monsanto Company warrants that this product conforms to the chemical description on the label and is reasonably fit for the purposes set forth in the Complete Directions for Use label booklet ("Directions") when used in accordance with those Directions under the conditions described therein. NO OTHER EXPRESS WARRANTY OR IMPLIED WARRANTY OF FITNESS FOR PARTICULAR PURPOSE OR MERCHANTABILITY IS MADE. This warranty is also subject to the conditions and limitations stated herein.

Buyer and all users shall promptly notify this Company of any claims whether based in contract, negligence, strict liability, other tort or otherwise.

To the fullest extent permitted by law, buyer and all users are responsible for all loss or damage from use or handling which results from conditions beyond the control of this Company, including, but not limited to, incompatibility with products other than those set forth in the Directions, application to or contact with desirable vegetation, unusual weather, weather conditions which are outside the range considered normal at the application site and for the time period when the product is applied, as well as weather conditions which are outside the application ranges set forth in the Directions, application in any manner not explicitly set forth in the Directions, moisture conditions outside the moisture range specified in the Directions, or the presence of products other than those set forth in the Directions in or on the soil, crop or treated vegetation.

This Company does not warrant any product reformulated or repackaged from this product except in accordance with this Company's stewardship requirements and with express written permission from this Company.

THE EXCLUSIVE REMEDY OF THE USER OR BUYER, AND THE LIMIT OF THE LIABILITY OF THIS COMPANY OR ANY OTHER SELLER FOR ANY AND ALL LOSSES, INJURIES OR DAMAGES RESULTING FROM THE USE OR HANDLING OF THIS PRODUCT (INCLUDING CLAIMS BASED IN CONTRACT, NEGLIGENCE, STRICT LIABILITY, OTHER TORT OR OTHERWISE) SHALL BE THE PURCHASE PRICE PAID BY THE USER OR BUYER FOR THE QUANTITY OF THIS PRODUCT INVOLVED, OR, AT THE ELECTION OF THIS COMPANY OR ANY OTHER SELLER, THE REPLACEMENT OF SUCH QUANTITY, OR, IF NOT ACQUIRED BY PURCHASE, REPLACEMENT OF SUCH QUANTITY. TO THE FULLEST EXTENT PERMITTED BY LAW, IN NO EVENT SHALL THIS COMPANY OR ANY OTHER SELLER BE LIABLE FOR ANY INCIDENTAL, CONSEQUENTIAL OR SPECIAL DAMAGES.

Upon opening and using this product, buyer and all users are deemed to have accepted the terms of this LIMIT OF WARRANTY AND LIABILITY which may not be varied by any verbal or written agreement. If terms are not acceptable, return all once unopened.

No license granted under any non-U.S. patent(s).

EPA Reg. No. 524-343

In case of an emergency involving this product, or for medical assistance, Call Collect, day or night, (314) 694-4000.

MONSANTO

MONSANTO COMPANY
800 N. Lindbergh Blvd.
St. Louis, Missouri, 63167 U.S.A.

032712

Specimen Label

Dow AgroSciences

Vastlan™

SPECIALTY HERBICIDE

®™ Trademark of The Dow Chemical Company ("Dow") or an affiliated company of Dow

TRICLOPYR CHOLINE	GROUP	4	HERBICIDE

For the control of woody plant species and annual and perennial broadleaf weeds on

- **range and permanent grass pastures, grasses grown for hay, Conservation Reserve Program (CRP) sites;**
- **forest sites, conifer and tree plantations, and Christmas tree plantations;**
- **non-crop areas for example, airports, barrow ditches, communication transmission lines or structures, manufacturing and storage sites, electrical power and utility rights-of-way, fencerows, gravel pits, industrial sites, military lands, mining and drilling areas, non-irrigation ditch banks, oil and gas pads, parking lots, petroleum tank farms, pipelines, railroads, roadsides, storage areas, storm water retention areas, substations, unimproved rough turf grasses, vacant lots and other non-crop residential areas, and around farm buildings;**
- **natural areas (open space) for example, campgrounds, parks, prairie management, trails and trailheads, recreation areas, wildlife openings and wildlife habitat and management areas;**
- **including grazed areas on these sites; and**
- **aquatic sites**

For use in New York State, comply with Section 24(c) Special Local Need labeling for Vastlan, SLN NY-160004.

Active Ingredient:

Triclopyr choline: 2-[(3,5,6-trichloro-2-pyridinyl)oxy] acetic acid, choline salt	54.72%
Other Ingredients	45.28%
Total	100.0%

Acid equivalent: triclopyr – 39.02% - 4 lb/gal

Precautionary Statements

Hazard to Humans and Domestic Animals

EPA Reg. No. 62719-687

WARNING

May be fatal if swallowed • Causes substantial but temporary eye injury • Prolonged or frequently repeated skin contact may cause allergic reactions in some individuals.

Do not get in eyes, on skin, or on clothing. Wash thoroughly after handling and before eating, drinking, chewing gum, using tobacco, or using the toilet. Remove and wash contaminated clothing before reuse.

Personal Protective Equipment (PPE)

Applicators and other handlers must wear:

- Protective eyewear
- Long-sleeved shirt and long pants
- Shoes plus socks
- Waterproof gloves

Discard clothing and other absorbent materials that have been drenched or heavily contaminated with this product's concentrate. Do not reuse them.

Follow manufacturer's instructions for cleaning/maintaining PPE. If no such instructions for washables exist, use detergent and hot water. Keep and wash PPE separately from other laundry.

Engineering Controls

When handlers use closed systems, enclosed cabs, or aircraft in a manner that meets the requirements listed in the Worker Protection Standard (WPS) for agricultural pesticides (40 CFR 170.240(d)(4-6)), the handler PPE requirements may be reduced or modified as specified in the WPS.

User Safety Recommendations

Users should:

- Remove clothing/PPE immediately if pesticide gets inside. Then wash thoroughly and put on clean clothing.
- Remove PPE immediately after handling this product. Wash the outside of gloves before removing. As soon as possible, wash thoroughly and change into clean clothing.

First Aid

If in eyes: Hold eye open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye. Call a poison control center or doctor for treatment advice.

If swallowed: Call a poison control center or doctor immediately for treatment advice. Have person sip a glass of water if able to swallow. Do not induce vomiting unless told to do so by a poison control center or doctor. Do not give anything by mouth to an unconscious person.

Have the product container or label with you when calling a poison control center or doctor, or going for treatment. You may also contact 1-800-992-5994 for emergency medical treatment information.

Environmental Hazards

Do not contaminate water when cleaning equipment or disposing of equipment washwaters. Under certain conditions, treatment of aquatic weeds can result in oxygen depletion or loss due to decomposition of dead plants, which may contribute to fish suffocation. This loss can cause fish suffocation. Therefore, to minimize this hazard, do not treat more than one-third to one-half of the water area in a single operation and wait at least 10 to 14 days between treatments. Begin treatment along the shore and proceed outwards in bands to allow fish to move into untreated areas. Consult with the State agency for fish and game before applying to public water to determine if a permit is needed.

This chemical has properties and characteristics associated with chemicals detected in groundwater. The use of this chemical in areas where soils are permeable, particularly where the water table is shallow, may result in groundwater contamination.

Directions for Use

It is a violation of Federal law to use this product in a manner inconsistent with its labeling.

Read all Directions for Use carefully before applying.

Do not apply this product in a way that will contact workers or other persons, either directly or through drift. Only protected handlers may be in the area during application. For any requirements specific to your state or tribe, consult the agency responsible for pesticide regulation

Agricultural Use Requirements

Use this product only in accordance with its labeling and with the Worker Protection Standard, 40 CFR Part 170. This Standard contains requirements for the protection of agricultural workers on farms, forests, nurseries, and greenhouses, and handlers of agricultural pesticides. It contains requirements for training, decontamination, notification, and emergency assistance. It also contains specific instructions and exceptions pertaining to the statements on this label about personal protective equipment (PPE), and restricted-entry interval. The requirements in this box only apply to uses of this product that are covered by the Worker Protection Standard.

Do not enter or allow worker entry into treated areas during the restricted entry interval (REI) of 24 hours.

Agricultural Use Requirements (Cont.)

PPE required for early entry to treated areas that is permitted under the Worker Protection Standard and that involves contact with anything that has been treated, such as plants, soil, or water, is:

- Protective eyewear
- Coveralls
- Shoes plus socks
- Waterproof gloves

Non-Agricultural Use Requirements

The requirements in this box apply to uses of this product that are NOT within the scope of the Worker Protection Standard for Agricultural Pesticides (40 CFR Part 170). The WPS applies when this product is used to produce agricultural plants on farms, forests, nurseries, or greenhouses.

Entry Restrictions for Non-WPS Uses: For applications to non-cropland areas, do not allow entry into areas until sprays have dried, unless applicator and other handler PPE is worn.

Storage and Disposal

Do not contaminate water, food, or feed by storage and disposal. Open dumping is prohibited.
Pesticide Storage: Store above 32°F or agitate before use.
Pesticide Disposal: Wastes resulting from the use of this product must be disposed of on site or at an approved waste disposal facility.

Nonrefillable containers 5 gallons or less:
Container Handling: Nonrefillable container. Do not reuse or refill this container. Offer for recycling if available or puncture and dispose of in a sanitary landfill, or by incineration, or by other procedures allowed by state and local authorities.

Triple rinse or pressure rinse container (or equivalent) promptly after emptying. **Triple rinse** as follows: Empty the remaining contents into application equipment or a mix tank and drain for 10 seconds after the flow begins to drip. Fill the container 1/4 full with water and recap. Shake for 10 seconds. Pour rinsate into application equipment or a mix tank or store rinsate for later use or disposal. Drain for 10 seconds after the flow begins to drip. Repeat this procedure two more times. **Pressure rinse** as follows: Empty the remaining contents into application equipment or a mix tank and continue to drain for 10 seconds after the flow begins to drip. Hold container upside down over application equipment or mix tank or collect rinsate for later use or disposal. Insert pressure rinsing nozzle in the side of the container, and rinse at about 40 psi for at least 30 seconds. Drain for 10 seconds after the flow begins to drip.

Refillable containers 5 gallons or larger:
Container Handling: Refillable container. Refill this container with pesticide only. Do not reuse this container for any other purpose. Cleaning the container before final disposal is the responsibility of the person disposing of the container. Cleaning before refilling is the responsibility of the refiller. To clean the container before final disposal, empty the remaining contents from this container into application equipment or a mix tank. Fill the container about 10% full with water. Agitate vigorously or recirculate water with the pump for two minutes. Pour or pump rinsate into application equipment or rinsate collection system. Repeat this rinsing procedure two more times.

Nonrefillable containers 5 gallons or larger:
Container Handling: Nonrefillable container. Do not reuse or refill this container. Offer for recycling if available or puncture and dispose of in a sanitary landfill, or by incineration, or by other procedures allowed by state and local authorities.

Triple rinse or pressure rinse container (or equivalent) promptly after emptying. **Triple rinse** as follows: Empty the remaining contents into application equipment or a mix tank. Fill the container 1/4 full with water. Replace and tighten closures. Tip container on its side and roll it back and forth, ensuring at least one complete revolution, for 30 seconds. Stand the container on its end and tip it back and forth several times. Turn the container over onto its other end and tip it back and forth several times. Empty the rinsate into application equipment or a mix tank or store rinsate for later use or disposal. Repeat this procedure two more times. **Pressure rinse** as follows: Empty the remaining contents into application equipment or a mix tank and continue to drain for 10 seconds after the flow begins to drip. Hold container upside down over application equipment or mix tank or collect rinsate for later use or disposal. Insert pressure rinsing nozzle in the side of the container, and rinse at about 40 psi for at least 30 seconds. Drain for 10 seconds after the flow begins to drip.

Product Information for All Use Sites

Use Vastlan™ for the control of woody plants and broadleaf weeds in range and pasture, grasses grown for hay, Conservation Reserve Program (CRP) sites; forest sites, conifer and tree plantations, and Christmas tree plantations; non-crop areas for example, airports, barrow ditches, communication transmission lines or structures, manufacturing and storage sites, electrical power and utility rights-of-way, fencerows, gravel pits, industrial sites, military lands, mining and drilling areas, non-irrigation ditch banks, oil and gas pads, parking lots, petroleum tank farms, pipelines, railroads, roadsides, , storage areas, storm water retention areas, substations, unimproved rough turf grasses, vacant lots and other non-crop residential areas, and around farm buildings; natural areas (open space) for example, campgrounds, parks, prairie management, trails and trailheads, recreation areas,wildlife openings and wildlife habitat and management areas and aquatic sites.

Obtain Required Permits: Consult with appropriate state or local water authorities before applying this product to public waters. State or local public agencies may require permits.

Use Precautions

When making applications to control unwanted plants on banks or shorelines of moving water sites, minimize overspray to open water.

It is permissible to treat non-irrigation ditch banks, seasonally dry wetlands (such as flood plains, deltas, marshes, swamps, or bogs), and transitional areas between upland and lowland sites.

It is the pesticide user's responsibility to ensure that all products in the listed mixtures are registered for the intended use. Users must follow the most restrictive directions for use and precautionary statements of each product in the tank mixture.

Use Restrictions

For use in New York State, comply with Section 24(c) Special Local Need labeling for Vastlan, SLN NY-160004.

Chemigation: Do not apply this product through any type of irrigation system.

Do not apply Vastlan directly to, or otherwise permit it to come into direct contact with, grapes, tobacco, vegetable crops, flowers, or other desirable broadleaf plants. Do not permit spray mists containing Vastlan to drift onto such plants.

Do not apply to salt water bays or estuaries.

Do not apply directly to un-impounded rivers or streams.

Do not apply where runoff water may flow onto agricultural land as injury to crops may result.

Do not apply with a mistblower.

Irrigation waters:

Do not apply on ditches or canals currently being used to transport irrigation water or that will be used for irrigation within 4 months following treatment. It is permissible to treat non-irrigation ditch banks and the outer banks of irrigation ditches.

Water treated with Vastlan may not be used for irrigation purposes for 120 days after application or until residue levels of Vastlan are determined by laboratory analysis, or other appropriate means of analysis, to be 1 ppb or less.

Seasonal Irrigation Waters: Vastlan may be applied during the off-season to surface waters that are used for irrigation on a seasonal basis provided that there is a minimum of 120 days between applying Vastlan and the first use of treated water for irrigation purposes, or until residue levels of Vastlan are determined by laboratory analysis, or other appropriate means of analysis, to be 1 ppb or less.

Irrigation Canals/Ditches: Do not apply Vastlan to irrigation canals/ditches unless the 120-day restriction on irrigation water usage can be observed or residue levels of Vastlan are determined by laboratory analysis, or other appropriate means of analysis, to be 1 ppb or less.

Restrictions for Potable Water Intakes for Emerged Aquatic Weed Control – Lakes, Reservoirs, Ponds:
See chart below for specific setback distances near functioning potable water intakes.
Note: Existing potable water intakes which are no longer in use, such as those replaced by potable water wells or connections to a municipal water system, are not considered to be functioning potable water intakes. These setback restrictions do not apply to terrestrial applications made adjacent to potable water intakes.

	Vastlan Application Rate			
Area Treated	1.5 qt/acre	3 qt/acre	4.5 qt/acre	6 qt/acre
(acres)	Setback Distance (ft)			
4	0	200	400	500
>4 - 8	0	200	700	900
>8 - 16	0	200	700	1000
>16	0	200	900	1300

To apply Vastlan around and within the distances noted above from a functioning potable water intake, the intake must be turned off until the triclopyr level in the intake water is determined to be 0.4 parts per million (ppm) or less by laboratory analysis or immunoassay.

Recreational Use of Water in Treatment Area: There are no restrictions on use of water in the treatment area for recreational purposes, including swimming and fishing.

Livestock Use of Water from Treatment Area: There are no restrictions on livestock consumption of water from the treatment area.

Restrictions for Potable Water Intakes for Submerged Weed Control – Lakes, Reservoirs, Ponds:
For applications of Vastlan to control submerged weeds in lakes, reservoirs or ponds that contain a functioning potable water intake for human consumption, see the chart below to determine the minimum setback distances of the application from the functioning potable water intakes.

Area Treated (acres)	Concentration of Triclopyr Acid in Water (ppm ae)				
	0.75 ppm	1 ppm	1.5 ppm	2 ppm	2.5 ppm
	Required Setback Distance (ft) from Potable Water Intake				
<4	300	400	600	800	1000
>4 – 8	420	560	840	1120	1400
>8 – 16	600	800	1200	1600	2000
>16 – 32	780	1040	1560	2080	2600
>32 acres, calculate a setback using the formula for the appropriate rate	Setback (ft) = (800*ln (acres) – 160)/3.33	Setback (ft) = (800*ln (acres) – 160)/2.50	Setback (ft) = (800*ln (acres) – 160)/1.67	Setback (ft) = (800*ln (acres) – 160)/1.25	Setback (ft) = (800*ln (acres) – 160)

Example Calculation 1: to apply 2.5 ppm Vastlan to 50 acres:

Setback in feet = (800 x ln (50 acres) - 160
= (800 x 3.912) – 160
= 2970 feet

Example Calculation 2: to apply 0.75 ppm Vastlan to 50 acres:

Setback in feet = $\frac{(800 \times \ln (50 \text{ acres}) - 160}{3.33}$
= $\frac{(800 \times 3.912) - 160}{3.33}$
= 892 feet

Note: Existing potable water intakes which are no longer in use, such as those replaced by potable water wells or connections to a municipal water system, are not considered to be functioning potable water intakes. These setback restrictions do not apply to terrestrial applications made adjacent to potable water intakes.

To apply Vastlan around and within the distances noted above from a functioning potable water intake, the intake must be turned off until the triclopyr level in the intake water is determined to be 0.4 parts per million (ppm) or less by laboratory analysis or immunoassay.

