



# Spring Lake

## Integrated Aquatic Vegetation Management Plan



February 2003



King County

# *Spring Lake*

## *Integrated Aquatic Vegetation Management Plan*



Department of Natural Resources and Parks  
Water and Land Resources Division

**Lake Stewardship Program**  
**Noxious Weed Control Program**

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February 2003

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**Cover Photos:** Spring Lake ca. 1950, taken by George Adams.

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## EXECUTIVE SUMMARY

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Eurasian watermilfoil (*Myriophyllum spicatum*) is a submersed aquatic noxious weed that proliferates to form dense mats of vegetation in the littoral zone of lakes and reservoirs. It reproduces by fragmentation, and is often spread as fragments that “hitch-hike” on boat trailers from one lake to another. *M. spicatum* can degrade the ecological integrity of a water body in just a few growing seasons. Dense stands of milfoil crowd out native aquatic vegetation, which in turn alters predator-prey relationships among fish and other aquatic animals. *M. spicatum* can also reduce dissolved oxygen – first by inhibiting water mixing in areas where it grows, and then as oxygen is consumed by bacteria during decomposition of dead plant material. Decomposition of *M. spicatum* also adds nutrients to the water that could contribute to increased algal growth and related water quality problems. Further, dense mats of *M. spicatum* can increase the water temperature by absorbing sunlight, create mosquito breeding areas, and negatively affect recreational activities such as swimming, fishing, and boating.

Spring Lake, in the lower Cedar River watershed in King County, Washington, is moderately infested with *M. spicatum*. Members of the Spring Lake Community Club realized the potential gravity of the aquatic weed problem and initiated a partnership with staff from the King County Department of Natural Resources and Parks to apply for an Aquatic Weeds Management Fund grant through the Washington Department of Ecology (Ecology). If awarded, grant money will fund initial eradication efforts, including several years of follow-up survey and control. Since complete eradication is very difficult to achieve, and re-introduction is very likely, the community is organizing a management structure and the funding mechanisms necessary to implement ongoing monitoring and spot control.

Three other noxious weed species with expanding infestations at Spring Lake threaten to degrade the ecological and recreational benefits of the system as well. Fragrant water lily (*Nymphaea odorata*) and purple loosestrife (*Lythrum salicaria*) are rapidly expanding beyond a pioneering level of infestation, and yellow flag iris (*Iris pseudacorus*) is already well established around the shoreline. Immediate control measures are also needed to protect the regionally significant resource areas of Spring Lake and its Class 1 system, Lower Cedar River Wetland 28, from all four of these invasive aquatic noxious weeds.

This *Integrated Aquatic Vegetation Management Plan* (IAVMP), is a planning document developed to ensure that the applicant and the community have considered the best available information about the waterbody and the watershed prior to initiating control efforts. Members of the Spring Lake Community Club and King County staff worked in partnership to develop this IAVMP for Spring Lake. To tackle the difficult task of generating community concern and action for an environmental issue, a core group of residents formed a steering committee, which included two King County staff members. Through their work, the Steering Committee was able to educate the wider community about the problem, inspire them to contribute feedback about potential treatment options, and explore ongoing community-based funding mechanisms. The community ultimately agreed upon an integrated treatment strategy, which includes an initial chemical treatment with a systemic aquatic herbicide, followed by a combination of manual, mechanical, and cultural control methods to maintain the outcome afterwards. This plan presents lake and

watershed characteristics, details of the aquatic weed problems at Spring Lake, the process for gaining community involvement, discussion of control alternatives, and recommendations for initial and ongoing control of noxious aquatic weeds threatening Spring Lake.