Maximum Use Rates

- Apply no more than 6 lb ae of triclopyr (6 quarts of Vastlan) per acre per year on aquatic sites.
- Apply no more than 2 lb ae of triclopyr (2 quarts of Vastlan) per acre per growing season on range and pasture sites, including rights-of-way, fence rows or any area where grazing or harvesting of hay is allowed.
- On forestry sites, Vastlan may be used at rates up to 6 lb ae of triclopyr (6 quarts of Vastlan) per acre per year.
- For all terrestrial use sites other than range, pasture, forestry sites, and grazed/hayed areas, the maximum application rate is 9 lb ae of triclopyr (9 quarts of Vastlan) per acre per year.
- See Maximum Labeled Rate versus Spray Volume per Acre table below for relationship between mixing rate, spray volume and maximum application rate.

Maximum Labeled Rate versus Spray Volume per Acre

Total Spray Volume (gal/acre)	Maximum Rate of Vastlan		
	Range and Pasture Sites[1] (gal/100 gal of spray)	Forestry Sites[2] (gal/100 gal of spray)	Non-Cropland Sites[3] (gal/100 gal of spray)
400	Do not use	0.375	0.57
300	Do not use	0.5	0.75
200	Do not use	0.75	1.125
100	0.5	1.5	2.25
50	1	3	4.5

Maximum Labeled Rate versus Spray Volume per Acre (Cont.)

Total Spray Volume (gal/acre)	Maximum Rate of Vastlan		
	Range and Pasture Sites[1] (gal/100 gal of spray)	Forestry Sites[2] (gal/100 gal of spray)	Non-Cropland Sites[3] (gal/100 gal of spray)
40	1.25	3.75	5.63
30	1.67	5	7.5
20	2.5	7.5	11.25
10	5	15	22.5

[1]Do not exceed the maximum use rate of 2 lb ae of triclopyr (2 quarts of Vastlan)/acre/year.
[2]Do not exceed the maximum use rate of 6 lb ae of triclopyr (6 quarts of Vastlan)/acre/year.
[3]Do not exceed the maximum use rate of 9 lb ae of triclopyr (9 quarts of Vastlan)/acre/year on non-cropland use sites other than rangeland, pasture, forestry, and grazed/hayed areas.

Use the higher dosage rates in the chart when woody plants approach an average of 15 feet in height or when the brush covers more than 60% of the area to be treated. If lower rates are used on hard to control species, resprouting may occur the year following treatment.

Haying Restrictions

Haying (harvesting of dried forage)
- Do not harvest hay for 14 days after application.

Slaughter Restriction: During the season of application, withdraw livestock from grazing treated grass at least 3 days before slaughter.

Avoiding Injurious Spray Drift

Make applications only when there is little or no hazard from spray drift. Small quantities of spray, which may not be visible, may seriously injure susceptible plants. Do not spray when wind is blowing toward susceptible crops or ornamental plants that are near enough to be injured. It is suggested that a continuous smoke column at or near the spray site or a smoke generator on the spray equipment be used to detect air movement, lapse conditions, or temperature inversions (stable air). If the smoke layers or indicates a potential of hazardous spray drift, do not spray.

Spray Drift Management
Avoiding spray drift at the application site is the responsibility of the applicator. The interaction of many equipment and weather related factors determine the potential for spray drift. The applicator and the grower are responsible for considering all these factors when making decisions.

Aerial Application:
The following drift management requirements must be followed to avoid off-target drift movement from aerial applications with aerial applications:

1. The distance of the outer most operating nozzles on the boom must not exceed 3/4 the length of the wingspan or rotor.
2. Nozzles must always point backward parallel with the air stream and never be pointed downwards more than 45 degrees.

Where states have more stringent regulations, they must be observed.

The applicator should be familiar with and take into account the information covered in the following Aerial Drift Reduction Advisory, below.

Aerial Drift Reduction Advisory
Information on Droplet Size: The most effective way to reduce drift potential is to apply large droplets. The best drift management strategy is to apply the largest droplets that provide sufficient coverage and control. Applying larger droplets reduces drift potential, but will not prevent drift if applications are made improperly, or under unfavorable environmental conditions (see Wind, Temperature and Humidity, and Temperature Inversions).

For aerial application on rights-of-way or other areas near susceptible crops, apply through a Microfoil† or Thru-Valve boom†, or use an agriculturally labeled drift control additive. Other drift reducing systems or thickened sprays prepared by using high viscosity inverting systems may be used if they are made as drift-free as mixtures containing agriculturally labeled thickening agents or applications made with the Microfoil or Thru-Valve boom. Do not use a thickening agent with the Microfoil or Thru-Valve booms, or other systems that cannot accommodate thick sprays. If a spray thickening agent is used, follow all use directions and precautions on the product label.

†Reference within this label to a particular piece of equipment produced by or available from other parties is provided without consideration for use by the reader at its discretion and subject to the reader's independent circumstances, evaluation, and expertise. Such reference by Dow AgroSciences is not intended as an endorsement of such equipment, shall not constitute a warranty (express or implied) of such equipment, and is not intended to imply that other equipment is not available and equally suitable. Any discussion of methods of use of such equipment does not imply that the reader should use the equipment other than is advised in directions available from the equipment's manufacturer. The reader is responsible for exercising its own judgment and expertise, or consulting with sources other than Dow AgroSciences, in selecting and determining how to use its equipment.

Controlling Droplet Size:
- **Volume** - Use high flow rate nozzles to apply the highest practical spray volume. Nozzles with higher rated flows produce larger droplets.
- **Pressure** - Do not exceed the nozzle manufacturer's recommended pressures. For many nozzle types, lower pressure produces larger droplets. When higher flow rates are needed, use higher flow rate nozzles instead of increasing pressure.
- **Number of Nozzles** - Use the minimum number of nozzles that provide uniform coverage.
- **Nozzle Orientation** - Orienting nozzles so that the spray is released parallel to the airstream produces larger droplets than other orientations and is the recommended practice. Significant deflection from horizontal will reduce droplet size and increase drift potential.
- **Nozzle Type** - Use a nozzle type that is designed for the intended application. With most nozzle types, narrower spray angles produce larger droplets. Consider using low-drift nozzles. Solid stream nozzles oriented straight back produce the largest droplets and the lowest drift.

Boom Length: The distance of the outer most operating nozzles on the boom must not exceed 75% of wingspan or rotor diameter.

Application Height: Applications should not be made at a height greater than 10 feet above the top of the largest plants unless a greater height is required for aircraft safety. Making applications at the lowest height that is safe reduces exposure of droplets to evaporation and wind.

Swath Adjustment: When applications are made with a crosswind, the swath will be displaced downwind. Therefore, on the up and downwind edges of the field, the applicator must compensate for this displacement by adjusting the path of the aircraft upwind. Swath adjustment distance should increase, with increasing drift potential (higher wind, smaller drops, etc.).

Wind: Drift potential is lowest between wind speeds of 2 to 10 mph. However, many factors, including droplet size and equipment type, determine drift potential at any given speed. Application should be avoided below 2 mph due to variable wind direction and high inversion potential. **Note:** Local terrain can influence wind patterns. Every applicator should be familiar with local wind patterns and how they affect spray drift.

Temperature and Humidity: When making applications in low relative humidity, set up equipment to produce larger droplets to compensate for evaporation. Droplet evaporation is most severe when conditions are both hot and dry.

Temperature Inversions: Applications should not occur during a local, low level temperature inversion because drift potential is high. Temperature inversions restrict vertical air mixing, which causes small suspended droplets to remain in a concentrated cloud. This cloud can move in unpredictable directions due to the light variable winds common during inversions. Temperature inversions are characterized by increasing temperatures with altitude and are common on nights with limited cloud cover and light to no wind. They begin to form as the sun sets and often continue into the morning. Their presence can be indicated by ground fog; however, if fog is not present, inversions can also be identified by the movement of the smoke from a ground source or an aircraft smoke generator. Smoke that layers and moves laterally in a concentrated cloud (under low wind conditions) indicates an inversion, while smoke that moves upward and rapidly dissipates indicates good vertical air mixing.

Sensitive Areas: The pesticide should only be applied when the potential for drift to adjacent sensitive areas (e.g., residential areas, bodies of water, known habitat for threatened or endangered species, non-target crops) is minimal (e.g., when wind is blowing away from the sensitive areas).

Ground Equipment: To aid in reducing spray drift, Vastlan should be used in thickened (high viscosity) spray mixtures using an agriculturally labeled drift control additive, high viscosity invert system, or equivalent as directed by the manufacturer. With ground equipment, spray drift can be reduced by keeping the spray boom as low as possible; by applying 20 gallons or more of spray per acre; by keeping the operating spray pressures at the lower end of the manufacturer's recommended pressures for the specific nozzle type used (low pressure nozzles are available from spray equipment manufacturers); and by spraying when wind velocity is low (follow state regulations). In hand-gun applications, select the minimum spray pressure that will provide adequate plant coverage (without forming a mist). Do not apply with nozzles that produce a fine-droplet spray.

High Volume Leaf-Stem Treatment: To minimize spray drift, do not use pressure exceeding 50 psi at the spray nozzle and keep sprays no higher than brush tops. An agriculturally labeled thickening agent may be used to reduce drift.

Use Information

Use Vastlan at rates of 0.75 to 9 quarts of Vastlan per acre to control broadleaf weeds and woody plants. In all cases, use the amount specified in enough water to give uniform and complete coverage of the plants to be controlled. Refer to Maximum Use Rates paragraph - follow defined rates restrictions based on use sites and whether or not grazing or haying is involved.

Surfactants
For best results, use a surfactant with foliar applications and apply when woody plants and weeds are actively growing. When hard to control species such as ash, blackgum, choke cherry, elm, maples, oaks, pines, or winged elm are prevalent and during applications made in late summer when the plants are mature or during drought conditions, use the higher rates of Vastlan alone or in combination with Milestone, Opensight, Tordon® or other herbicides to broaden the spectrum of activity.

Tank Mixing
Before using any recommended tank mixtures, read the directions and all use precautions and restrictions on all labels in the tank mix. Prior to large scale batch mixing, conduct a "jar test" for spray mixture compatibility by mixing each component in the required order and proportion in a clear glass jar. **Note:** If tank mixing with glyphosate herbicides, mix the Vastlan with at least 75% of the total spray volume desired and ensure that Vastlan is well mixed before adding the glyphosate herbicides to avoid incompatibility. When using Vastlan in combination with Freelexx, 2,4-D amine (like DMA 4 IVM) or low volatile ester herbicides, generally the higher rates should be used for satisfactory brush control.

A surfactant should be added to the spray tank last or as recommended on the product label. If combined with emulsifiable concentrate herbicides, moderate continuous adequate agitation is required.
It is the pesticide user's responsibility to ensure that all products are registered for the intended use. Read and follow the applicable restrictions and limitations and directions for use on all product labels involved in tank mixing. Users must follow the most restrictive directions for use and precautionary statements of each product in the tank mixture.

Broadcast Applications With Ground Equipment
Apply using equipment that will ensure uniform coverage of the spray volumes applied. To improve spray coverage, add a non-ionic surfactant. See Maximum Labeled Rate versus Spray Volume per Acre table below for relationship between mixing rate, spray volume and maximum application rate.

Aerial Application
Aerial sprays should be applied using suitable drift control. (See Use Precautions and Restrictions.) Add a non-ionic surfactant. See Maximum Labeled Rate versus Spray Volume per Acre table above for relationship between mixing rate, spray volume and maximum application rate.

Woody Plant Control With Ground Equipment for Noncropland sites

High Volume Foliage Treatment

For control of woody plants, use Vastlan at the rate of 3 to 9 quarts per 100 gallons of spray solution, or Vastlan at 0.75 to 3 quarts may be tank mixed with Freelexx, 2,4-D (like DMA 4 IVM, or low volatile esters), or products such as Milestone, Opensight, Tordon* and diluted to make 100 gallons of spray solution. Apply at a volume of 100 to 400 gallons of total spray per acre depending upon size and density of woody plants. Applications should be sufficient to provide thorough plant coverage. (See Use Precautions and Restrictions.) Do not exceed maximum allowable use rates per acre.

* Tordon is not registered for use in the states of California and Florida. This product is a restricted use pesticide. Check to ensure tank mix partners are state registered before use. See this product label for more information.

Low Volume Foliage Treatment

To control susceptible woody plants, apply up to 9 quarts of Vastlan in 10 to 100 gallons of finished spray. The maximum volume of the finish spray applied to an acre is limited by the maximum use rate per site type (See Maximum Use Rate section - Range and Pasture, Grazing, Haying sites 2 lb ae, Forestry and aquatic sites 6 lb ae, and all other sites 9 lb ae triclopyr). For best results, a surfactant should be added to all spray mixtures. The spray concentration of Vastlan and total spray volume per acre should be adjusted according to the size and density of target woody plants and kind of spray equipment used. With low volume sprays, use sufficient spray volume to obtain uniform coverage of target plants including the surfaces of all foliage, stems, and root collars (see Use Precautions and Restrictions). Match equipment and delivery rate of spray nozzles to height and density of woody plants. When treating tall, dense brush, a truck mounted spray gun with spray tips that deliver up to 2 gallons per minute at 40 to 60 psi may be required. Backpack or other types of specialized spray equipment with spray tips that deliver less than 1 gallon of spray per minute may be appropriate for short, low to moderate density brush.

Tank Mixing: As a low volume foliar spray, up to 9 quarts of Vastlan may be applied in tank mix combination with Tordon* or Graslan L* in 10 to 100 gallons of finished spray. The maximum volume of the finish spray applied to an acre is limited by the maximum use rate per site type (See Maximum Use Rate section - Range and Pasture, Grazing, Haying sites 2 lb ae, Forestry and aquatic sites 6 lb ae, and all other sites 9 lb ae triclopyr).

* Tordon and Graslan L are not registered for use in the states of California and Florida. These products are restricted use pesticides. See product labels for more information.

Foliage Treatment (Non-Grazed/Non-Hayed Areas)

Use 6 to 9 quarts of Vastlan alone or in a tank mix combination with other herbicides such as Freelexx, 2,4-D (like DMA 4 IVM, or low volatile esters) or Milestone, Opensight, Tordon*, or Graslan L* and apply in a total spray volume of 10 to 30 gallons per acre. Use the higher rates and volumes when plants are dense or under drought conditions.

Interspersed areas in non-grazed/hayed rights-of-ways that may be subject to grazing or haying may be spot treated with this rate if the treated area comprises no more than 10% of the total grazed/hayed area.

* Tordon and Graslan L are not registered for use in the states of California and Florida. These products are restricted use pesticides. See product labels for more information.

Foliage Treatment (Range and Pasture and Grazed/Hayed Areas)

Use 1 to 2 quarts of Vastlan per acre. Apply as a broadcast spray in a total volume of 10 gallons or more per acre. Apply anytime the weeds are actively growing. Tank mixtures can be made with other herbicides registered for use on grazed/hayed sites such as Milestone, Opensight, PastureGard HL, Surmount, Freelexx, or Tordon* or Graslan L*.

* Tordon and Graslan L are not registered for use in the states of California and Florida. These products are restricted use pesticides. Check to ensure tank mix partners are state registered before use. See product labels for more information.

Weed Resistance Management:

Triclopyr, the active ingredient in this product, is a Group 4 herbicide based on the mode of action classification system of the Weed Science Society of America. Any weed population may contain or develop plants resistant to Group 4 herbicides. Resistant weeds may dominate the weed population if these herbicides are used repeatedly in the same field. Such resistant weed plants may not be effectively managed using Group 4 herbicides but may be effectively managed utilizing other herbicides alone or in mixtures from different herbicide Groups that are labeled for control of these weeds and/or by using cultural or mechanical practices. Consult your local company representative, state cooperative extension service, professional consultants or other qualified authorities to determine appropriate actions for treating specific resistant weeds.

Best Management Practices:

Proactively implementing diversified weed control strategies to minimize selection for weed populations resistant to one or more herbicides is recommended. A diversified weed management program may include the use of multiple herbicides with different modes of action and overlapping weed spectrum with or without tillage operations and/or other cultural practices. Research has demonstrated that using the labeled rate and directions for use is important to delay the selection for resistant weeds. Scouting after a herbicide application is important because it can facilitate the early identification of weed shifts and/or weed resistance and thus provide direction on future weed management practices. One of the best ways to contain resistant weed populations is to implement measures to avoid allowing weeds to reproduce by seed or to proliferate vegetatively. Cleaning equipment between sites and avoiding movement of plant material between sites will greatly aid in reducing the spread of resistant weed seed.

Woody Plants and Weeds Controlled

alder	dogwood	salt cedar[2]
arrowwood	elderberry	salmonberry
ash	elm	sassafras
aspen	gallberry	scotch broom
Australian pine	gorse	sumac
bear clover (bearmat)	hazel	sweetbay magnolia
beech	hornbean	sweetgum
birch	kudzu[1]	sycamore
blackberry	locust	tanoak
blackgum	madrone	thimbleberry
Brazilian pepper	maples	tulip poplar
broom, Scotch, French, Spanish, Portugese	melaleuca (seedlings)	waxmyrtle
	mulberry	western hemlock
cascara	oaks	wild rose
ceanothus	persimmon	willow
cherry	pine	winged elm
chinquapin	poison ivy	
choke cherry	poison oak	
cottonwood	poplar	
crataegus (hawthorn)	Russian olive 1/	
Douglas fir	salt-bush (*Baccharis* spp.)	

[1]For complete control, re-treatment may be necessary.
[2]Use cut surface treatments for best results.

Annual and Perennial Broadleaf Weeds

bindweed	lambsquarter	Spanish needles/ common beggarthicks
burdock	lespedeza	
Canada thistle	Mexican petunia	tansy ragwort
chicory	plantain	thistle
clover	purple loosestrife 2/	tropical soda apple
curly dock	oxalis	vetch
dandelion	ragweed	wedelia
field bindweed	smartweed	wild lettuce
ground ivy		

Aquatic Weeds

alligatorweed	nuphar (spatterdock)	purple loosestrife
American lotus	parrotfeather*	waterhyacinth
American frogbit	phragmites 3/	waterlily
aquatic sodaapple	pickerelweed	waterprimose
Eurasian watermilfoil	pennywort	watershield
milfoil species		

*Re-treatment may be needed to achieve desired level of control.

1/ Russian olive

Apply Vastlan at 3 quarts per acre plus Milestone® and a non-ionic surfactant at 0.25 to 0.5% v/v or 1 quart/acre of crop oil concentrate or methylated seed oil. Treatments can be made to small (usually less than 6 feet in height) trees or to regrowth of trees after cutting, mowing, or shredding operations. For foliar applications, apply until foliage is wet, but not to runoff. When treating regrowth of mowed trees, allow time for the plants to re-grow and develop adequate leaf area for a foliar application. This may mean the application will need to be done the year after cutting or, at least, in September or October after mowing the previous winter or early spring.

These treatments may need to be re-applied in subsequent years to achieve the desired level of long term control if trees resprout after the initial treatment

2/ Purple Loosestrife
Purple loosestrife can be controlled with foliar applications of Vastlan. For broadcast applications, use a minimum of 4.5 to 6 quarts of Vastlan per acre. Apply Vastlan when purple loosestrife is at the bud to mid-flowering stage of growth. Follow-up applications for control of regrowth should be made the following year in order to achieve increased control of this weed species. For all applications, a non-ionic surfactant should be added to the spray mixture. Follow all directions and use precautions on the label of the surfactant. Thorough wetting of the foliage and stems is necessary to achieve satisfactory control. A minimum spray volume of 50 gallons per acre is needed for ground broadcast applications.

If using a backpack sprayer, a spray mixture containing 0.75% to 1.25% Vastlan should be used. All purple loosestrife plants should be thoroughly wetted.

3/ Phragmites (*Phragmites australis*)
Phragmites can be selectively controlled with foliar applications of Vastlan. For broadcast applications, a minimum of 2 1/4 lb ae of triclopyr (2 1/4 quarts of Vastlan) per acre should be used. For optimum control, apply Vastlan when phragmites is in the early state of growth, 1/2 to 3 feet in height, prior to seed head development. Follow-up applications for control of regrowth may be made the following year in order to achieve increased control of this weed species. For all applications, a non-ionic surfactant labeled for aquatics should be added to the spray mixture. Follow all directions and use precautions on the label of the surfactant. Thorough wetting of the foliage and stems is necessary to achieve satisfactory control. A minimum spray volume of 50 gallons per acre is recommended for ground broadcast applications.

If a backpack sprayer is used, a spray mixture containing 0.75% to 1.25% of Vastlan should be used. All phragmites foliage should be thoroughly wetted.

Aerial application by helicopter may be needed when treating restoration sites that are inaccessible, remote, difficult to traverse, isolated, or otherwise unsuited to ground application, or in circumstances where invasive exotic weeds dominate native plant populations over extensive areas and efforts to restore native plant diversity are being conducted. By air, apply in a minimum spray volume of 30 gallons per acre.

Cut Surface Treatments

Individual plant treatments such as cut surface applications may be used on any use site listed on this label at a maximum use rate of 6 or 9 quarts of Vastlan (6 lb ae on forestry sites and 9 lb ae of triclopyr on other sites) per acre. These types of applications are made directly to ungrazed parts of plants and, therefore, are not restricted by the grazing maximum rate of 2 quarts of Vastlan (2 lb ae of triclopyr) per acre on a grazed site.

To control unwanted hardwood trees such as elm, maple, oak and conifers in labeled sites, apply Vastlan, either undiluted or diluted in a 1 to 1 ratio with water, as directed below.

Tree Injector Method
Apply by injecting 1/2 milliliter of undiluted Vastlan or 1 milliliter of the diluted solution through the bark at intervals of 3 to 4 inches between centers of the injector wound. The injections should completely surround the tree at any convenient height. **Note: No Worker Protection Standard worker entry restrictions or worker notification requirements apply when this product is injected directly into plants.**

Hack and Squirt Method
Make cuts around the tree trunk at a convenient height with a hatchet or similar equipment so that the cuts overlap slightly and make a continuous circle around the trunk. Spray 1/2 milliliter of undiluted Vastlan or 1 milliliter of the diluted solution into the pocket created between the bark and the inner stem/trunk by each cut.

Frill or Girdle Method
Make a single girdle through the bark completely around the tree at a convenient height. The frill should allow for the herbicide to remain next to the inner stem and absorb into the plant. Wet the cut surface with undiluted or diluted solution.

Both of the above methods may be used successfully at any season except during periods of heavy sap flow of certain species - for example, maples.

Stump Treatment
Spray or paint the cut surfaces of freshly cut stumps and stubs with undiluted Vastlan. The cambium area next to the bark is the most vital area to wet.

Chemical Mowing

Vastlan may be applied to the cut surfaces of weed or brush stubble under the deck of a rotary mower such as the Brown Brush Monitor or other equipment that is designed to uniformly apply the herbicide. This method of application may be used for control of annual and perennial broadleaf weeds and for suppression and stem density reduction of woody species. Apply when growing conditions are favorable and there is active plant growth.

Application

Broadleaf Weed Control: Apply at labeled rates for Vastlan under the section "Broadcast Applications with Ground Equipment - Broadleaf Weed Control". Apply the specified rate in a minimum spray volume of 3 gallons per acre. Follow label directions for herbicides that may be applied in tank mix combination with Vastlan to improve weed control or broaden the spectrum of weeds controlled.

Woody Plant Control: For suppression and stem density reduction of woody species, use 2.25 to 4.5 quarts of Vastlan in a minimum spray volume of 5 gallons per acre. Follow label directions under the woody plant control for herbicides that may be applied in tank mix combination with Vastlan to improve control or broaden the spectrum of woody plants controlled.

Tank mixing: For possible increased effectiveness of this treatment, Vastlan may be tank mixed with other herbicides such as Milestone, Tordon*, Graslan L* or imazapyr. Follow all product use directions and do not exceed maximum labeled use rates.

* Tordon and Graslan L are not registered for use in the states of California and Florida. These products are restricted use pesticides. See product labels for more information.

Forest Management Applications

For best control from broadcast applications of Vastlan, add a surfactant and use a spray volume which will provide thorough plant coverage. Recommended spray volumes are usually 10 to 25 gallons per acre by air or 10 to 100 gallons per acre by ground. For spray volumes less than 50 gallons per acre the additon of a non-ionic surfactant will improve spray coverage. Nozzles or additives that produce larger droplets of spray may require higher spray volumes to maintain brush control.

Forest Site Preparation
Use up to 6 quarts of Vastlan alone and apply in a total spray volume of 10 to 30 gallons per acre or Vastlan may be used in a tank mix with other herbicides such as Graslan L*, Freelex, or 2,4-D amine or low volatile ester in a total spray volume of 10 to 30 gallons per acre. Use a non-ionic surfactant for all foliar applications.

*Graslan L is not registered for use in the states of California and Florida. This product is a restricted use pesticide. Check to ensure tank mix partners are state registered before use. See product label for more information.

Note: Conifers planted sooner than one month after treatment with Vastlan at less than 4 lb ae of triclopyr (4 quarts of Vastlan) per acre or sooner than two months after treatment at 4 to 6 lb ae of triclopyr (4 to 6 quarts of Vastlan) per acre may be injured. When tank mixtures of herbicides are used for forest site preparation, labels for all products in the mixture must be consulted and the longest waiting period before conifer planting must be used.

Directed Spray Applications in Tree Plantations such as for Conifer Release
To release conifers or desirable trees from competing vegetation, mix 3 to 6 quarts of Vastlan in enough water to make 100 gallons of spray mixture. To improve spray coverage, add a non-ionic surfactant. The spray mixture should be directed onto foliage of competitive vegetation using knapsack or backpack sprayers with flat fan nozzles or equivalent any time after vegetation has reached full leaf size, but before autumn coloration. When treating woody plants, it is best if the majority of treated plants are less than 6 feet in height to ensure adequate spray coverage. Use care to direct spray away from contact with foliage of conifers and desirable vegetation as injury or death could occur .

Note: Spray may cause temporary damage and growth suppression where contact with conifers occurs; however, injured conifers should recover and grow normally. Over-the-top spray applications can kill pines.

Broadcast Applications for Conifer Release in the Northeastern United States
To release spruce, fir, red pine and white pine from competing hardwoods, such as red maple, sugar maple, striped maple, alder, birch (white, yellow or gray), aspen, ash, pin cherry and *Rubus* spp. and perennial and annual broadleaf weeds, use Vastlan at rates of 1.5 to 3 quarts per acre alone or with Freelexx, 2,4-D (like DMA 4 IVM), or a low volatile ester to provide no more than 4 lb ae per acre from both products. Apply in late summer or early fall after conifers have formed their over wintering buds and hardwoods are in full leaf and prior to autumn coloration.

Broadcast Applications for Douglas-fir Release in the Pacific Northwest and California

To release Douglas-fir from susceptible competing vegetation such as broadleaf weeds, alder, blackberry or Scotch broom, apply Vastlan at 1 to 1.5 quarts per acre alone or in combination with other herbicides to broaden the spectrum of activity. Apply in early spring after hardwoods begin growth and before Douglas-fir bud break ("early foliar" hardwood stage) or after Douglas-fir seasonal growth has "hardened off" (set winter buds) in late summer, but while hardwoods are still actively growing. When treating after Douglas-fir bud set, apply prior to onset of autumn coloration in hardwood foliage. **Note:** Treatments applied during active Douglas-fir shoot growth (after spring bud break and prior to bud set) may cause injury to Douglas-fir trees.

Christmas Tree Plantations

Use Vastlan for the control of woody plants and annual and perennial broadleaf weeds in established Christmas tree plantations. For best results, apply when woody plants and weeds are actively growing. Vastlan does not control weeds which have not emerged at the time of application. If lower rates are used on hard to control woody species, resprouting may occur the year following treatment. Brush over 8 feet tall is difficult to treat efficiently using hand equipment such as backpack or knapsack sprayers. When treating large brush or trees or hard to control species such as ash, blackgum, choke cherry, elm, hazel, madrone, maples, oaks or sweetgum, and for applications made during drought conditions or in late summer when the leaves are mature, use the higher rates of Vastlan or use cut surface applications (see Cut Surface section above). For foliar applications, use a surfactant and apply in enough water to give uniform and complete coverage of the plants to be controlled. Applications made under drought conditions may provide less than desirable results.

Use Precautions:

- Newly seeded turf (alleyways, etc.) should be mowed two or three times before treatment with Vastlan.
- Use Vastlan where legumes, such as clover, are present only if injury and possible control of legumes can be tolerated.

Use Restrictions:

- Do not use on newly seeded grass until well established as indicated by vigorous growth and development of secondary root system and tillering
- Do not reseed Christmas tree areas treated with Vastlan for a minimum of three weeks after application.
- Apply Vastlan only to established Christmas trees that were planted at least one full year prior to application.
- **Do not apply with 2,4-D containing products.**

Application

Apply in late summer or early autumn after terminal growth of Christmas trees has hardened off but before leaf drop of the target weeds. Apply at a rate of 0.75 to 1.75 quarts of Vastlan per acre as a foliar spray directed toward the base of Christmas trees. Use sufficient spray volume to provide uniform coverage of target plants (20 to 100 gallons per acre). Application rates of Vastlan directed for Christmas trees will only suppress some well established woody plants that are greater than 2 to 3 years old (see table below). Broadcast sprays may also be applied in bands between the rows of planted trees. Use spray equipment that will ensure uniform coverage of the desired spray volume.

Vastlan can cause needle and branch injury to Christmas trees. To minimize injury to Christmas trees, direct sprays so as to avoid or minimize contact with foliage. Blue spruce, white spruce, balsam fir and Frasier fir are less susceptible to injury than white pine and Douglas-fir.

Application Rates and Species Controlled (or also see list above):

Vastlan		
0.75 quart/acre	1.25 to 1.5 quarts/acre	1.75 quarts/acre
clover dandelion dock, curly lambsquarters lespedeza plantain, broadleaf plantain, buckhorn ragweed, common vetch	bindweed, field (TG) blackberry[1] chicory (s) fireweed ivy, ground lettuce, wild oxalis poison ivy smartweed (TG) thistle, Canada (TG) violet, wild Virginia creeper[1]	arrowwood (SDL) aspen beech (SDL) birch (SDL) chinquapin cottonwood (SDL) elderberry grape, wild mulberry (SDL) poplar (SDL) sassafras (SDL) sumac (SDL) sycamore (SDL)

(TG) Top growth control, retreatment may be necessary
(S) Suppression
(SDL) Seedlings less than 2 to 3 years old
[1]Use 1.5 quarts per acre rate

Directed Applications

To control hardwoods such as red maple, sugar maple, striped maple, sweetgum, red and white oaks, ash, alder, birch, aspen, and pin cherry, mix 0.19 to1 pint of Vastlan in enough water to make 3 gallons of spray mixture. For directed applications, do not exceed 6 quarts of Vastlan per acre per year. To improve coverage, add a non-ionic agricultural surfactant to the spray. This spray mixture should be directed onto foliage of competitive hardwoods using knapsack or backpack sprayers with flat fan nozzles or equivalent any time after hardwoods have reached full leaf size, but before autumn coloration (when plants are actively growing). The majority of treated hardwoods should be less than 8 feet in height to ensure adequate spray coverage. **Note:** To prevent Christmas tree injury, care should be taken to direct spray away from contact with Christmas tree foliage.

Aquatic and Wetland Sites

Use Vastlan™ for control of emersed, submersed and floating aquatic plants in aquatic sites such as ponds, lakes, reservoirs, non-irrigation canals, and ditches which have little or no continuous outflow, marshes and wetlands, including broadleaf and woody vegetation on banks and shores within or adjacent to these and other aquatic sites.

Obtain Required Permits: Consult with appropriate state or local water authorities before applying this product to public waters. State or local public agencies may require permits.

Aquatic Application Methods

Use a non-ionic surfactant in the spray mixture to improve control with foliar applications. Follow all directions and use precautions on the aquatic surfactant label.

Surface Application

Use a spray boom, handgun or other similar suitable equipment mounted on a boat or vehicle. Thorough wetting of foliage is essential for maximum effectiveness. Use 20 to 200 gallons per acre of spray mixture. Special precautions such as the use of low spray pressure, large droplet producing nozzles or addition of a labeled thickening agent may minimize spray drift in areas near sensitive crops.

Aerial Application (Helicopter Only)

Apply with a helicopter using a Microfoil or Thru-Valve boom, or a drift control additive in the spray solution. Apply in a minimum of 10 gallons of total spray mix per acre. Do not apply when weather conditions favor drift to sensitive areas. See label section on aerial application directions and precautions.

Floating and Emerged Weeds

Apply when plants are actively growing. For control of waterhyacinth, alligatorweed (see specific directions below), and other susceptible emerged and floating herbaceous weeds and woody plants, apply 1.5 to 6 quarts of Vastlan per acre as a foliar application using surface or aerial equipment. Use higher rates in the rate range when plants are mature, when the weed mass is dense, or for difficult to control species. Repeat as necessary to control regrowth and plants missed in the previous operation, but do not exceed a total of 6 quarts of Vastlan per acre per annual growing season.

Aquatic Weeds

alligatorweed	parrotfeather[1]	purple loosestrife
aquatic sodaapple	phragmites	waterprimose
Eurasian watermilfoil	pickerelweed	
milfoil species	pennywort	

[1]Re-treatment may be needed to achieve desired level of control.

Alligatorweed

Apply Vastlan at 2 to 6 quarts per acre to control alligatorweed. It is important to thoroughly wet all foliage with the spray mixture. For best results, add an approved non-ionic aquatic surfactant to the spray mixture. Alligatorweed growing outside the margins of a body of water can be controlled with this treatment. However, alligatorweed growing in water will only be partially controlled. Top growth above the water will be controlled, but the plant will likely regrow from tissue below the water surface.

Restrictions for Potable Water Intakes for Emerged Aquatic Weed Control– Lakes, Reservoirs, Ponds:

See chart below for specific setback distances near functioning potable water intakes.

Note: Existing potable water intakes which are no longer in use, such as those replaced by potable water wells or connections to a municipal water system, are not considered to be functioning potable water intakes. These setback restrictions do not apply to terrestrial applications made adjacent to potable water intakes.

	Vastlan Application Rate			
Area Treated	**1.5 qt/acre**	**3 qt/acre**	**4.5 qt/acre**	**6 qt/acre**
(acres)	**Setback Distance (ft)**			
4	0	200	400	500
>4 - 8	0	200	700	900
>8 - 16	0	200	700	1000
>16	0	200	900	1300

To apply Vastlan around and within the distances noted above from a functioning potable water intake, the intake must be turned off until the triclopyr level in the intake water is determined to be 0.4 parts per million (ppm) or less by laboratory analysis or immunoassay.

Recreational Use of Water in Treatment Area: There are no restrictions on use of water in the treatment area for recreational purposes, including swimming and fishing.
Livestock Use of Water from Treatment Area: There are no restrictions on livestock consumption of water from the treatment area.

Submerged Weeds

For control of Eurasian watermilfoil and other susceptible submerged weeds in ponds, lakes, reservoirs, and in non-irrigation canals or ditches that have little or no continuous outflow, apply Vastlan as either a surface or subsurface application. Select rates according to the rate chart below to provide a triclopyr concentration of 0.75 to 2.5 ppm ae in treated water. Use higher rates in the rate range in areas of greater water exchange. These areas may require a repeat application. However, total application of Vastlan must not exceed an application rate of 2.5 ppm of triclopyr for the treatment area per annual growing season.

Apply in spring or early summer when Eurasian watermilfoil or other submersed weeds are actively growing.

Areas near susceptible crops or other desirable broadleaf plants may be treated by subsurface injection applied by boat to avoid spray drift.

Surface Application
Apply the desired amount of Vastlan as either a concentrate or a spray mixture in water. However, use a minimum spray volume of 5 gallons per acre. Do not apply when weather conditions favor drift to sensitive areas.

Average water depth (feet) x 0.678 x target concentration (ppm) = gallons of Vastlan per surface acre treated.