## PROBLEM STATEMENT

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Spring Lake is located 6 miles East of Renton on the southern ridge of the Cedar River valley. Lakes Spring, Desire, and Shady are all within the Peterson Creek subbasin of the Cedar River Watershed. King County's Spring Lake / Lake Desire park comprises approximately 373 acres, spanning from the southeastern corner of Lake Desire to the southwest shore of Spring Lake. These lakes drain into the Cedar River and its extremely valuable salmon habitat, and provide Regionally significant wetland and aquatic habitat (King County, 1993). The park bordering Spring Lake includes a rare peat fen and a rocky knoll with montane vegetation. It is a wildlife refuge and popular hiking area. Lakes Desire, Shady, and Spring each have public boat launches and are popular boating, fishing, and swimming destinations. Residents of the Spring Lake watershed are very proud of their setting and are active recreational users. Both the Spring Lake and Lake Desire community clubs are active in social and environmental issues. Nearby Shady Lake recently created its own Lake Utility District to install sewer lines.

Due to prolific growth of several species of dense, invasive aquatic noxious weeds, Spring Lake is in danger of losing its aesthetic beauty, its wildlife habitat, and its recreational attributes. If left untreated, the worst of these weeds, Eurasian water milfoil (*Myriophyllum spicatum*), will blanket the lake in a short time, preventing most recreational uses and eliminating badly needed wildlife habitat. There will be long-term financial and recreational loss and the loss of conservation areas, all affecting watershed residents and other members of the public who use the lake. Increasing development in the area is likely to increase the number of people using the lake in coming years, which accelerates the magnitude of the loss of beneficial uses to the community.

The shallow shoreline area provides an excellent habitat for aquatic plants. In the past few years aggressive, non-native Eurasian water milfoil (milfoil) has invaded the lake and is colonizing much of the near-shore aquatic habitat. The dense submersed growth of milfoil has begun to cause a significant deterioration in the quality of the lake and its value to the community. The boat launch area has dense patches of milfoil, which can spread to other lakes by fragments on boat trailers. Lake Desire and Shady Lake are threatened with new introductions if milfoil if Spring Lake is not controlled because of the high probability of transport by boat trailers to these nearby systems.

Milfoil is the most significant submersed invasive threat but other noxious weeds have also invaded Spring Lake. These include fragrant water lily (*Nymphaea odorata*), purple loosestrife (*Lythrum salicaria*), and yellow flag iris (*Iris pseudacorus*). All of these species are considered noxious weeds as listed in WAC 16-750. None of the native aquatic plants in the system are a management issue at this time. The native plants

provide important benefits to the aquatic system and are not impeding any of the recreational uses of the lake. Removing the noxious invaders will halt the degradation of the system and allow the dynamic natural equilibrium to be maintained.

Unfortunately, these invasive plants concentrate in the near shore zone which is also that portion of the lake that is valued and utilized most by lake residents and visitors. Dense weed growth poses a threat to swimmers, and the portion of the lake where people can fish is shrinking. Both milfoil and fragrant water lilies foul fishing gear, motors, and oars. It is no longer possible to troll through large portions of the lake.

As a group 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 as well as degrading wildlife and wildlife viewing opportunities
- Pose a threat to adjoining ecosystems

The Spring Lake community has documented three decades of neighborhood funded efforts to control invasive weeds. They have not been able to meet the current challenge of controlling such widespread infestations or of preventing re-infestation. Immediate action is necessary to control Eurasian water milfoil and other invasive weeds. If left unchecked, the lake will soon become heavily infested with aquatic weeds, severely degrading the lake ecosystem and making them even harder to eradicate. The community recognizes that after initial control efforts, opportunity for re-infestation must be prevented.

## **MANAGEMENT GOALS**

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The overarching management goal is to control noxious aquatic weeds in Spring Lake in a manner that allows sustainable native plant and animal communities to thrive, maintains acceptable water quality conditions, and facilitates recreational enjoyment of the lake.

There are four main strategies to ensure success in meeting this goal:

1. Involve the community in each phase of management process;
2. Use the best available science to identify and understand likely effects of management actions on aquatic and terrestrial ecosystems prior to implementation;
3. Review the effectiveness of management actions;
4. Adjust the management strategy as necessary to achieve the overall goal.

Specific details related to the implementation of management objectives are covered in subsequent sections of this plan.

## **COMMUNITY INVOLVEMENT**

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From the very beginning, members of the Spring Lake community have demonstrated their commitment to improving their community and protecting the lake as well as the expansive natural areas around their homes. This section provides an overview of past, present, and future of community involvement.