Example: to achieve a 2 ppm concentration of triclopyr in water averaging 4 feet deep

4 x 0.678 x 2 ppm = 5.4 gallons of Vastlan per surface acre treated

	Concentration of Triclopyr Acid in Water (ppm ae)				
	0.75 ppm	**1 ppm**	**1.5 ppm**	**2 ppm**	**2.5 ppm**
Water Depth (ft)	**Gallons of Vastlan per Surface Acre at Specified Depth**				
1	0.5	0.7	1.0	1.4	1.7
2	1.0	1.4	2.0	2.7	3.4
3	1.5	2.0	3.1	4.1	5.1
4	2.0	2.7	4.1	5.4	6.8
5	2.5	3.4	5.1	6.8	8.5
6	3.1	4.1	6.1	8.1	10.2
7	3.6	4.7	7.1	9.5	11.9
8	4.1	5.4	8.1	10.8	13.6
9	4.6	6.1	9.2	12.2	15.3
10	5.1	6.8	10.2	13.6	17.0
15	7.6	10.2	15.3	20.3	25.4
20	10.2	13.6	20.3	27.1	33.9

Subsurface Application
Apply desired amount of Vastlan per acre directly into the water through boat-mounted distribution systems. When treating target plants that are 6 feet below the surface of the water, trailing hoses should be used along with an aquatic approved sinking agent (except California).

Restrictions for Potable Water Intakes for Submerged Weed Control – Lakes, Reservoirs, Ponds:
For applications of Vastlan to control submerged weeds in lakes, reservoirs or ponds that contain a functioning potable water intake for human consumption, see the chart below to determine the minimum setback distances of the application from the functioning potable water intakes.

	Concentration of Triclopyr Acid in Water (ppm ae)				
Area Treated (acres)	0.75 ppm	1 ppm	1.5 ppm	2 ppm	2.5 ppm
	Required Setback Distance (ft) from Potable Water Intake				
<4	300	400	600	800	1000
>4 – 8	420	560	840	1120	1400
>8 – 16	600	800	1200	1600	2000
>16 – 32	780	1040	1560	2080	2600
>32 acres, calculate a setback using the formula for the appropriate rate	Setback (ft) = (800*ln (acres) – 160)/3.33	Setback (ft) = (800*ln (acres) – 160)/2.50	Setback (ft) = (800*ln (acres) – 160)/1.67	Setback (ft) = (800*ln (acres) – 160)/1.25	Setback (ft) = (800*ln (acres) – 160)

Example Calculation 1: to apply 2.5 ppm Vastlan to 50 acres:

Setback in feet = (800 x ln (50 acres) - 160
= (800 x 3.912) – 160
= 2970 feet

Example Calculation 2: to apply 0.75 ppm Vastlan to 50 acres:

$$\text{Setback in feet} = \frac{(800 \times \ln(50 \text{ acres}) - 160}{3.33}$$
$$= \frac{(800 \times 3.912) - 160}{3.33}$$
= 892 feet

Note: Existing potable water intakes which are no longer in use, such as those replaced by potable water wells or connections to a municipal water system, are not considered to be functioning potable water intakes. These setback restrictions do not apply to terrestrial applications made adjacent to potable water intakes.

To apply Vastlan around and within the distances noted above from a functioning potable water intake, the intake must be turned off until the triclopyr level in the intake water is determined to be 0.4 parts per million (ppm) or less by laboratory analysis or immunoassay.

Wetland Sites

Wetlands include flood plains, deltas, marshes, swamps, bogs, and transitional areas between upland and lowland sites. Wetlands may occur within noncropland, rangeland, pastures, forests, wildlife habitat restoration and management areas and similar sites as well as areas adjacent to or surrounding domestic water supply reservoirs, lakes and ponds.

For control of woody plants and broadleaf weeds in wetland sites, follow use directions and application methods on this label for terrestrial sites.

Note: Consult local public water control authorities before applying this product in and around public water. Permits may be required to treat such areas.

Terms and Conditions of Use

If terms of the following Warranty Disclaimer, Inherent Risks of Use and Limitation of Remedies are not acceptable, return unopened package at once to the seller for a full refund of purchase price paid. To the extent permitted by law, otherwise, use by the buyer or any other user constitutes acceptance of the terms under Warranty Disclaimer, Inherent Risks of Use and Limitation of Remedies.

Warranty Disclaimer

Dow AgroSciences warrants that this product conforms to the chemical description on the label and is reasonably fit for the purposes stated on the label when used in strict accordance with the directions, subject to the inherent risks set forth below. To the extent permitted by law, Dow AgroSciences MAKES NO OTHER EXPRESS OR IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR ANY OTHER EXPRESS OR IMPLIED WARRANTY.

Inherent Risks of Use

It is impossible to eliminate all risks associated with use of this product. Crop injury, lack of performance, or other unintended consequences may result because of such factors as use of the product contrary to label instructions (including conditions noted on the label, such as unfavorable temperatures, soil conditions, etc.), abnormal conditions (such as excessive rainfall, drought, tornadoes, hurricanes), presence of other materials, the manner of application, or other factors, all of which are beyond the control of Dow AgroSciences or the seller. To the extent permitted by law, all such risks shall be assumed by buyer.

Limitation of Remedies

To the extent permitted by law, the exclusive remedy for losses or damages resulting from this product (including claims based on contract, negligence, strict liability, or other legal theories), shall be limited to, at Dow AgroSciences' election, one of the following:

1. Refund of purchase price paid by buyer or user for product bought, or
2. Replacement of amount of product used.

To the extent permitted by law, Dow AgroSciences shall not be liable for losses or damages resulting from handling or use of this product unless Dow AgroSciences is promptly notified of such loss or damage in writing. To the extent permitted by law, in no case shall Dow AgroSciences be liable for consequential or incidental damages or losses.

The terms of the Warranty Disclaimer, Inherent Risks of Use and this Limitation of Remedies cannot be varied by any written or verbal statements or agreements. No employee or sales agent of Dow AgroSciences or the seller is authorized to vary or exceed the terms of the Warranty Disclaimer or this Limitation of Remedies in any manner.

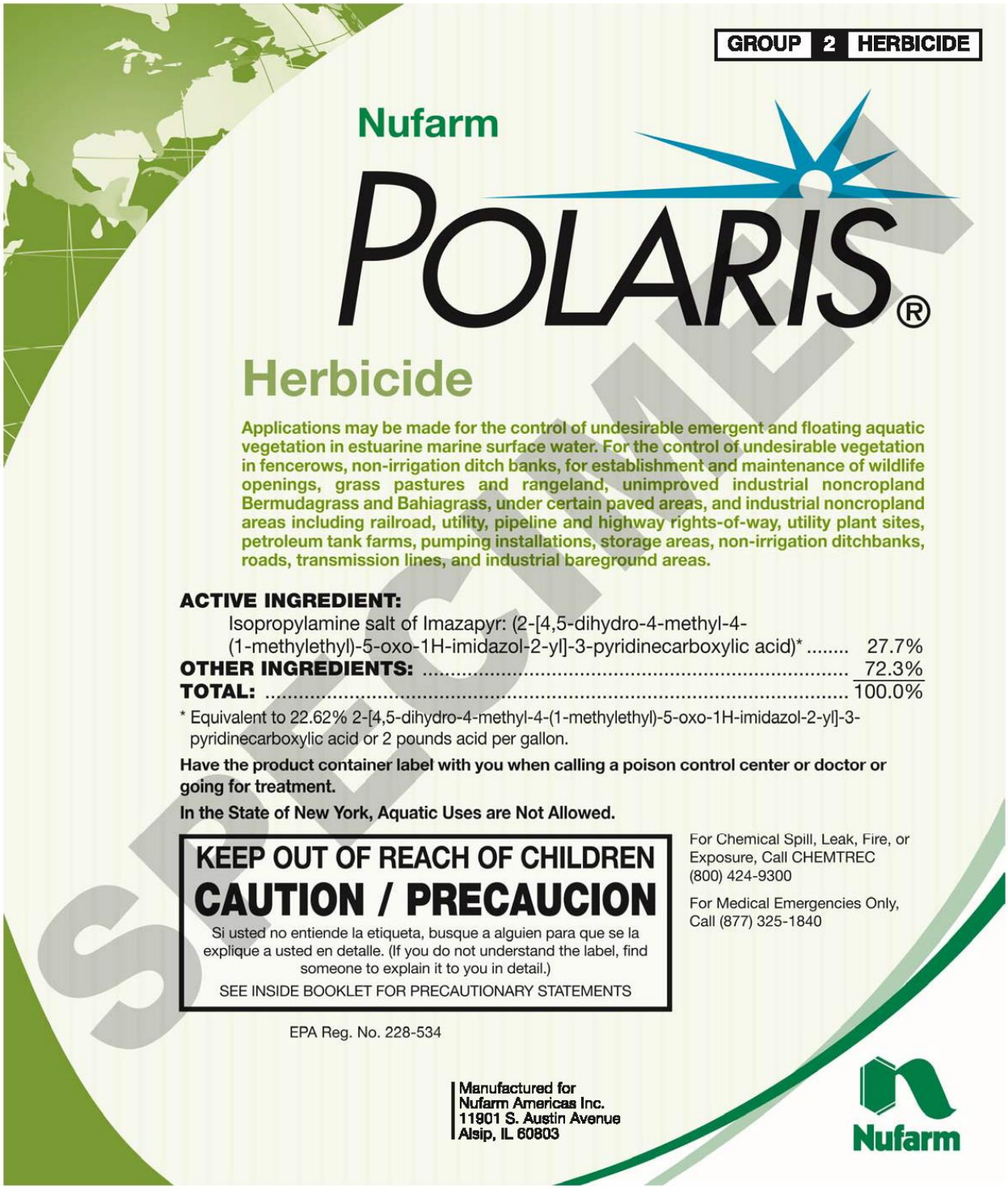
Produced for
Dow AgroSciences LLC
9330 Zionsville Road
Indianapolis, IN 46268

Label Code: D02-409-003
Replaces Label: D02-409-002
LOES Number: 010-02328

EPA accepted 12/06/17

Revisions:

1. Updated MOA box per PR Notices 2017-1/2
2. Updated storage temperature under Storage and Disposal section.
3. Deleted the following restriction: Do not apply using fixed wing aircraft.
4. Updated the Aerial Application section under Avoiding Injurious Spray Drift and Use Information sections by deleting Helicopter Only and adding fixed wing language. The aerial fixed wing application language can be found on other triclopyr labels (e.g. Garlon 4)
5. Updated language for High Volume Foliage Treatment under Woody Plant Control with Ground Equipment for Noncropland sites.
6. Updated title and language under Foliage Treatment (Non-Grazed/ Non-Hayed Areas) section.
7. Added the following under the Foliage Treatment (Range and Pasture and Grazed/Hayed Areas) section:
    a. Check to ensure tank mix partners are state registered before use.
8. Updated rates under Cut Surface Treatment section.
9. Updated language under Forest Site Preparation section.
10. Updated rate for Directed Applications under Christmas Tree Plantations.
11. Corrected Vastlan's application rates calculations and units throughout the label.
12. Deleted "in a water spray" for the following sentence under Foliage Treatment:
    a. Use 1 to 2 quarts of Vastlan per acre in a water spray.
13. Added "containing products" to the following restriction under Christmas Tree Plantations:
    a. Do not apply with 2,4-D…


GROUP 2 HERBICIDE
Nufarm
POLARIS®
Herbicide
Applications may be made for the control of undesirable emergent and floating aquatic vegetation in estuarine marine surface water. For the control of undesirable vegetation in fencerows, non-irrigation ditch banks, for establishment and maintenance of wildlife openings, grass pastures and rangeland, unimproved industrial noncropland Bermudagrass and Bahiagrass, under certain paved areas, and industrial noncropland areas including railroad, utility, pipeline and highway rights-of-way, utility plant sites, petroleum tank farms, pumping installations, storage areas, non-irrigation ditchbanks, roads, transmission lines, and industrial bareground areas.
ACTIVE INGREDIENT:
Isopropylamine salt of Imazapyr: (2-[4,5-dihydro-4-methyl-4-(1-methylethyl)-5-oxo-1H-imidazol-2-yl]-3-pyridinecarboxylic acid)* 27.7%
OTHER INGREDIENTS: 72.3%
TOTAL: 100.0%
* Equivalent to 22.62% 2-[4,5-dihydro-4-methyl-4-(1-methylethyl)-5-oxo-1H-imidazol-2-yl]-3-pyridinecarboxylic acid or 2 pounds acid per gallon.
Have the product container label with you when calling a poison control center or doctor or going for treatment.
In the State of New York, Aquatic Uses are Not Allowed.
KEEP OUT OF REACH OF CHILDREN
CAUTION / PRECAUCION
Si usted no entiende la etiqueta, busque a alguien para que se la explique a usted en detalle. (If you do not understand the label, find someone to explain it to you in detail.)
SEE INSIDE BOOKLET FOR PRECAUTIONARY STATEMENTS
For Chemical Spill, Leak, Fire, or Exposure, Call CHEMTREC (800) 424-9300
For Medical Emergencies Only, Call (877) 325-1840
EPA Reg. No. 228-534
Manufactured for
Nufarm Americas Inc.
11901 S. Austin Avenue
Alsip, IL 60803
Nufarm
SPECIMEN

PRECAUTIONARY STATEMENTS
HAZARDS TO HUMANS AND DOMESTIC ANIMALS
CAUTION / PRECAUCION

No human or domestic animal hazard statements are required. Follow instructions for Personal Protective Equipment and User Safety Recommendations.

PERSONAL PROTECTIVE EQUIPMENT (PPE):

Some materials are chemical resistant to this product are natural rubber ≥14 mils. If you want more options, follow the instructions for category A on the EPA chemical resistance category selection chart.

Mixers, loaders, applicators and other handlers must wear:

- Long-sleeved shirt and long pants,
- Shoes plus socks
- Chemical-resistant gloves for mixers and loaders, plus applicators using handheld equipment.

Follow manufacturer's instructions for cleaning/maintaining PPE. If no such instructions for washables exist, use detergent and hot water. Keep and wash PPE separately from other laundry.

Discard clothing and other absorbent materials that have been drenched or heavily contaminated with this product's concentrate. DO NOT reuse them.

Pilots must use an enclosed cockpit that meet the requirements listed in the Worker Protection Standard (WPS) for agricultural pesticides [40 CFR 170.240(d) (6)].

USER SAFETY RECOMMENDATIONS

Users Should:

- Wash hands before eating, drinking, chewing gum, using tobacco or using the toilet.
- Remove clothing/PPE immediately if pesticide gets inside. Then wash thoroughly and put on clean clothing. If pesticide gets on skin, wash immediately with soap and water.
- Remove PPE immediately after handling this product. Wash the outside of gloves before removing. As soon as possible, wash thoroughly and change into clean clothing.

PHYSICAL AND CHEMICAL HAZARDS

Spray solutions of this product should be mixed, stored and applied only in stainless steel, fiberglass, plastic and plastic-lined steel containers.

DO NOT mix, store or apply this product or spray solutions of this product in unlined steel (except stainless steel) containers or spray tanks.

ENVIRONMENTAL HAZARDS

This pesticide is toxic to plants. Drift and run off may be hazardous to plants in water adjacent to treated areas. DO NOT apply directly to water except as specified on the label. Treatment of aquatic weeds may result in oxygen depletion or loss due to decomposition of dead plants. DO NOT treat more than one half the surface area of the water in a single operation and wait at least 10 to 14 days between treatments. Begin treatment along the shore and proceed outward in bands to allow aquatic organisms to move into untreated areas. DO NOT contaminate water when disposing of equipment washwater or rinsate. See Directions for Use for additional precautions and requirements.

DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling. DO NOT apply this product in a way that will contact workers or other persons, either directly or through drift. Only protected handlers may be in the area during application. For any requirements specific to your State or Tribe, consult the agency responsible for pesticide regulation.

AGRICULTURAL USE REQUIREMENTS

Use this product only in accordance with its labeling and with the Worker Protection Standard, 40 CFR Part 170. This Standard contains requirements for the protection of agricultural workers on farms, forests, nurseries, and greenhouses, and handlers of agricultural pesticides. It contains requirements for training, decontamination, notification, and emergency assistance. It also contains specific instructions and exceptions pertaining to the statements on this label about personal protective equipment (PPE) and restricted entry interval. The requirements in this box only apply to uses of this product that are covered by the Worker Protection Standard.

DO NOT enter or allow worker entry into treated areas during the restricted entry interval (REI) of 48 hours.

PPE required for early entry to treated areas that is permitted under the Worker Protection Standard and that involves contact with anything that has been treated, such as plants, soil, or water, is:

- Coveralls
- Shoes plus socks
- Chemical-resistant gloves made of any waterproof material
- Protective eyewear

NON-AGRICULTURAL USE REQUIREMENTS

The requirements in this box apply to uses of this product that are NOT within the scope of the Worker Protection Standard (WPS) for agricultural pesticides (40 CFR Part 170). The WPS applies when this product is used to produce agricultural plants on farms, forests, nurseries, or greenhouses.

Noncrop weed control is not within the scope of the Worker Protection Standard. See the PRODUCT INFORMATION section of this label for a description of noncrop sites.

DO NOT enter or allow others to enter treated areas until sprays have dried.

RESTRICTIONS

DO NOT use on food or feed crops.

DO NOT apply this product within 0.5 miles upstream of an active potable water intake in flowing water (i.e. river, stream, etc.) or within 0.5 miles of an active potable water intake in a standing body of water, such as a lake, pond or reservoir.

DO NOT apply to water used for irrigation except as described in USE PRECAUTIONS AND RESTRICTIONS section of this label.

Keep from contact with fertilizers, insecticides, fungicides and seeds.

DO NOT drain or flush equipment on or near desirable trees or other plants, or on areas where their roots may extend, or in locations where the treated soil may be washed or moved into contact with their roots.

DO NOT side trim desirable vegetation with this product unless severe injury and plant death can be tolerated. Prevent drift of spray to desirable plants.

Clean application equipment after using this product by thoroughly flushing with water.

Noncropland Sites

- DO NOT apply more than 1.5 pounds acid equivalent Imazapyr (equivalent to 6 pints) per acre per year.

Pasture/Rangeland Sites

- DO NOT apply more than 0.75 pound acid equivalent Imazapyr (equivalent to 3 pints) per acre per year.
- DO NOT treat more than 1 /10 of the available area to be grazed or cut for hay.
- For spot treatment only.

Aquatic Sites

- DO NOT apply more than 1.5 pounds acid equivalent Imazapyr (equivalent to 6 pints) per acre per year.

Aerial application - Aerial application to aquatic sites is restricted to helicopter only.

Irrigation water - Application to water used for irrigation that results in residues greater than 1.0 part per billion (ppb) MUST NOT be used for irrigation purposes for 120 days after application or until residue levels of this product are determined by laboratory analysis or other appropriate means of analysis to be 1.0 ppb or less. When applications are made within 500 feet of an active irrigation intake, DO NOT irrigate for at least 24 hours following application to allow for dissipation.

Restrictions for potable water intakes. DO NOT apply this product directly to water within 0.5 miles upstream of an active potable water intake in flowing water (i.e. river, stream, etc.) or within 0.5 miles of an active potable water intake in a standing body of water such as a lake, pond or reservoir. To make aquatic applications around and within 0.5 miles of active potable water intakes, the water intake must be turned off during application and for a minimum of 48 hours after the application. These aquatic applications may be made only in the cases where there are alternative water sources or holding ponds that would permit the turning off of an active potable water intake for a minimum period of 48 hours after the applications.

NOTE: Existing potable water intakes that are no longer in use, such as those replaced by connections to wells or a municipal water **system, are not considered to be active potable water intakes. This restriction does not apply to intermittent, inadvertent overspray of water in terrestrial use sites.**

PRECAUTIONS

Applications may be made for the control of undesirable vegetation growing within specified aquatic, pasture/rangeland, industrial noncropland sites, and railroad, utility, and highway rights-of-way, fence rows and other noncropland sites as listed on the label. Aquatic *sites consist of standing and flowing water, estuarine/marine, wet-land and riparian areas. Industrial noncropland sites include utility plant* sites, petroleum tank farms, pumping installations, fence rows, storage areas, and nonirrigation ditchbanks. This product may also be used for the establishment and maintenance of wildlife openings, for the release of unimproved Bermudagrass and Bahiagrass, for bareground weed control, for use under certain paved surfaces and other locations specified on this label.

Aquatic Sites

Permitting - Consult local state fish and game agency and water control authorities before applying this product to public water. Permits may be required to treat such water.

Public waters - Application of this product to water can only be made by federal or state agencies, such as Water Management District personnel, municipal officials, and the U.S. Army Corps of Engineers, or those applicators who are licensed or certified as aquatic pest control applicators and are authorized by the state or local government. Treatment to other than non-native invasive species is limited to only those plants that have been determined to be a nuisance by a federal or state government entity.

Private waters - Applications may be made to private waters that are still, such as ponds, lakes and drainage ditches where there is minimal or no outflow to public waters.

Recreational use of water in treatment area. There are no restrictions on the use of water in the treatment area for recreational purposes, including swimming and fishing.

Livestock use of water in/from treatment area. There are no restrictions on livestock consumption of water from the treatment area.

Quiescent or Slow-moving Waters. In lakes and reservoirs, DO NOT apply this product within 1 mile of an active irrigation water intake during the irrigation season. Applications less than 1 mile from an active irrigation water intake may be made during the off-season, provided that the irrigation intake will remain inactive for a minimum of 120 days after application or until residue levels of this product are determined by laboratory analysis or other appropriate means of analysis to be 1.0 ppb or less.

PRODUCT INFORMATION

This product is an aqueous solution to be mixed with water and a surfactant and applied as a spray solution to control undesirable vegetation growing within specified aquatic, pasture/rangeland, industrial noncropland sites, and railroad, utility, and highway rights-of-way, and fence rows. Aquatic sites consist of standing and flowing water, estuarine/marine, wetland, and riparian areas. Industrial noncropland sites include utility plant sites, petroleum tank farms, pumping installations, fence rows, storage areas, and nonirrigation ditchbanks. This product may also be used for the establishment and maintenance of wildlife openings, for the release of unimproved Bermudagrass and Bahiagrass, for bareground weed control, for use under certain paved surfaces and other locations specified on this label.

Herbicidal Activity: This product will control most annual and perennial grasses and broadleaf weeds in addition to many brush and vine species with some residual control of undesirable species that germinate above the waterline. This product is readily absorbed through emergent leaves and stems and is translocated rapidly throughout the plant, with accumulation in the meristematic regions. Treated plants stop growing soon after spray application. Chlorosis appears first in the newest leaves, and necrosis spreads from this point. In perennials, the herbicide is translocated into, and kills, underground or submerged storage organs, which prevents regrowth. Chlorosis and tissue necrosis may not be apparent in some plant species until two or more weeks after application. Complete kill of plants may not occur for several weeks. Applications of this product are rainfast one hour after treatment.

This product does not control plants which are completely submerged or have a majority of their foliage under water.

Application Methods: This product may be applied to the emergent foliage of the target vegetation and has little to no activity on submerged aquatic vegetation. Product concentrations resulting from direct application to water are not expected to be of sufficient concentration or duration to provide control of target vegetation. Application should be made in such a way as to maximize spray interception by the target vegetation while minimizing the amount of overspray that enters the water. For maximum activity, weeds should be growing vigorously at the time of application and the spray solution should include a surfactant (See ADJUVANTS section for specific recommendations). This product may be selectively applied by using low-volume directed application techniques or may be broadcast-applied by using ground equipment, watercraft or aircraft (aerial applications to aquatic sites must be made by helicopter). In addition, this product may also be used for cut stump, cut stem and frill and girdle treatments within aquatic sites (see AERIAL APPLICATIONS and GROUND APPLICATIONS sections for additional details).

This product must be applied with surface or helicopter application equipment in a minimum of 5 gallons of water per acre. When applying by helicopter, follow directions under the AERIAL APPLICATIONS section of this label, otherwise refer to section on GROUND APPLICATIONS when using surface equipment.

Applications made to moving bodies of water should be made while traveling upstream to prevent concentration of this herbicide in water. DO NOT apply to bodies of water or portions of bodies of water where emergent and/or floating weeds do not exist.

When application is to be made to target vegetation that covers a large percentage of the surface area of impounded water, treating the area in strips may avoid oxygen depletion due to decaying vegetation. Oxygen depletion may result in the suffocation of some sensitive aquatic organisms. DO NOT treat more than one half of the surface area of the water in a single operation and wait at least 10 to 14 days between **treatments. Begin treatment along the shore and proceed outward in bands to allow aquatic organisms to move into untreated areas.**

Avoid wash-off of sprayed foliage by spray boat or recreational boat backwash for one hour after application.

Apply this product at 2 to 6 pints per acre depending on species present and weed density. DO NOT exceed the maximum label rate of 1.5 pounds acid equivalent Imazapyr (equivalent to 6 pints) per acre per year. Use the higher labeled rates for heavy weed pressure. Consult the AQUATIC WEEDS CONTROLLED section and the ADDITIONAL WEEDS CONTROLLED section of this label for specific rates.

This product may be applied as a draw down treatment in areas described above. Apply this product to weeds after water has been drained and allow 14 days before reintroduction of water.

Terrestrial Use Sites: This product is an aqueous solution to be mixed with water and a surfactant and applied as a spray solution to grass pasture and rangeland and noncropland areas such as railroad, utility, pipeline and highway rights-of-way, utility plant sites, petroleum tank farms, pumping installations, fence rows, storage areas, non-irrigation ditchbanks, including grazed or hayed areas within these sites. This product is used for the establishment and maintenance of wildlife openings. This product may also be used for the release of unimproved Bermudagrass (see specific directions) and for use under certain paved surfaces (see specific directions).

Application Methods: This product will control most annual and perennial grasses and broadleaf weeds in addition to many brush and vine species and this product will provide residual control of labeled weeds which germinate in the treated areas. This product may be applied either preemergence or post-emergence to the weeds; however, post-emergence application is the method of choice in most situations, particularly for perennial species. For maximum activity, weeds should be growing vigorously at the time of post-emergence application and the spray solution should include a surfactant (See Adjuvant Section for specific recommendations). These solutions may be applied selectively by using low-volume techniques or may be applied broadcast by using ground equipment or aerial equipment. In addition, this product may also be used for stump and cut stem treatments (see specific directions).

PRECAUTIONS FOR AVOIDING INJURY TO NON-TARGET PLANTS

Untreated desirable plants can be affected by root uptake of this product from treated soil. Injury or loss of desirable plants may result if this product is applied on or near desirable plants, on areas where their roots extend, or in locations where the treated soil may be washed or moved into contact with their roots. When making applications along shorelines where desirable plants may be present, caution should be exercised to avoid spray contact with their foliage or spray application to the soil in which they are rooted. Shoreline plants that have roots that extend into the water in an area where this product has been applied generally will not be adversely affected by uptake of the herbicide from the water.

RESTRICTION: If treated vegetation is to be removed from the application site, DO NOT use the vegetative matter as mulch or compost on or around desirable species.

Untreated trees can occasionally be affected by root uptake of this product through movement into the top soil. Injury or loss of desirable trees or other plants may result if this product is applied on or near desirable trees or other plants, on areas where their roots extend, or in locations where the treated soil may be washed or moved into contact with their roots.

MANAGING OFF-TARGET MOVEMENT

The following information is provided as general guidance for managing off-target movement. Specific use for this product may differ depending on the application technique used and the vegetation management objective.

Spray Drift: Avoiding spray drift at the application site is the responsibility of the applicator. The interaction of many equipment-and-weather-related factors determines the potential for spray drift. The applicator and the entity authorizing spraying are responsible for considering all these factors when making decisions. The following drift management requirements must be followed to avoid off-target drift movement from aerial applications: 1) The distance of the outer most operating nozzles must not exceed 3/4 the length of the rotor. 2) Nozzles must always point backward parallel with the air stream and never be pointed downwards more than 45 degrees. Where states have more stringent regulations, they must be observed.

Spray drift from applying this product may result in damage to sensitive plants adjacent to the treatment area. Only apply this product when the potential for drift to these and other adjacent sensitive areas (e.g. residential areas, bodies of water, known habitat for threatened or endangered species, or non-target crops) is minimal. DO NOT apply when the following conditions exist that increase the likelihood of spray drift from intended targets: high or gusty winds, high temperatures, low humidity, temperature inversions.

To minimize spray drift, the applicator should be familiar with and take into account the following drift reduction advisory information. Additional information may be available from state enforcement agencies or the Cooperative Extension on the application of this product.

The best drift management strategy and most effective way to reduce drift potential are to apply large droplets that provide sufficient coverage and control. Applying larger droplets reduces drift potential, but will not prevent drift if applications are made improperly, or under unfavorable environmental conditions (see WIND, TEMPERATURE AND HUMIDITY, and TEMPERATURE INVERSIONS).

CONTROLLING DROPLET SIZE

- Volume - Use high flow rate nozzles to apply the highest practical spray volume. Nozzles with higher rated flows produce larger droplets.
- Pressure - DO NOT exceed the nozzle manufacturer's recommended pressures. For many nozzle types, lower pressure produces larger droplets. When higher flow rates are needed, use higher flow rate nozzles instead of increasing pressure.
- Number of Nozzles - Use the minimum number of nozzles that provide uniform coverage.
- Nozzle Orientation - Orienting nozzles so that the spray is released parallel to the airstream produces larger droplets than other orientations and is recommended practice. Significant deflection from the horizontal will reduce droplet size and increase drift potential.

• **Nozzle Type - Use a nozzle type that is designed for the intended application. With most nozzle types, narrower spray angles produce larger droplets. Consider using low-drift nozzles. Solid stream nozzles oriented straight back produce the largest droplets and the lowest drift. DO NOT use nozzles producing a mist droplet spray.**

APPLICATION HEIGHT

Making applications at the lowest possible height (helicopter, ground driven spray boom) that is safe and practical reduces exposure of droplets to evaporation and wind.

SWATH ADJUSTMENT

When applications are made with a crosswind, the swath will be displaced downwind. Therefore, on the up and downwind edges of the treatment area, the applicator must compensate for this displacement by adjusting the path of the application equipment (e.g. aircraft, ground) upwind. Swath adjustment distance should increase with increasing drift potential (higher wind, smaller droplets, etc.).

WIND

Drift potential is lowest between wind speeds of 3-10 mph. However, many factors, including droplet size and equipment type, determine drift potential at any given speed. Application should be avoided below 3 mph due to variable wind direction and high inversion potential. NOTE: Local terrain can influence wind patterns. Every applicator should be familiar with local wind patterns and how they affect spray drift.

TEMPERATURE AND HUMIDITY

When making applications in low relative humidity, set up equipment to produce larger droplets to compensate for evaporation. Droplet evaporation is most severe when conditions are both hot and dry.

TEMPERATURE INVERSIONS

Drift potential is high during a temperature inversion. Temperature inversions restrict vertical air mixing, which causes small suspended droplets to remain in a concentrated cloud, which can move in unpredictable directions due to the light variable winds common during inversions. Temperature inversions are characterized by increasing temperatures with altitude and are common on nights with limited cloud cover and light to no wind. They begin to form as the sun sets and often continue into the morning. Their presence can be indicated by ground fog; however, if fog is not present, inversions can also be identified by the movement of smoke from a ground source or an aircraft smoke generator. Smoke that layers and moves laterally in a concentrated cloud (under low wind conditions) indicates an inversion, while smoke that moves upward and rapidly dissipates indicates good vertical air mixing.

WIND EROSION

Avoid treating powdery dry or light sandy soils when conditions are favorable for wind erosion. Under these conditions, the soil surface should first be settled by rainfall or irrigation.

ADJUVANTS

Post-emergence applications of this product require the addition of a spray adjuvant for optimum herbicide performance. Only spray adjuvants that are approved or appropriate for aquatic use can be utilized. The addition of a Chemical Producers and Distributors Associations (CPDA) certified adjuvant can increase control. A CPDA certified drift control agent may also be used.

Nonionic Surfactants: Use a nonionic surfactant at the rate 0.25% v/v or higher (see manufacturer's label) of the spray solution (0.25% v/v is equivalent to 1 quart in 100 gallons). For best results, select a nonionic surfactant with a HLB (hydrophilic to lipophilic balance) ratio between 12 and 17 with at least 70% surfactant in the formulated product (alcohols, fatty acids, oils, ethylene glycol or diethylene glycol should not be considered as surfactants to meet the above requirements).

Methylated Seed Oils or Vegetable Oil Concentrates: Instead of a surfactant, a methylated seed oil or vegetable-based seed oil concentrate may be used at the rate of 1.5 to 2 pints per acre. When using spray volumes greater than 30 gallons per acre, methylated seed oil or vegetable based seed oil concentrates should be mixed at a rate of 1 % of the total spray volume, or alternatively use a nonionic surfactant as described above. Research indicates that these oils may aid in product deposition and uptake by plants under moisture or temperature stress.

Silicone Based Surfactants: See manufacturer's label for specific rate recommendations. Silicone-based surfactants may reduce the surface tension of the spray droplet, allowing greater spreading on the leaf surface as compared to conventional nonionic surfactants. However, some silicone-based surfactants may dry too quickly, limiting herbicide uptake.

Invert emulsions: This product can be applied as an invert emulsion. The spray solution results in an invert (water-in-oil) spray emulsion designed to minimize spray drift and spray run-off, resulting in more herbicide on the target foliage. The spray emulsion may be formed in a single tank (batch mixing) or injected (in-line mixing). Consult the invert chemical label for proper mixing directions.

Fertilizer/Surfactant Blends: Nitrogen based liquid fertilizers such as 28%N, 32%N, 10-34-0 or ammonium sulfate, may be added at the rate of 2 to 3 pints per acre in combination with the recommended rate of nonionic surfactant, methylated seed oil or vegetable/seed oil concentrate. The use of fertilizers in a tank mix without a nonionic surfactant, methylated seed oil or vegetable/seed oil concentrate is not recommended.

Other: An antifoaming agent, spray pattern indicator or drift reducing agent may be applied at the product labeled rate if necessary or desired.

TANK MIXES

This product may be tank-mixed with other herbicides provided that the label for the tank mix product does not prohibit such mixing. Consult manufacturer's labels for specific rates and weeds controlled. Always follow the more restrictive label when making an application involving tank-mixes.

AERIAL APPLICATIONS

All restrictions must be taken to minimize or eliminate spray drift. Both helicopter and fixed wing aircraft can be used to apply this product, but applications to aquatic sites are restricted to helicopter only. DO NOT make applications by helicopter or fixed wing aircraft unless appropriate buffer zones can be maintained to prevent spray drift out of the target area, or when spray drift as a result of helicopter application can be tolerated.

Uniformly apply the specified amount of this product in 2 to 30 gallons of water per acre. A foam reducing agent may be added at the specified label rate.

Immediately after each use of this product thoroughly clean application equipment, including landing gear. Uncoated steel surfaces (except stainless steel surfaces) may result in corrosion and failure after prolonged exposure to the product. The maintenance of an paint (organic coating) may prevent corrosion.

Aerial Applications Restrictions:

1. Applicators are required to use a Coarse or Coarser droplet size (ASABE S572) or, if specifically using a spinning atomizer nozzle, applicators are required to use a volume mean diameter (VMD) of 385 microns or greater for release heights below 10 feet; Applicators are required to use a Very Coarse or coarser droplet size or, if specifically using a spinning atomizer nozzle, applicators are required to use a VMD of 475 microns or greater for release heights above 10 feet; Applicators must consider the effects of nozzle orientation and flight speed when determining droplet size.
2. Applicators are required to use upwind swath displacement.
3. The boom length must not exceed 60% of the wingspan or 90% of the rotor blade diameter to reduce spray drift.
4. Applications with wind speeds less than 3 mph and with wind speeds greater than 10 mph are prohibited.
5. Applications into temperature inversions are prohibited.
6. Aerial equipment designed to minimize spray drift, such as a helicopter equipped with a Microfoil boom, Thru-Valve boom or raindrop nozzles, must be used and calibrated. Except when applying with a Microfoil boom, a drift control agent may be added at the label rate.