### **Community History**

Albert Spring purchased a logged Weyerhaeuser parcel that surrounded the lake, renamed the natural lake from Otter Lake to Spring Lake, and in 1949 began selling the Spring Lake Community. The first year-round residents settled in the early 1950s, and today there are 110 residences on the lake, 245 within its watershed.

From their earliest days, members of the Spring Lake community have worked together to promote common goals, including the health of the lake. During the 1960s the Spring Lake Community Club formed to petition the Washington State Utilities and Transportation Commission for improved telephone service.

One of the Club's largest challenges came in the 1960s, when they fought development plans that included dredging the wetlands to build nine hundred home sites with golf course and pools, as well as a 500-acre mall. Spring Lake residents initiated that legal battle which ended with SEC injunctions against the development firm.

In 1978 lakefront property owners contracted with A & T Weed Service of Tacoma for control of noxious aquatic weeds. In the late 1980s Spring Lake residents were active in petitioning for inclusion of the south shore in King County's Open Space purchases. They also collected neighborhood recycling to document and demonstrate need for county pick-up. In 1989 lakefront property owners hired Allied Aquatics of Washington, Inc. to manage further aquatic plant problems. In both of the prior aquatic weed control efforts, Eurasian watermilfoil was the targeted species.

The membership of today's Spring Lake Community Club reflects the strength of new perspectives and energies. As properties change hands, and the last developable lots sprout homes, new families on the lake join children and grandchildren of the original owners. All share a love of this unique ecosystem, and are committed to honor and perpetuate the legacy of good stewardship.

### **Community commitment**

Throughout its history, the Spring Lake community has demonstrated its commitment to preserving the health and recreational quality of the lake. As mentioned above, available records show the community has funded milfoil removal projects on Spring Lake at least

two times in the past (See Appendix A). Families living around the lake paid for those efforts. Today's active Spring Lake Community Club works to unite the neighborhood and inform residents of environmental and safety hazards regarding the lake.

Examples of issues discussed by the Community Club in recent years include:

- The impact of letting purple loosestrife (*Lythrum salicaria*) continue to grow
- How to eradicate purple loosestrife
- What to do about yellow iris (*Iris pseudacorus*)
- How phosphates and other nonpoint source runoff affects water quality
- Problems posed by fragrant water lilies (*Nymphaea odorata*)

Community members have participated in King County's Volunteer Lake Monitoring program since its inception. Currently, three members of the Community Club are volunteer monitors participating in the King County Lake Stewardship program. Lake Stewardship program volunteers monitor lake level and precipitation daily, Secchi transparency, water temperature, algae and bird observations weekly, and collect water samples every other week from April through October. Water samples are analyzed for total phosphorus, total nitrogen, chlorophyll *a* (an analog for phytoplankton concentration) and concentrations of phytoplankton species. Volunteer data are published each year in reports produced by the King County Lake Stewardship program.

In the spring of 2001, the Spring Lake Community Club responded to the over population of Canada geese on the lake. There were 32 resident Canada geese on the 69-acre lake, causing approximately 96 pounds of waste per day to be deposited in and around the lakeshore (Seattle Parks & Recreation, 2002). Out of concern for the health of the lake, the Washington State Department of Fish & Wildlife was contacted. Details of the operation to remove the geese were discussed at a community club meeting and funding was approved. Coordination among shoreline owners resulted in the capture of 27 geese and their removal from the Spring Lake area. The goose population has not returned, except for brief stays, and no further removal has been necessary to date.

The community regularly organizes work parties to control purple loosestrife and yellow iris. The lake community has a history of homes staying within family ownership, and of children returning to build or purchase a house near the one in which they grew up. This is further evidence of the community's intent to preserve the integrity of the unique Spring Lake ecosystem for generations to come. Based on past involvement, and the legacy of families staying within the community, it is anticipated that shoreline residents will be willing to contribute directly to lake-related maintenance activities.