GROUND APPLICATION (BROADCAST)

FOLIAR APPLICATIONS

Low Volume Foliar:

Use equipment calibrated to deliver 5 to 20 gallons of spray solution per acre. To prepare the spray solution, thoroughly mix in water 0.5 to 5% of this product plus surfactant (see the ADJUVANTS section of this label for specific recommendations). A foam reducing agent may be applied at the label rate, if needed. For control of difficult species (see AQUATIC WEEDS CONTROLLED section and the TERRESTRIAL WEEDS CONTROLLED section for relative susceptibility of weed species), use the higher concentrations of herbicide and/or spray volumes but DO NOT apply more than 1.5 pounds acid equivalent Imazapyr (equivalent to 6 pints) per acre per year. Excessive wetting of foliage is not recommended. See the MIXING GUIDE below for some suggested volumes of this product and water.

For low volume, select proper nozzles to avoid over-application. Proper application is critical to ensure desirable results. Best results are achieved when the spray covers the crown and approximately 70% of the plant. The use of an even flat fan tip with a spray angle of 40 degrees or less will aid in proper deposition.

Recommended tip sizes include 4004E, or 1504E. For a straight stream and cone pattern, adjustable cone nozzles such as 5500 X3 or 5500 X4 may be used. Attaching a rollover valve onto a Spraying Systems Model 30 gunjet or other similar spray guns allows for the use of both a flat fan and cone tips on the same gun.

Moisten, but DO NOT drench target vegetation causing spray solution to run off.

Low Volume Foliar with Backpacks:

For low-growing species, spray down on the crown, covering crown and penetrating approximately 70% of the plant.

For target species 4 to 8 feet tall, swipe the sides of target vegetation by directing spray to at least two sides of the plant in smooth vertical motions from the crown to the bottom. Make sure to cover the crown whenever possible.

For target species over 8 feet tall, lace sides of the target vegetation by directing spray to at least two sides of the target in smooth zigzag motions from crown to bottom.

Low Volume Foliar with Hydraulic Handgun Application Equipment:

Use same technique as described above for Low Volume Foliar with Backpacks.

For broadcast applications, simulate a gentle rain near the top of target vegetation, allowing spray to contact the crown and penetrate the target foliage without falling to the understory. Herbicide spray solution which contacts the understory may result in severe injury or **death of plants in the understory.**

SPRAY SOLUTION MIXING GUIDE FOR LOW-VOLUME FOLIAR APPLICATIONS

AMOUNT OF SPRAY SOLUTION BEING PREPARED	DESIRED CONCENTRATION (fluid volume)				
	0.5%	0.75%	1%	1.5%	5%
	(amount of product to use)				
1 gallon	0.6 fl. oz.	0.9 fl. oz.	1.3 fl. oz.	1.9 fl. oz.	6.5 fl. oz.
3 gallons	1.9 fl. oz.	2.8 fl. oz.	3.8 fl. oz.	5.8 fl. oz.	1.2 pint
4 gallons	2.5 fl. oz.	3.8 fl. oz.	5.1 fl. oz.	7.7 fl. oz.	1.6 pint
5 gallons	3.2 fl. oz.	4.8 fl. oz.	6.5 fl. oz.	9.6 fl. oz.	2 pints
50 gallons	2 pints	3 pints	4 pints	6 pints	10 quarts
100 gallons	4 pints	6 pints	8 pints	6 quarts	5 gallons
2 Tablespoons = 1 fluid ounce					

High Volume Foliar:
For optimum performance when spraying medium to high-density vegetation and brush, use equipment calibrated to deliver up to 100 gallons of spray solution per acre (GPA). Spray solutions exceeding 100 GPA may result in excessive spray run-off, causing increased ground cover injury, and injury to desirable species. To prepare the spray solution, thoroughly mix this product in water and add a surfactant (see ADJUVANT section for specific recommendations and rates of surfactants). A foam-reducing agent may be added at the label rate, if needed. For control of difficult species (see AQUATIC WEEDS CONTROLLED section and the ADDITIONAL WEEDS CONTROLLED section for relative susceptibility of weed species), use the higher concentrations of herbicide and/or spray volumes, but DO NOT apply more 1.5 pounds acid equivalent Imazapyr (equivalent to 6 pints) per acre per year in aquatic and non-cropland sites and 0.75 pounds acid equivalent Imazapyr (equivalent to 3 pints) per acre per year in pasture and rangeland sites. Uniformly cover the foliage of the vegetation to be controlled but DO NOT apply to run-off. Excessive wetting of foliage is not recommended.

Side Trimming:
DO NOT side trim with this product unless severe injury or death of the treated tree can be tolerated. This product is readily translocated and can result in death of the entire tree.

Ground Boom Applications Restrictions:
1. Applicators are required to use a nozzle height below 4 feet above the plant canopy or the ground and coarse or Coarser droplet size (ASABE S572) or, if specifically using a spinning atomizer nozzle, applicators are required to use a volume mean diameter (VMD) of 385 microns or greater.
2. Applications with wind speeds greater than 10 mph are prohibited.
3. Applications into temperature inversions are prohibited.

CUT SURFACE TREATMENTS

This product may be used to control undesirable woody vegetation by applying the product solution to the cambium area of freshly cut stump surfaces or to fresh cuts on the stem of the target woody vegetation. Applications can be made at any time of the year except during periods of heavy sap flow in the spring. DO NOT over apply solution causing run-off from the cut surface.

Injury may occur to desirable woody plants if the shoots extend from the same root system or their root systems are grafted to those of the treated tree.

Mixing: This product may be mixed as either a concentrated or dilute solution for stump and cut stem treatments. The dilute solution may be used for applications to the surface of the stump or to cuts on the stem of the target woody vegetation. Concentrated solutions may be used for applications to cuts on the stem. Use of the concentrated solution permits application to fewer cuts on the stem, especially for large diameter trees. Follow the application instructions to determine proper application techniques for each type of solution.

- To prepare a dilute solution, mix 8 to 12 fluid ounces of this product with one gallon of water. If temperatures are such that freezing of the spray mixture may occur, antifreeze (ethylene glycol) may be used according to manufacturer's label to prevent freezing. The use of a surfactant or penetrating agent may improve uptake through partially callused cambiums.
- To prepare a concentrated solution, mix 2 quarts of this product with no more than 1 quart of water.

Cut stump treatments:
- Dilute Solution - Spray or brush the solution onto the cambium area of the freshly cut stump surface. Insure that the solution thoroughly wets the entire cambium area (the wood next to the bark of the stump).

Cut stem (injection, hack & squirt) treatments:
- Dilute Solutions- Using standard injection equipment, apply 1 milliliter of solution at each injection site around the tree with no more than one-inch intervals between cut edges. Insure that the injector completely penetrates the bark at each injection site.
- **Concentrate Solutions- Using standard injection equipment, apply 1 milliliter of solution at each injection site. Make at least one injection cut for every 3 inches of Diameter at Breast Height (DBH) on the target tree. For example, a 3-inch DBH tree will receive 1 injection cut**

and a 6-inch DBH tree will receive 2 injection cuts. On trees requiring more than one injection site place the injection cuts at approximately equal intervals around the tree.

Frill or girdle treatments:

• *Using a hatchet, machete, or chain saw, make cuts through the bark and completely around the tree to expose the cambium. The* cut should angle downward extending into the cambium enough to expose at least two growth rings. Using a spray applicator or brush, apply a 25% to 100% solution of this product into each cut until thoroughly wet. Avoid applying so much herbicide that runoff to the ground or water occurs.

BASAL APPLICATION

This product is an aqueous formulation that requires mixing with **basal oil containing at least 15% emulsifier or will require the addition of an emulsifier, for application to the basal area** of brush and trees to control undesirable vegetation in the following noncropland areas: access roads; airfields; airports; along forest roads; around commercial or industrial structures or outbuildings; around farm and ranch structures and outbuildings; bare ground; construction sites; ditch banks; dry ditches & canals; fences & fencerows; firebreaks; gravel yards; habitat restoration & management areas; highways & roadsides (including aprons, medians, guardrails & right of ways); industrial plant sites; industrial areas; lumber yards; natural areas; paved areas; petroleum & other tank farms; pumping installations; pipeline, power, telephone & utility rights-of-way; power stations; railroad rights-of way; refineries; resorts; storage areas; substations; uncropped farmstead areas; uncultivated non-agricultural areas; vacant lots; walkways; wastelands; & wildlife habitat areas.

Thinline Basal and Stem Application

• This product may be applied as a thinline basal or arcing application to the stems of susceptible species such as big leaf maple (*Acer macrophyllum*), willow (*Salix* spp.) and Eucalyptus (*Eucalyptus* spp.) with a stem ground line diameter of 3 inches or less. Mix 24 to 48 ounces of this product in one gallon of **basal oil containing at least 15% emulsifier**. Maintain uniform mixtures with frequent agitation. Direct a thin line of the spray solution to the stems beginning a few feet from the ground and descending toward the base of the tree making a zig-zag motion. Do not over apply causing puddling.

Low Volume Basal Bark Treatments

• This product, at the rate of 8 to 12 ounces per gallon, may be applied for low volume basal bark treatments. This product at 3.0 to 5.0% is recommended to be tank mixed with Relegate™ or Garlon® 4 or other basal products to broaden the spectrum of control. Consult the herbicide labels for rates and susceptible brush species. Mixing with basal requires compatibility tests prior to mixing large quantities. Mixing aids (such as emulsifiers, etc.) and ongoing agitation are required to attain a homogenous tank mix.

• Basal application should be made to the lower 12" to 18" of the target brush and go to the soil. Care should be taken to not puddle or over treat the stem. Basal application is best suited for low density brush sites, where stems do not exceed 700 stems per acre.

For Basal Application – It is advisory to mix only the intended amount of mixture that is to be sprayed that day. Adequate agitation must be maintained with all emulsion mixtures to prevent phase separation. Prior to tank mixing with other products, herbicides and oils, you must determine the compatibility of the proposed mixture (See **COMPATIBILITY** section).

SPRAY SOLUTION MIXING GUIDE FOR BASAL BARK APPLICATIONS

AMOUNT OF SPRAY SOLUTION BEING PREPARED	NUFARM POLARIS		NUFARM POLARIS WHEN TANK MIXING		RELEGATE or GARLON 4	
	8.0 oz	12.0 oz.	3.0%	5.0%	15%	20%
1 Gallon	8.0 oz.	12.0 oz.	3.8 oz.	6.4 oz.	1.2 pts.	1.6 pts.
3 Gallons	1.5 pts.	2.25 pts.	11.5 oz.	1.2 pts.	1.8 qts.	2.4 qts.
4 Gallons	1.0 qt.	1.5 qts.	15.4 oz.	1.6 pts.	2.4 qts.	3.2 qts.
5 Gallons	1.25 qts.	1.0 qt. + 28.0 oz.	1.2 pts.	1.0 qt.	3.0 qts.	1.0 gal.
50 Gallons	3.0 gals. + 1.0 pt.	4.0 gals. + 2.75 qts.	1.5 gals.	2.5 gals.	7.5 gals.	10.0 gals.
100 Gallons	6.0 gals. + 1.0 qt.	9.0 gals. + 1.5 qts.	3.0 gals.	5.0 gals.	15.0 gals.	20.0 gals.
16 ounces = 1 pint : 2 pints = 1 quart : 4 quarts = 1 gallon						

COMPATIBILITY

Before full-scale mixing of this product with other pesticides, emulsifiers, fertilizers, surfactants or oils, determine the compatibility of the proposed mixture. Use proportionate quantities of each ingredient and mix in a small container. Always mix one product thoroughly with the diluent before adding another product. If no incompatibility is evident after 30 minutes, the mixture is generally compatible for spraying. To evaluate potential short term effects of applying the mixture, test the tank mix combination on a few plants or a small area before larger-scale treatments. Wait at least 2 to 3 days for problems to become apparent.

IMPORTANT: MIXING WITH OTHER SUBSTANCES MAY INCREASE THE RISK OF MIXING INCOMPATIBILITIES, REDUCED EFFECTIVENESS AND/OR CAUSE CROP INJURY OR LOSS. ANY LIABILITY FOR LOSS, INJURY OR DAMAGE RESULTING FROM A MIXTURE NOT SPECIFIED ON THIS LABEL OR IN MANUFACTURER'S SUPPLEMENTAL LABELING DISTRIBUTED FOR THIS **PRODUCT IS SPECIFICALLY DISCLAIMED BY MANUFACTURER.**

NONCROPLAND USES

When applied as directed and under the conditions described applications may be made for the control of undesirable vegetation growing in the following areas: airfields; airports; alleys, lanes, trails & access roads; around commercial or industrial structures or outbuildings; around farm and ranch structures and outbuildings; bare ground; beaches; campgrounds; construction sites; ditch banks; drive-in theaters; driveways & ramps; dry ditches & canals; fences & fencerows; firebreaks; gravel yards; habitat restoration & management areas; highways & roadsides (including aprons, medians, guardrails & right of ways); industrial plant sites; industrial areas; lumber yards; mulched areas; natural areas; paths and trails; parking areas; parks; paved areas; petroleum & other tank farms; pumping installations; pipeline, power, telephone & utility rights-of-way; power stations; preplant to turf & ornamental plants; railroad rights-of way; recreation areas; refineries; resorts; schools; sidewalks; sports areas; storage areas; substations; tennis courts; uncropped farmstead areas; uncultivated non-agricultural areas; vacant lots; walkways; wastelands; & wildlife habitat areas.

This product may also be used for the establishment and maintenance of wildlife openings, for the release of unimproved Bermudagrass and Bahiagrass, for bareground weed control, and for under certain paved surfaces. Applications to noncropland areas are not applicable to treatment of commercial timber or other plants grown for sale or other commercial use, or for commercial seed production, or for research purposes.

TANK-MIXES AND APPLICATION RATES FOR LOW VOLUME FOLIAR CONTROL*

Target Vegetation	Rate of this product	Tank Mix
Mixed hardwoods without elm, locust, or pine	1.0 - 1.5% by volume	Surfactant
Mixed hardwoods containing elm, locust, and pine	0.5 - 1.0% by volume	Accord® or AquaNeat® at 2 - 3% by volume plus surfactant
Mixed hardwoods with locust and pine but no elm	0.5 - 1.0% by volume	Krenite at 2 - 5% by volume plus surfactant
Mixed hardwoods with locust and elm but no pine	0.5 - 1.0% by volume	Escort® at 2 oz./Acre or 2.3 grams/gal. plus surfactant

* Tank-Mixes with 2,4-D or products containing 2,4-D have resulted in reduced efficacy of this product.

MIXING CHART

% Solution	Amount of this product per Gallon of Mix	Amount of this product per 4 Gallon Backpack
0.5%	0.6 fl. oz.	2.6 fl. oz.
1.0%	1.3 fl. oz.	5.1 fl. oz.
2.0%	2.6 fl. oz.	10.2 fl. oz.
3.0%	3.8 fl. oz.	15.4 fl. oz.
5.0%	6.4 fl. oz.	25.6 fl. oz.

MEASURING CHART		
128 fluid ounces	=	1 gallon
16 fluid ounces	=	1 pint
8 pints	=	1 gallon
4 quarts	=	1 gallon
2 pints	=	1 quart

FOR CONTROL OF UNDESIRABLE WEEDS IN UNIMPROVED BERMUDAGRASS AND BAHIAGRASS AND OTHER NON-CROPLAND INDUSTRIAL SITES

This product may be used on unimproved industrial noncropland Bermudagrass and bahiagrass turf, roadsides and utility rights-of-way. The application of this product on established common and coastal Bermudagrass and bahiagrass provides control of labeled broadleaf and grass weeds. Competition from these weeds is eliminated, releasing the Bermudagrass and bahiagrass. Treatment of Bermudagrass with this product results in a compacted growth habit and seedhead inhibition.

Uniformly apply with properly calibrated ground equipment using at least 10 gallons of water per acre with a spray pressure 20 to 50 psi.

IMPORTANT: Temporary yellowing of grass may occur when treatment is made after growth commences. DO NOT add surfactant in **excess of the recommended rate (1 fluid ounce per 25 gallons of spray solution). DO NOT apply to grass during its first growing season. DO NOT apply to grass that is under stress from drought, disease, insects, or other causes.**

DOSAGE RATES AND TIMING:

Bermudagrass - Apply this product at 6 to 12 fluid ounces per acre when the Bermudagrass is dormant. Apply this product at 6 to 8 fluid ounces per acre after the bermudagrass has reached full green-up. Applications made during green-up will delay green-up. Include a *surfactant in the spray solution (See IMPORTANT statement above).*

For additional pre-emergence control of annual grasses and small seeded broadleaf weeds, add Pendulum® Aquacap™ herbicide at the rate of 3.1 to 6.3 pints per acre. Consult the Pendulum® label for weeds controlled and for other use directions and precautions.

For control of Johnsongrass in bermudagrass turf, apply this product at 8 fluid ounces per acre plus Roundup® or Razor® at 12 fluid ounces per acre plus surfactant. For additional control of broadleaves and vines, Tahoe®3A or Garlon®3A may be added to the above mix at the rate of 1-2 pints per acre. Observe all precautions and restrictions on the Tahoe®3A, Garlon®3A and Roundup® labels.

Bahiagrass - Apply this product at 4 to 8 fluid ounces per acre when the bahiagrass is dormant or after the grass has initiated green-up but has not exceeded 25% green-up. Include in the spray solution a surfactant (See Adjuvant section for specific recommendations on surfactants).

WEEDS CONTROLLED

Bedstraw *(Galium spp.)*
Bishopweed *(Ptilimnium capillaceum)*
Buttercup *(Ranunculus parviflorus)*
Carolina geranium *(Geranium carolinianum)*
Fescue *(Festuca spp.)*
Foxtail *(Setaria spp.)*
Little barley *(Hordeum pusillum)*
Seedling Johnsongrass *(Sorghum halepense)*
Wild carrot *(Daucus carota)*
White clover *(Trifolium repens)*
Yellow woodsorrel *(Oxalis stricta)*

GRASS GROWTH AND SEEDHEAD SUPPRESSION

This product may be used to suppress growth and seedhead development of certain turfgrass in unimproved areas. When applied to desirable turf, this product may result in temporary turf damage and/or discoloration. Effects to the desirable turf may vary with environmental conditions. For optimum performance, application should be made prior to culm elongation. Applications may be made before or after mowing. If applied prior to mowing, allow at least three days of active growth before mowing. If following a mowing, allow sufficient time for the grasses to recover before applying this product or injury may be amplified.