If a new infestation of milfoil or other noxious weeds develops after the anticipated control work, the Community Club will act as a forum to determine what further work needs to be done and how to fund it. Annual dues and assessments have been used in the past and no one has objected to the idea of community based funding. If it became a major issue (i.e., very costly), the Community Club would explore taking steps to form a

Lake Management District to ensure further support for ongoing water quality maintenance and aquatic weed control efforts at Spring Lake.

The success of noxious weed control efforts at Spring Lake rely, in the long run, on providing a funding mechanism for monitoring the success of control measures, surveying for noxious weed species each year, and responding to new infestations quickly to maintain a weed-free lake. The Spring Lake Community Club is exploring ways to provide maintenance funding in perpetuity. Community members are currently discussing several funding ideas. The best long-term solution will inevitably utilize multiple mechanisms. Possible strategies include:

1. Using a portion of the club treasury (\$800) to start an endowment. Continued contribution to the endowment could be supported by a \$10 - \$15 increase in annual Community club dues. The endowment and dues would be dedicated to creating a Noxious Weed Management Fund. Based on current club membership, this would result in a \$3800 fund to initiate eradication maintenance after five years, and return approximately \$600 per year thereafter.
2. Lake Management District formation. Forming an LMD would levy a “tax” on all property owners within the watershed. The tax paid by each property owner would be determined by the size of the property and proximity to the lake. Funds collected would be used to address specific problems at the lake. In order to form an LMD, watershed property owners need to vote to approve it, and the governing agency (King County) needs to adopt an ordinance recognizing the fee collection structure, problems to be addressed, and the methods by which problems will be addressed.
3. A donation-based fund. This would involve collecting money through fundraising activities, as well as door to door campaigning. Although less consistent, this type of activity is expected to work because of the stability of the neighborhood. Many people are second generation residents and have actively participated in protecting the local environment.
4. Volunteer maintenance: Train residents to perform the monitoring and removal efforts. There are 10 certified divers on the lake. Funds would be collected by the Community Club to purchase necessary equipment and obtain training to conduct the milfoil removal operations by volunteers after the grant funds expire. Currently, lake residents perform invasive weed control efforts voluntarily on the emergent plants at Spring Lake.

### **Steering Committee, outreach, and education process**

Community participation has been an integral part of the development of the Spring Lake IAVMP. Community involvement educates community members about the potential problems posed by noxious aquatic weeds. Since watershed residents were given ample opportunity to comment throughout the process, there should be greater community support for implementation efforts. Documents used to guide the outreach and education process are contained in Appendix B. Meeting agendas, attendance lists, and meeting

notes are contained in a separate document entitled *Spring Lake Public Involvement and Meeting Summaries*.

The remainder of this section provides a chronological overview of the community involvement process from the first discussions through the completion of the IAVMP.

**Early Discussion:** Explored potential for King County-Spring Lake partnership

Ted Barnes, current president of the Spring Lake Community Club contacted King County Department of Natural Resources and Parks (KC DNRP) Lake Stewardship Program staff in the fall 2001. Ted wanted to apply to the Washington State Department of Ecology (Ecology) Aquatic Weed Management Fund for money to help with Spring Lake weed control efforts in summer of 2002. Given the amount of work required to develop an IAVMP, which is necessary prior to application, Ted Barnes and King County staff decided to resume the discussion in spring 2002 to work toward a grant application to Ecology in fall 2002.

**June 2002:** First meeting with Spring Lake Community Club

Ted Barnes invited King County Lake Stewardship Program and King County Noxious Weed Control Program staff to a Spring Lake Community Club meeting on June 27, 2002. Ted Barnes and King County staff discussed the process by which the community could work with King County to submit an application for funds to control noxious aquatic weeds in Spring Lake. Ted emailed all members of the Community Club and made phone calls to recruit as many members as possible. Twenty-seven people attended the meeting. The primary purpose was to discuss the problem with Eurasian watermilfoil and other aquatic noxious weeds and to learn about the application/ IAVMP development process. A second motive was to assess community interest in moving forward. That evening 12 residents committed themselves to continued involvement in the project through working as a Steering Committee.

**July 2002:** Project planning begins, Steering Committee meets, begins IAVMP development

KC DNRP staff developed drafts of a project timeline and education and outreach plan (See Appendix B), and began to research necessary components of the IAVMP.

July 17 was the first meeting for the potential Steering Committee members. The primary goal was to formally approve the project Steering Committee, outline necessary tasks for the grant application process, and assign tasks to each Steering Committee member. At this meeting, attendees formally recognized themselves as a Steering Committee to guide the application process, and steering committee members reviewed and approved the proposed IAVMP/grant application timeline and an outreach plan. Tasks were assigned.

**August 2002:** Steering committee continues IAVMP work, hosts first watershed-wide meeting

In August, steering committee members continued work on the IAVMP and prepared for the first watershed-wide public meeting on August 22. Much of the committee's work occurred in meetings, although email exchanges were also productive. Key achievements in August included a flyer sent to all watershed residents asking them to attend a watershed-wide community meeting; continued work on the draft problem statement; Steering Committee review of available treatment options (adapted from Ecology's website); and community "canvassing" to inform people about the August 22 meeting.

Thirty-eight people attended the Watershed-wide public meeting on August 22. Most in attendance were watershed residents, although there was also a representative from the Cedar River Council. Scientists from the Washington Department of Fish and Wildlife (WDFW), the U.S. Fish and Wildlife Service, and the Department of Ecology were invited to the meeting, but could not attend. King County Council member David Irons was also invited, but did not attend.

At the August 22 meeting, steering committee members presented the problems posed by noxious aquatic weeds, a detailed description of Eurasian watermilfoil and the three other noxious weeds, and reviewed all possible treatment options. In general, community members agreed there was a problem and that the project should continue. Further details of public comment are provided in the Public comment section later in this document.

**September 2002:** Additional IAVMP work. 2<sup>nd</sup> Watershed-wide meeting, letter of support circulated

The steering committee continued to research elements of the IAVMP and reach out to community members through phone calls, emails, and personal communications. At a meeting on September 10, the steering committee reviewed comments and content of the August 22 public meeting and all agreed that the wider community expressed agreement that milfoil posed a threat and that action should be taken to eradicate it. Tricia Shoblom from the Washington State Department of Ecology attended the meeting to offer her expertise and provide feedback as to the progress the community had made thus far.

At the September 10<sup>th</sup> meeting the steering committee developed a control strategy to present to the wider community at the second watershed-wide meeting to be held on September 19. Staff at King County distributed a flyer to all watershed residents to announce the September 19 Watershed-wide meeting.

About 50 community members attended the September 19 watershed-wide public meeting. At that meeting, steering committee members reviewed the problem of noxious aquatic weeds, the results of the steering committee's work, and the process ahead. King County Staff detailed the proposed treatment strategy and cost estimates. After the formal presentation, there was general agreement among all that milfoil and the other noxious weeds present a threat to the lake, and treatment must be a priority. There was discussion about which costs the community would cover and how to raise money to cover those costs. Further details of the public comment are provided below.

At the end of the meeting Steering Committee members read a copy of the Letter of Support and circulated it amongst community members for their signatures. Several people took copies of the letter and signature sheets so that others unable to attend the meeting could sign the letter.

### **October 2002, Continued IAVMP work, circulation of Letter of Support**

Steering committee members and King County staff continued to work on the IAVMP. Spring Lake Residents continued to circulate the letter of support among their neighbors.

The final draft of the IAVMP was issued to Ecology on October 18, and the grant application was mailed to Ecology on October 29.

### **Public comment**

At each of the watershed-wide public meetings, presenters encouraged attendees to ask questions and offer comments.

At the first Watershed-wide meeting on August 22, most comments supported acting as quickly as possible to control weeds in the lake. There were questions about the effectiveness of various treatment options presented. Several comments expressed concern that the community members would need to “foot the bill” for control costs. Steering Committee members addressed concerns when possible, and if answers were not readily apparent, offered to do more research and report back at the September 19 public meeting.