DO NOT apply to turf under stress (drought, cold, insect damaged, etc.) or severe injury or death may occur.

Bermudagrass - Apply this product at 6 to 8 fluid ounces per acre from early green-up to prior to seed head initiation. DO NOT add a surfactant for this application.

Cool Season Unimproved Turf - Apply this product at 2 fluid ounces per acre plus 0.25% nonionic surfactant. For increased suppression, this product may be tank-mixed with such products as Campaign® (24 fluid ounces per acre) or Embark® (8 fluid ounces per acre).

Tank-mixes may increase injury to desired turf. Consult each product label for recommended turf species and other use directions and precautions. Tank mixes with 2,4-D or products containing 2,4-D may decrease the effectiveness of this product.

TOTAL VEGETATION CONTROL WHERE BAREGROUND IS DESIRED

This product is an effective herbicide for preemergence or post-emergence control of many annual and perennial broadleaf and grass weeds where bareground is desired .This product is particularly effective on hard-to-control perennial grasses. This product at 1.5 to 6 pints per acre can be used alone or in tank-mix with herbicides approved for use in bare ground. The degree and duration of control are dependent on the rate of this product used, tank-mix partner, the volume of carrier, soil texture, rainfall and other conditions.

Consult manufacturer's labels for specific rates and weeds controlled. Always follow the more restrictive label when making an application involving tank-mixes.

TANK MIX RECOMMENDATIONS FOR BAREGROUND

Herbicide Rates per Acre*		
This product in Pints	Pendulum® 3.3 EC in Quarts	Diuron in Pounds a.i.
1.5 - 3	4.8	4 - 6
2 - 4	4.8	6 - 10
3 - 6	4.8	8 - 12

* Use higher rates for fall applications and in areas that have not been previously treated or that feature heavy infestations.

Applications of this product may be made anytime of the year. Use equipment calibrated to deliver desired gallons per acre spray volume and uniformly distribute the spray pattern over the treated area.

Post-emergence Applications: Always use a spray adjuvant (See Adjuvant section of this label) when making a post-emergence application. For optimum performance on tough to control annual grasses, applications should be made at a total volume of 100 gallons per acre or less. For quicker burndown or brown-out of target weeds, this product may be tank-mixed with products such as Razor®, or **Roundup®. Tank mixes with 2,4-D or products containing 2,4-D may reduce the performance of this product. Always follow the more restrictive label when tank-mixing.**

Spot Treatments: This product may be used as a follow-up treatment to control escapes or weed encroachment in a bareground situation. To prepare the spray solution, thoroughly mix in each gallon of water 0.5 to 5% of this product plus an adjuvant. For increased burndown, include Razor®, Roundup® or similar products. For added residual weed control or to increase the weed spectrum, add *Pendulum®* Aquacap™ herbicide, *Overdrive®* herbicide or diuron. *Always follow the more restrictive label when tank-mixing.*

FOR CONTROL OF UNDESIRABLE WEEDS UNDER PAVED SURFACES

This product can be used under asphalt, pond liners and other paved areas, ONLY in industrial sites or where the pavement has a suitable barrier along the perimeter that prevents encroachment of roots of desirable plants.

This product should be used only where the area to be treated has been prepared according to good construction practices. If rhizomes, stolons, tubers or other vegetative plant parts are present in the site, they should be removed by scalping with a grader blade to a depth sufficient to insure their complete removal.

IMPORTANT: Paving should follow applications of this product as soon as possible. DO NOT apply where the chemical may contact the roots of desirable trees or other plants.

Injury or death of desirable plants may result if this product is applied where roots are present or where they may extend into the treated area. Roots of trees and shrubs may extend a considerable distance beyond the branch extremities or so-called drip line.

APPLICATION DIRECTIONS FOR PAVED SURFACES:

Applications should be made to the soil surface only when final grade is established. DO NOT move soil following application of this product. Apply this product in sufficient water (at least 100 gal. per acre) to ensure thorough and uniform wetting of the soil surface, including the shoulder areas. Add this product at a rate of 6 pints per acre (2.2 fluid ounce per 1000 square feet) to clean water in the spray tank during the filling operation. Agitate before spraying.

If the soil is not moist prior to treatment, incorporation of this product is needed for herbicide activation. This product can be incorporated into the soil to a depth of 4 to 6 inches using a rototiller or disc. Rainfall or irrigation of 1 inch will also provide uniform incorporation. DO NOT allow treated soil to wash or move into untreated areas.

SPOT TREATMNETS AND CRACK –AND-CREVICE TREATMENTS:

Use this product as a follow up or initial treatment to control weed escapes or weed encroachment in bareground situations, including cracks and crevices in paved surfaces such as parking lots, paths, sidewalks, runways and roadways.

FOR SPOT TREATMENT WEED CONTROL IN GRASS PASTURE AND RANGELAND

For the control of undesirable vegetation in grass pasture and rangeland, this product may be applied as a spot treatment at a rate of 2 to 48 fluid ounces of product per acre using any of the ground application methods as described in this label. Spot applications may not exceed more than one tenth of the area to be grazed or cut for hay in grass pasture and rangeland. See appropriate sections of this label for specific use directions for the application method and vegetation control desired.

DO NOT apply more than 48 fluid ounces per acre per year.

Grazing and Haying Restrictions:

- DO NOT cut forage grass for hay for 7 days after application of this product.
- There are no grazing restrictions following application of this product.

Rangeland Use Instructions:

This product may be applied to rangeland for the control of undesirable vegetation to achieve one or more of the following vegetation management objectives:

- Control of undesirable (noxious, invasive and non-native) plant species.
- Control of undesirable vegetation for wildlife habitat improvement.
- Control of undesirable vegetation to aid in the establishment of desirable rangeland plant species.
- Release of existing desirable rangeland plant communities from the competitive pressure of undesirable plant species.
- Control of undesirable vegetation to aid in the establishment of undesirable vegetation following a fire.
- Control of undesirable vegetation to reduce wildfire fuel.

To ensure the protection of threatened and endangered plants, when applying this product to rangeland:

- Federal agencies must follow NEPA regulations to ensure protection of threatened and endangered plants.
- Other organizations or individuals must operate under a habitat conservation plan if threatened or endangered plants are known to be present on the land to be treated.
- State agencies must work with the Fish and Wildlife Service or the Service's designated state conservation agency to ensure protection of threatened and endangered plants.

See appropriate sections of this label for specific use directions for the desired rangeland vegetation management control desired.

This product must only be applied to a given rangeland acre as specific weed problems arise. Long-term control of undesirable weeds ultimately depends on the successful use of the land management practices that promote the sustainability and growth of desirable rangeland plant species.

ROTATIONAL CROP GUIDELINE

Rotational crops may be planted 12 months after applying this product at the specified pasture and rangeland rate. Twelve months after an application of this product, and before planting any crop, a successful field bioassay must be completed. The field bioassay consists *of a test strip of the intended rotational crop planted in the previously treated area in the grass pasture and rangeland once grown to* maturity. The test strip should include low areas and knolls, and include variations in soil type and pH within the treated area. If no crop injury is evident in the test strip, the intended rotational crop may be planted the following year.

Use of this product in accordance with label directions is expected to result in normal growth of rotational crops in most situations; however, various agronomic factors and environmental factors make it impossible to eliminate all risks associated with the use of this product and, therefore, rotational crop injury is always possible.

TERRESTRIAL WEEDS CONTROLLED

In terrestrial sites, this product will provide preemergence or post-emergence control with residual control of the following target vegetation species at the rates listed. Residual control refers to control of newly germinating seedlings in both annuals and perennials. In general, annual weeds may be controlled by preemergence or postemergence applications of this product. For established biennials and perennials postemergence applications of this product are recommended.

The rates shown below pertain to broadcast applications and indicate the relative sensitivity of these weeds. The relative sensitivity should be referenced when preparing low volume spray solutions (see "Low Volume" section of "Ground Applications"); low volume applications may provide control of the target species with less product per acre than is shown for the broadcast treatments. This product must be used only in accordance with the Directions for Use on this label.

The relative sensitivity of the species listed below can also be used to determine the relative risk of causing non-target plant injury if any of the below listed species are considered to be desirable within the area to be treated.

Resistant Biotypes: Naturally occurring biotypes (a plant within a given species that has a slightly different, but distinct genetic makeup from other plants of the same species) of some weeds listed on this label may not be effectively controlled. If naturally occurring resistant biotypes are present in an area, this product should be tank-mixed or applied sequentially with an appropriate registered herbicide having a different mode of action to ensure control.

TERRESTRIAL WEEDS CONTROLLED		
COMMON NAME	**SCIENTIFIC NAME**	**GROWTH HABIT[2]**
GRASS WEEDS		
Apply 2 to 3 pints per acre[1]		
Annual bluegrass	*Poa annua*	A
Broadleaf signalgrass	*Brachiaria platyphylla*	A
Canada bluegrass	*Poa compressa*	P
Downy brome	*Bromus tectorum*	A
Fescue	*Festuca* spp.	A/P
Foxtail	*Setaria* spp.	A
Italian ryegrass	*Lotium multiflorum*	A
Johnsongrass[4]	*Sorghum halepense*	P
Kentucky bluegrass	*Poa pratensis*	P
Napier grass[5]	*Pennisetum purpureum*	P
Orchardgrass	*Dactytis glomerata*	P
Paragrass	*Brachiaria mutica*	P
Quackgrass	*Agropyron repens*	P
Sandbur	*Cenchrus* spp.	A
Smooth brome	*Bromus inermis*	P
Vaseygrass	*Paspalum urvillei*	P
Wild oats	*Avena fatua*	A
Witchgrass	*Panicum capillare*	A

(continued)

TERRESTRIAL WEEDS CONTROLLED (continued)		
COMMON NAME	**SCIENTIFIC NAME**	**GROWTH HABIT[2]**
GRASS WEEDS (continued)		
Apply 3 to 4 pints per acre[1]		
Barnyardgrass	*Echinochloa crus-galli*	A
Beardgrass	*Andropogon* spp.	P
Bluegrass, annual	*Poa annua*	A
Bulrush[5]	*Scirpus validus*	P
Cheat	*Bromus secalinus*	A
Cogongrass	*Imperata cylindrica*	P
Crabgrass	*Digitaria* spp.	A
Crowfootgrass	*Dactyloctenium aegyptium*	A
Fall panicum	*Panicum dichotomiflorum*	A
Goosegrass	*Eleusine indica*	A
Itch grass	*Rottboellia exaltata*	A
Lovegrass[4]	*Eragrostis* spp.	P
Maidencane[5]	*Panicum hemitomon*	A
Panicum, browntop	*Panicum fasciculatum*	A
Panicum, Texas	*Panicum texanum*	A
Prairie threeawn	*Aristida oligantha*	P
Sandbur, field	*Cenchrus incertus*	A
Signalgrass	*Brachiaria platyphylla*	A
Wild barley	*Hordeum* spp.	A
Woolly cupgrass	***Eriochloa villosa***	**A**

(continued)

TERRESTRIAL WEEDS CONTROLLED (continued)

COMMON NAME	SCIENTIFIC NAME	GROWTH HABIT[2]
GRASS WEEDS (continued)		
Apply 4 to 6 pints per acre[1]		
Bahiagrass	*Paspalum notatum*	P
Bermudagrass[3,4]	*Cynodon dactylon*	P
Big bluestem	*Andropogon gerardii*	P
Dallisgrass	*Paspalum dilatatum*	P
Feathertop	*Pennisetum villosum*	P
Guineagrass	*Panicum maximum*	P
Saltgrass[3]	*Distichlis stricta*	P
Sand dropseed	*Sporobolus cryptandrus*	P
Sprangletop	*Leptochloa* spp.	A
Timothy	*Phleum pratense*	P
Wirestem muhly	*Muhlenbergia frondosa*	P

[1] Use higher rate where heavy or well-established infestations occur.
[2] Growth Habit: A = Annual, P = Perennial
[3] Use a minimum of 75 GPA.
[4] Use higher labeled rates.
[5] Use not permitted in California unless otherwise directed by supplemental labeling.

(continued)

TERRESTRIAL WEEDS CONTROLLED (continued)

COMMON NAME	SCIENTIFIC NAME	GROWTH HABIT[2]
BROADLEAF WEEDS		
Apply 2 to 3 pints per acre[1]		
Burdock	*Arctium* spp.	B
Carolina geranium	*Geranium carolinianum*	A
Carpetweed	*Mollugo verticillata*	A
Clover	*Trifolium* spp.	A/P
Common chickweed	*Stellaria media*	A
Common ragweed	*Ambrosia artemisiifolia*	A
Dandelion	*Taraxacum officinale*	P
Dogfennel	*Eupatorium capillifolium*	A
Filaree	*Erodium* spp.	A
Fleabane	*Erigeron* spp.	A
Hoary vervain	*Verbena stricta*	P
Indian mustard	*Brassica juncea*	A
Kochia	*Kochia scoparia*	A
Lambsquarters	*Chenopodium album*	A
Lespedeza[3]	*Lespedeza* spp.	P
Miners lettuce	*Montia perfoliata*	A
Mullein	*Verbascum* spp.	B
Nettleleaf goosefoot	*Chenopodium murale*	A
Oxeye daisy	*Chrysanthemum leucanthemum*	P
Pepperweed	*Lepidium* spp.	A
Pigweed	*Amaranthus* spp.	A
Puncturevine	*Tribulus terrestris*	A
Russian thistle	*Salsola kali*	A
Smartweed	*Polygonum* spp.	A/P
Sorrell	*Rumex* spp.	P
Sunflower	*Helianthus* spp.	A
Sweet clover	*Melilotus* spp.	A/B
Tansymustard	*Descurainia pinnata*	A
Western ragweed	*Ambrosia psilostachya*	P
Wild carrot	*Daucus carota*	B
Wild lettuce	*Lactuca* spp.	A/B
Wild parsnip	*Pastinaca saliva*	B
Wild turnip	*Brassica campestris*	B
Woollyleaf bursage	*Franseria tomentosa*	P
Yellow woodsorrel	*Oxalis stricta*	P

(continued)

TERRESTRIAL WEEDS CONTROLLED (continued)

COMMON NAME	SCIENTIFIC NAME	GROWTH HABIT[2]
BROADLEAF WEEDS (continued)		
Apply 3 to 4 pints per acre[1]		
Broom snakeweed	*Gutierrezia sarothrae*	P
Bull thistle	*Cirsium vulgare*	B
Burclover	*Medicago* spp.	A
Chickweed mouseear	*Cerastium vulgatum*	A
Clover hop	*Trifolium procumbens*	A
Cocklebur	*Xanthium strumarium*	A
Cudweed	*Gnaphalium* spp.	A
Desert camelthorn	*Alhagi pseudalhagi*	P
Dock	*Rumex* spp.	P
Fiddleneck	*Amsinckia intermedia*	A
Goldenrod	*Solidago* spp.	P
Henbit	*Lamium amplexicaule*	A
Knotweed, prostrate	*Polygonum aviculare*	A/P
Pokeweed	*Phytolacca americana*	P
Purslane	*Portulaca* spp.	A
Pusley, Florida	*Richardia scabra*	A
Rocket London	*Sisymbrium irio*	A
Rush skeletonweed[4]	*Chondrilla juncea*	B
Saltbush	*Atriplex* spp.	A
Shepherdspurse	*Capsella bursa-pastoris*	A
Spurge, annual	*Euphorbia* spp.	A
Stinging nettle[4]	*Urtica dioica*	P
Velvetleaf	*Abutilon theophrasti*	A
Yellow starthistle	*Centaurea solstitialis*	A
Apply 4 to 6 pints per acre[1]		
Arrowwood	Pluchea sericea	A
Canada thistle	Cirsium arvense	P
Giant ragweed	Ambrosia trifida	A
Gray rabbitbrush	*Chrysothamnus nauseosus*	P
Little mallow	*Malva parviflora*	B
Milkweed	*Asclepias* spp.	P
Primrose	*Oenothera kunthiana*	P
Silverleaf nightshade	*Solarium elaeagnifolium*	P
Sowthistle	*Sonchus* spp.	A
Texas thistle	*Cirsium* texanum	P

[1] Use higher labeled rate where heavy or well-established infestations occur.
[2] Growth Habit: A = Annual, B = Biennial, P = Perennial
[3] Use not permitted in California unless otherwise directed by supplemental labeling.
[4] For best results, early postemergence applications are required.

(continued)

TERRESTRIAL WEEDS CONTROLLED (continued)

COMMON NAME	SCIENTIFIC NAME	GROWTH HABIT[2]
VINES AND BRAMBLES		
Apply 1 pint per acre		
Field bindweed	*Convolvulus arvensis*	P
Hedge bindweed	*Calystegia sepium*	A
Apply 2 to 3 pints per acre[1]		
Wild buckwheat	*Polygonum convolvulus*	P
Apply 3 to 4 pints per acre[1]		
Greenbriar	*Smilax* spp.	P
Honeysuckle[3]	*Lonicera* spp.	P
Morningglory	*Ipomoea* spp.	A/P
Poison ivy	*Rhus radicans*	P
Redvine	*Brunnichia cirrhosa*	P
Wild rose[3]	*Rosa* spp.	P
Including:		
Multiflora rose	*Rosa multiflora*	P
Macartney rose	*Rosa bracteata*	P
Apply 4 to 6 pints per acre[1]		
Trumpetcreeper	*Campsis radicans*	P
Virginia creeper	*Parthenocissus quinquefolia*	P
Wild grape	*Vitis* spp.	P

[1] Use higher labeled rate where heavy or well-established infestations occur.
[2] Growth Habit: A = Annual, B = Biennial, P = Perennial
[3] Use higher labeled rate.