After the presentation of the proposed milfoil control strategy at the September 19 public meeting, Steering Committee members encouraged discussion about the plan. There was general agreement among all present that the proposed management plan made sense, and that managing milfoil would be a community priority. There were several questions about community-based funding mechanisms. Michael Murphy, King County staff member on the steering committee, explained the concept of a Lake Management District to the audience. Another Steering Committee member offered the idea of purchasing a bond, so earned interest could be used for ongoing lake management. Ted Barnes, Spring Lake Community Club President, proposed the concept of setting aside one third (\$800) of the current treasury and increasing Club dues by \$10 (attendees suggested more) annually and using the extra revenue to fund lake management. While meeting attendees did not reach an agreement on a single community-based fund-raising strategy, all were in agreement that the community should cover costs of ongoing weed management after initial control efforts.

At the meeting in September, Steering Committee members presented anonymous comment forms, in case any community members wanted to offer comments that might be construed as “unpopular” among those present at the meeting. No one offered any anonymous comments. Complete notes from all steering committee meetings and watershed-wide public meetings are in a separate document entitled *Spring Lake Public Involvement and Meeting Summaries*.

## **Public consensus**

Members of the steering committee drafted a “Letter of Support” that members of the community could sign to demonstrate their support of the proposed milfoil control strategy while recognizing its potential cost. To date, there have been no objections to the proposed project or for the proposed methods of treatment. Every person who has learned about the project has voiced support.

Given the community’s small size, and their dedication and enthusiasm for keeping Spring Lake healthy, none of the steering committee members anticipate resistance to the proposed project prior to, during, or after implementation. The letter of support and copies of the signature sheets are in Appendix C.

## **Continuing Community Education**

The Spring Lake Community Club will offer the means by which the community will organize ongoing education. In addition, the Steering Committee for the proposed aquatic weed removal project will remain intact, although membership on the steering committee is likely to change over time.

To ensure that community efforts are consistent with best available science and water quality standards, the community club will designate a point of contact liaison within the KC Dept of Natural Resources and Parks. Information will be disseminated through community club meetings, watershed mailings when applicable, and revival of the community club newsletter. A liaison with school and youth organizations will also be designated. Additionally, the community club will work to recruit new lake monitors and surveyors. A community website was developed in September 2002: (<http://www.springlakeclub.com>). All of the documents and PowerPoint presentations generated by the Watershed-wide and Steering Committee meetings are available for download. Links are provided to the websites for the Washington State Department of Ecology, the King County Noxious Weed Control Program, and the King County Department of Natural Resources and Parks to learn more about aquatic noxious weeds and other natural resource management issues.

The public education program for Spring Lake will consist of two elements that will be implemented concurrently:

### **1. Noxious Aquatic Weeds Prevention and Detection**

Initial eradication and control efforts are only worth doing if future infestations are prevented, or detected and eliminated soon after detection. Since the re-introduction of milfoil and other weeds to Spring Lake is almost certain, a prevention and detection plan is essential. There are three main elements to the prevention and detection plan:

- a) Annual distribution of educational materials. Steering Committee members will compile published materials and generate literature specifically related to Spring Lake to distribute to all watershed residents each year at the beginning of the growing season.

- b) Annual aquatic plant identification workshops. Workshops each spring will cover native plants as well as noxious aquatic weeds. Samples of our target weeds will be collected and pressed in Year 1 as a permanent reference and education tool for the community. All watershed residents and lake-users will be invited and encouraged to attend. The lakefront residents at Lake Desire, Shady Lake and other nearby waterbodies might also be invited to expand the educational effort beyond Spring Lake. Aquatic plant experts could be invited from Ecology, the King County Noxious Weed Control Program, or other applicable agencies. A better-educated community of residents and lake-users will be more likely to identify and report noxious aquatic weeds and other potential problems.
- c) Two aquatic weed surveys each growing season. Volunteers (community members) will undergo training with lakes/aquatic plant specialists prior to conducting surveys. There are at least 10 certified divers living on the lake, several of whom have been active in developing the IAVMP and project proposal. Divers will be trained to survey the lake bottom to complement visual surveys from the surface and to take samples for identification.