(continued)

TERRESTRIAL WEEDS CONTROLLED (continued)

COMMON NAME	SCIENTIFIC NAME	GROWTH HABIT[2]
BRUSH SPECIES		
Apply 2 to 4 pints per acre[1]		
Brazilian peppertree	*Schinus terebinthifolius*	P
Chinese tallow tree Popcorn tree	*Sapium sebiferum*	P
Russian olive	*Elaeagnus angustifolia*	P
Sumac	*Rhus* spp.	P
Willow	*Salix* spp.	P
Apply 4 to 6 pints per acre[1]		
Alder	*Alnus* spp.	P
American beech	*Fagus grandifolia*	P
Ash[3]	*Fraxinus* spp.	P
Aspen	*Populus* spp.	P
Autumn olive	*Elaeagnus umbellata*	P
Bald cypress	*Taxodium distichum*	P
Bigleaf maple	*Acer macrophyllum*	P
Birch[3]	*Betula* spp.	P
Black gum[4]	*Nyssa sylvatica*	P
Black oak	*Quercus kelloggii*	P
Boxelder	*Acer negundo*	P
Ceanothis	*Ceanothis* spp.	P
Cherry[3, 4]	*Prunus* spp.	P
Chinaberry	*Melia azedarach*	P
Chinquapin	*Castanopsis chrysophylla*	P
Cottonwood	*Populus trichocarpa* *P deltoides*	P
Cypress	*Taxodium* spp.	P
Dogwood[3]	*Cornus* spp.	P
Elm	*Ulmus* spp.	P
Eucalyptus	*Eucalyptus* spp.	P
Hawthorn	*Crataegus* spp.	P
Hickory[3]	*Carya* spp.	P
Huckleberry	*Gaylussacia* spp.	P
Lyonia spp. Including: Fetterbush Staggerbush	 *Lyonia lucida* *Lyonia mariana*	 P P
Madrone	*Arbutus menziesii*	P
Maple	*Acer* spp.	P
Melaleuca	*Melaleuca quinquenervia*	P
Mulberry[3, 6]	*Morus* spp.	P

(continued)

TERRESTRIAL WEEDS CONTROLLED (continued)

COMMON NAME	SCIENTIFIC NAME	GROWTH HABIT[2]
BRUSH SPECIES (continued)		
Apply 4 to 6 pints per acre[1] (continued)		
Oak[7]	*Quercus* spp.	P
Persimmon[4]	*Diospyros virginiana*	P
Poison oak	*Rhus diversiloba*	P
Poplar	*Populus* spp.	P
Privet	*Ligustrum vulgare*	P
Red alder	*Alnus rubra*	P
Red maple	*Acer rubrum*	P
Saltcedar	*Tamarix pentandra*	P
Sassafras	*Sassafras albidum*	P
Sourwood[4]	*Oxydendrum arboreum*	P
Sweetgum	*Liquidambar styraciflua*	P
Sycamore	*Platanus occidentals*	P
Tanoak[3]	*Lithocarpus densiflorus*	P
Titi[8]	*Cyrilla racemiflora*	P
Tree of heaven	*Ailanthus altissima*	P
Vaccinium spp. Including: Blueberry Sparkleberry	 *Vaccinium* spp. *Vaccinium arboreum*	 P P
Water willow[9]	*Justicia americana*	P
Yellow poplar[3]	*Liriodendron tulipifera*	P

[1] Use higher labeled rate where heavy or well-established infestations occur.
[2] Growth Habit: A = Annual, B = Biennial, P = Perennial
[3] Use higher labeled rate.
[4] Best control with applications before formation of fall leaf color.
[5] Tank mix with glyphosate.
[6] Degree of control may be species dependent.
[7] For water oak (*Quercus nigia*) laurel oak (*Quercus laurifloria*) willow oak(*Quercus phellos*) and live oak (*Quercus virginiana*) use higher labeled rates.
[8] Suppression only.
[9] Use not permitted in California unless otherwise directed by supplemental labeling.

AQUATIC WEEDS CONTROLLED

This product may be applied for control of floating and emergent weeds (see Aquatic Weeds Controlled and Terrestrial Weeds Controlled) in or near bodies of water that may be nonflowing, flowing, or transient. This product may be applied to aquatic sites that include rivers, lakes, streams, seeps, drainage ditches, ponds, reservoirs, canals, bogs, marshes, swamps, estuaries, bays, brackish water, transitional areas between terrestrial and aquatic sites, riparian sites and seasonal wet areas. See Use Precautions and Restrictions section of this label for instructions, directions, precautions and restrictions on aquatic uses.

Read and observe the following directions if aquatic sites are present in noncrop areas and are part of the intended treatment area.

This product must be applied to the emergent foliage of the target vegetation and little to no activity on submerged aquatic weeds. Concentration of this product, resulting from direct application to water, are not expected to be of sufficient concentration nor duration to control target vegetation. Application should be made in such a way as to maximize spray interception by the target vegetation while minimizing the amount of overspray that enters the water.

This product does not control plants that have a majority of their foliage underwater or plants that are completely submerged.

Product Application: This product should be applied with helicopter or surface application equipment in a minimum of 2 gallons of water per acre. When applying by helicopter, follow directions under Aerial Application section of this label; when using surface equipment refer to the Ground Application section.

When applying this product to moving bodies of water applications should be made while traveling upstream to prevent concentration of this herbicide in water. DO NOT apply to bodies of water or portions of bodies of water where emergent and/or floating weeds do not exist.

Large Application Areas / O^2 Depletion: When application is to be made to target vegetation that covers a large percentage of surface area of impounded water, treating area in strips may avoid oxygen depletion from vegetation decay. Oxygen depletion may result in the suffocation of some sensitive aquatic organisms. If oxygen depletion is a concern, treat no more than 1/2 of the surface area of the water at a time. Wait at least 10 to 14 days between treatments. Begin treatment along the shore and proceed outward in bands to allow aquatic organisms ability to move into untreated areas.

Avoid washoff of sprayed foliage by recreational boat backwash or spray boat for 1 hour after application.

Apply this product at 2 to 6 pits per acre depending on weed density and species present. DO NOT exceed the maximum label rate of 1.5 pounds acid equivalent Imazapyr (equivalent to 6 pints) per acre per year. Use the higher labeled rate for heavy weed pressure. See Aquatic Weeds Controlled and Terrestrial Weeds Controlled sections for specific rates.

This product may be applied as a draw-down treatment in areas described in this label. Apply this product to weeds after water has been drained and allow 14 days before reintroduction of water.

AQUATIC WEEDS CONTROLLED

This product will control the following target species as specified in the Use Rates and Application Directions section of the table. Rate instructions are expressed in terms of product volume for broadcast applications and as a percent solution for directed applications including spot treatments. For percent solution applications, DO NOT apply more than 1.5 pounds acid equivalent Imazapyr (equivalent to 6 pints) per acre per year. Not for aquatic use sites in the states of Massachusetts and New York.

COMMON NAME	SCIENTIFIC NAME	USE RATES AND APPLICATION DIRECTIONS
Floating Species		
*Floating heart	*Nymphodes* spp.	2-4 pints/acre (0.5% to 1% solution) applied in 100 GPA water mix. Ensure 100% coverage of actively growing, emergent foliage.
*Frogbit	*Limnobium spongia*	1-2 pints/acre (0.5% solution) applied in 100 GPA water mix. Ensure 100% coverage of actively growing, emergent foliage.
*Spatterdock	*Nuphar luteum*	Apply a tank-mix of 2-4 pints/acre of this product + 4-6 pints/acre glyphosate (0.5% this product + 1.5% glyphosate) in 100 GPA water for best control. Ensure 100% coverage of actively growing, emergent foliage.
*Water Hyacinth	*Eichhornia crassipes*	1-2 pints/acre (0.5% solution) applied in 100 GPA water to actively growing foliage.
*Water Lettuce	*Pistia stratiotes*	1-2 pints/acre (0.5% solution) applied in 100 GPA water mix. Ensure 100% coverage of actively growing, emergent foliage.
Emerged Species		
*Alligatorweed	*Alternanthera philoxeroides*	1-4 pints/acre (0.5% solution) applied in 100 GPA water mix. Ensure 100% coverage of actively growing emergent foliage.
*Arrowhead, duck-potato	*Sagittaria* spp.	1-2 pints/acre (0.5% solution) applied in 100 GPA water mix. Ensure 100% coverage of actively growing, emergent foliage.
*Bacopa, lemon	*Bacopa* spp.	1-2 pints/acre (0.5% solution) applied in 100 GPA water mix. Ensure 100% coverage of actively growing, emergent foliage.

***Use not permitted in California unless otherwise directed by supplemental labeling.**

(continued)

AQUATIC SPECIES CONTROLLED *(continued)*

COMMON NAME	SCIENTIFIC NAME	USE RATES AND APPLICATION DIRECTIONS
Emerged Species (continued)		
*Parrot feather	*Myriophyllum aquaticum*	Foliage above water for sufficient product uptake. Apply 2-4 pints to actively growing emergent foliage.
*Pennywort	*Hydrocotyle* spp.	1-2 pints/acre (0.5% solution) applied in 100 GPA water mix. Ensure 100% coverage of actively growing, emergent foliage.
*Pickerelweed	*Pontederia cordata*	2-3 pints/acre (1% solution) applied in 100 GPA water mix. Ensure 100% coverage of actively growing, emergent foliage.
*Taro, wild; Dasheen; Elephant's Ear; Coco Yam	*Colocasia esculentum*	4-6 pints/acre (1.5% solution) applied in 100 GPA with a high quality 'sticker' adjuvant. Ensure good coverage of actively growing, emergent foliage.
*Water chestnut	*Trappa natans*	2-4 pints/acre (0.5 to 1% solution) applied in 100 GPA water mix. Ensure 100% coverage of actively growing, emergent foliage.
*Water lily	*Nymphaea odorata*	2-3 pints/acre (1% solution) applied in 100 GPA water mix. Ensure 100% coverage of actively growing, emergent foliage.
*Water primrose	*Ludwigia uruguayensis*	4-6 pints/acre (1.5% solution), ensure 100% coverage of actively growing, emergent foliage.
Terrestrial/Marginal		
*Aquatic nightshade Soda apple	*Solanum tampicense*	2 pints/acre applied to foliage
*Bamboo, Japanese	*Phyllostachys* spp.	3-4 pints/acre applied to the foliage when plant is actively growing. Before setting seed head. More foliage will result in greater herbicide uptake, resulting in greater root kill.
*Beach, vitex	*Vitex rotundifolia*	5% solution + 1% MSO foliar spray / 17% solution stem injection (hack and squirt)
Brazilian pepper; Christmasberry	*Schinus terebinthifolius*	2-4 pints/acre applied to foliage
Cattail	*Typha* spp.	2-4 pints (1% solution) applied to actively growing, green foliage after full leaf elongation. Lower rates will control cattail in the north; higher rates are needed in the south.
Chinese tallow tree	*Sapium sebiferum*	16-24 fluid ounces applied to foliage
Cogongrass	*Imperata cylindrica*	Burn foliage, till area, that fall spray 2 quarts/acre this product + MSO applied to new growth.
Cordgrass, prairie	*Spartina* spp.	4-6 pints applied to actively growing foliage
*Cutgrass	*Zizaniopsis miliacea*	4-6 pints applied to actively growing foliage
*Elephant grass; Napier grass	*Pennisetum purpureum*	3 pints/acre applied to actively growing foliage
*Flowering rush	*Butumu umbellatus* L.	2-3 pints applied to actively growing foliage
Giant reed, Wild cane	*Arundo donax*	4-6 pints/acre applied in spring to actively growing foliage
*Golden bamboo	*Phyllostachys aurea*	3-4 pints/acre applied to the foliage when plant is actively growing. Before setting seed head. More foliage will result in greater herbicide uptake, resulting in greater root kill.
Junglerice	*Echinochloa colonum*	3-4 pints applied to actively growing foliage
Knapweeds	*Centaurea species*	Russian Knapweed - 2 to 3 pints + 1 quart/acre MSO fall applied after senescence begins
Knotweed, Japanese	*Polygonum cuspidatum*	3-4 pints/acre applied postemergence to actively growing foliage

*Use not permitted in California unless otherwise directed by supplemental labeling. *(continued)*

AQUATIC SPECIES CONTROLLED *(continued)*

COMMON NAME	SCIENTIFIC NAME	USE RATES AND APPLICATION DIRECTIONS
Terrestrial/Marginal *(continued)*		
Melaleuca; Paperbark Tree	*Melaleuca quinquenervia*	**For established stands,** apply 6 pints/acre this product+ 6 pints/acre glyphosate + spray adjuvant. For best results use 4 quarts/A methylated seed oil as an adjuvant. **For ground foliar application,** uniformly apply to ensure 100% coverage. **For broadcast foliar control,** apply aerially in a minimum of two passes at 10 gallons/acre applied cross treatment. **For spot treatment,** use a 25% this product + 25% solution of + glyphosate + 1.25% MSO in water applied as a frill or stump treatment.
*Nutgrass; Kili'p'opu	*Cyperus rotundus*	2 pints this product + 1 quart/acre MSO applied early postemergence
*Nutsedge	*Cyperus* spp.	2-3 pints postemergence to foliage or pre-emergence incorporated, non-incorporated preemergence applications will not control
Phragmites; Common Reed	*Phragmites australis*	4-6 pints/acre applied to actively growing, green foliage after full leaf elongation, ensure 100% coverage. If stand has a substantial amount of old stem tissue, mow or burn, allow to regrow to approximately 5' tall before treatment. Lower rates will control phragmites in the north; higher rates are needed in the south.
*Poison Hemlock	*Conium maculatum*	2 pints this product + 1 quart/acre MSO applied preemergence to early postemergence to rosette, prior to flowering
Purple Loosestrife	*Lythrum salicaria*	1 pint/acre applied to actively growing foliage
Reed canarygrass	*Phalaris arundinacea*	3-4 pints/acre applied to actively growing foliage
Rose, swamp	*Rosa palustris*	2-3 pints/acre applied to actively growing foliage
Russian-Olive	*Elaeagnus angustifolia*	2-4 pints/acre or a 1% solution, applied to foliage
Saltcedar; Tamarisk	*Tamarix species*	Aerial apply 2 quarts this product + 0.25%v/v NIS applied to actively growing foliage during flowering. For spot spraying use 1% solution of this product + 0.25%v/v NIS and spray to wet foliage. After application wait at least two years before disturbing treated saltcedar. Earlier disturbance can reduce overall control.
Smartweed	*Polygonum* spp.	2 pints/acre applied early postemergence
Sumac	*Rhus* spp.	2-3 pints/acre applied to foliage
Swamp Morning Glory; Water Spinach; Kangkong	*Ipomoea aquatica*	1-2 pints/acre this product + 1 quart/acre MSO applied early postemergence
Torpedo Grass	*Panicum repens*	4 pints/acre (1 - 1.5% solution), ensure good coverage to actively growing foliage.
*White Top; Hoary Cress	*Cardaria draba*	1-2 pints/acre applied in spring, to foliage, during flowering.
Willow	*Salix* spp.	2-3 pints/acre of this product applied to actively growing foliage, ensure good coverage.

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STORAGE AND DISPOSAL

DO NOT contaminate water, food or feed by storage or disposal.

PESTICIDE STORAGE: DO NOT store below 10° F.

PESTICIDE DISPOSAL: Wastes resulting from the use of this product must be disposed of on site or at an approved waste disposal facility.

CONTAINER DISPOSAL:
NOTE: This product is available in multiple containers. Refer to the Net Contents section of this products labeling for the applicable "Nonrefillable" or "Refillable" designation. Follow the container disposal [handling] instructions below that apply to your container type / size.

[Nonrefillable Containers 5 Gallons or Less:] Nonrefillable container. DO NOT reuse or refill this container. Offer for recycling if available. Triple rinse container (or equivalent) promptly after emptying. **Triple rinse as follows:** Empty the remaining contents into application equipment or a mix tank and drain for 10 seconds after the flow begins to drip. Fill the container 1/4 full with water and recap. Shake for 10 seconds. Pour rinsate into application equipment or a mix tank or store rinsate for later use or disposal. Drain for 10 seconds after the flow begins to drip. Repeat this procedure two more times. Then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or by other procedures approved by State and local authorities. Plastic containers are also disposable by incineration, or, if allowed by State and local authorities, by burning. If burned stay out of smoke.

[Nonrefillable containers larger than 5 gallons:] Nonrefillable container. Do not reuse or refill this container. Offer for recycling if available. If recycling or reconditioning not available, puncture and dispose of in a sanitary landfill, or by other procedures approved by State and local authorities. Plastic containers are also disposable by incineration, or, if allowed by State and local authorities, by burning. If burned stay out of smoke. Triple rinse or pressure rinse container (or equivalent) promptly after emptying. **Triple rinse as follows:** Empty the remaining contents into application equipment or a mix tank. Fill the container ¼ full with water. Replace and tighten closures. Tip container on its side and roll it back and forth, ensuring at least one complete revolution, for 30 seconds. Stand the container on its end and tip it back and forth several times. Turn the container over onto its other end and tip it back and forth several times. Empty the rinsate into application equipment or a mix tank or store rinsate for later use or disposal. Repeat this procedure two more times. **Pressure rinse as follows:** Empty the remaining contents into application equipment or a mix tank and continue to drain for 10 seconds after the flow begins to drip. Hold container upside down over application equipment or mix tank or collect rinsate for later use or disposal. Insert pressure rinsing nozzle in the side of the container, and rinse at about 40 psi for at least 30 seconds. Drain for 10 seconds after the flow begins to drip.

[Refillable containers larger than 5 gallons:] Refillable container. Refill this container with pesticide only. DO NOT reuse this container for any other purpose. Cleaning the container before final disposal is the responsibility of the person disposing of the container. Cleaning before refilling is the responsibility of the refiller. To clean the container before final disposal, empty the remaining contents from this container into application equipment or a mix tank. Fill the container about 10% full with water. Agitate vigorously or recirculate water with the pump for two minutes. Pour or pump rinsate into application equipment or rinsate collection system. Repeat this rinsing procedure two more times. Then offer for recycling if available or puncture and dispose of in a sanitary landfill, or by incineration, or by other procedures allowed by state and local authorities If burned stay out of smoke.

WARRANTY DISCLAIMER

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