## **2. Lake Stewardship Education Program**

All residents in the watershed affect Spring Lake, although sometimes the cause and effect relationships are not readily apparent. Hopefully educating community members and other lake users will illuminate the relationship between human behaviors and water quality. Each watershed resident will be provided information on how to reduce the amount of pollutants entering the lake from their property. Property owners with lakeside lots will be provided information on lake-friendly landscaping, subsequently ensuring a healthier lake environment.

Improved signs will be posted at the boat ramp to inform lake-users of the problems caused by noxious aquatic weeds and how to prevent spreading them from lake to lake. The Steering Committee has generated some ideas for signage related to the transport of milfoil by boats and trailers. If the signs posted at the boat launch included step by step directions on how to properly clean boats and trailers, and why it is important, lake-users may be more apt to do the right thing. Obvious problems for boat cleaning involve questions of where it can be done and the right equipment to do the job. The boat launch at Spring Lake does not have any tools to perform this cleaning, which is similar to most other lakes in the area. Any adhering pollutants that are washed off by a diligent boat owner at the launch site will probably end up in the lake since there is no facility to collect the gray water. The Steering Committee has discussed the option of installing a Cleaning Station at the Spring Lake boat launch with a hose, handpump, and a catchment and drain to encourage the proper cleaning of boats and trailers. The handpump would hopefully discourage using the station for cleaning cars or other inappropriate uses. Spring Lake may pursue these issues with the Washington Department of Fish and Wildlife, which has just begun a pilot program to address these concerns.

# WATERSHED AND WATERBODY CHARACTERISTICS

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## Watershed Characteristics

Spring (Otter) Lake's watershed is located in south-central King County, Washington in an unincorporated area located 6 miles east of Renton and 3.5 miles northwest of Maple Valley. State resource agencies frequently use a system of Water Resource Inventory Areas (WRIA) to refer to the state's major watershed basins. Spring Lake is located in WRIA 8, which refers to the Cedar-Sammamish combination watershed and includes Lake Washington, Lake Sammamish, and most of the City of Seattle.

The Spring Lake watershed constitutes approximately 450 acres (11%) of the Peterson Creek Sub-basin of the Lower Cedar River watershed. The Peterson Creek Sub-basin is 4043 acres and receives a mean annual rainfall of 44.4 in., with a water yield of 47.5% (or 21.1 in.). The Spring Lake watershed receives drainage from the steeply sloping areas surrounding the lake on the west, north and east sides. There are two small peaks to the northwest, one of which is referred to as Echo Mountain that rises more than 860 feet above sea level. There is a ridge on the eastside of Spring Lake that quickly rises 150 feet to peak at 620 feet along 196<sup>th</sup> Ave. SE. The remaining land, to the southwest of the lake, is a large wetland at the elevation of the lake (490 feet). The Spring Lake watershed is located on a plateau above the Cedar River in an area of an unusually high density of lakes. Within 2 mi<sup>2</sup> are Lake Desire (57 acres), Shady Lake (19 acres) and Peterson Lake (4 acres), all within the Peterson Creek Sub-basin. Shadow Lake (56 acres) and Lake Youngs (685 acres) are close by to the south. Lake Youngs is not open to the public because it is part of the City of Seattle Municipal Water Supply.

According to the Soil Survey for King County Area, Washington, the soils in the Spring Lake watershed are composed of five major soil series (U.S. Department of Agriculture, 1973). The primary soil series are Alderwood gravelly sandy loam in both 6-15% slopes (AgC) and 15-30% slopes (AgD). There is one small section of Norma sandy loam (No) on the northeast edge of the watershed along 196<sup>th</sup> Ave. SE. The large wetland area southwest of Spring Lake (LCR 28) is composed of Orcas peat (Or) in the north associated with the fen, and Seattle muck (Sk) to the south and on both sides of the outlet (Tributary 0328). The Alderwood soil association are moderately well drained, undulating to hilly soils that have dense, very slowly permeable glacial till at a depth of 20 to 40 inches. It is found in uplands and terraces. Its hydrologic properties differ dramatically from the underlying parent material. Compaction or removal of these soils during the typical urban or suburban development result in commensurately large hydrologic effects (King County, 1993). There is a significant area of recessional outwash mapped around Spring Lake (except on the east side), with all the surrounding area composed primarily of till. The recessional outwash area is largest in the southwest (LCR 28) and down along Tributary 0328 on both sides of Peterson Lake. This outwash corresponds directly with mapped areas of high groundwater recharge in the midst of the large area of low recharge that occurs on the till. Recharge occurs when the water level in a wetland is higher than the water table of its surroundings, and groundwater flows out of the wetland (Mitsch & Gosselink, 1993).

The Peterson Creek Sub-basin tributaries drain approximately 6.3 mi<sup>2</sup>, including Spring Lake and Lake Desire. Over half the area is classified as forested, with another quarter of the land use as low-density residential, and 9% of the sub-basin classified as wetland. While this sub-basin is among the largest in the Cedar River Basin, it is also one of the least developed. Data from 1981 detailed land use within the Spring Lake watershed as follows: 8% residential-suburban, 77% forest or “unproductive”, and 15% lake surface when there were 44 nearshore homes (70% of the shoreline in residential development) (Sumioka & Dion, 1985). There are now 76 nearshore homes, which indicates that single family high-density land use has continued to increase on the west side of the lake. Future land use plans include a single family, medium density area stretching along the eastside of the lake, west of 196<sup>th</sup> Ave. SE (King County, 1993). A 373-acre King County Park (Lake Desire/Spring Lake Park) occupies the remaining 30% of the shoreline in the southwest and around the outlet stream. The park supports only passive recreational uses on a small trail system through forest and adjacent to large wetland areas, and includes regionally valuable habitats like the rare plant communities found on the rocky bald of Echo Mt. and the large fen with its *Sphagnum* plant communities. The park is part of almost 1000 acres of contiguous parcels owned by King County, much of which is preserved as open space. In light of the habitat fragmentation that has degraded forest and wetland resources in the region, these tracts provide regionally significant wildlife corridors and habitat (King County, 1993).

Tributary 0328 drains Spring Lake from its southern tip, and joins Tributary 0328B which drains Lake Desire immediately to the west. Spring Lake and Lake Desire’s outlets join above Peterson Lake about 0.3 stream miles downstream from the outlet of Spring Lake. They flow southeast together as Tributary 0328 another 0.7 stream miles to Peterson Lake, and enter the Cedar River as Peterson Creek 1.6 stream miles downstream from an ecology-block weir that controls Peterson Lake’s level. Both of these larger tributary channels are largely contained in a large Class 1 wetland system (LCR 28) that dominates much of the valley area downstream of Spring Lake. The surrounding wetlands and a lack of development protects the stream habitat in this reach. The banks of the stream are densely vegetated, mostly with deciduous woody plants, with low gradient channels that are dominated by silt. There is abundant coarse woody debris (CWD) that contributes to habitat complexity.

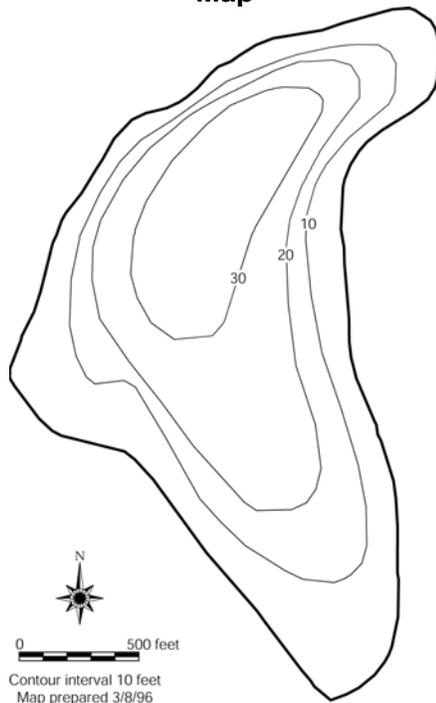
There is a significant amount of shoreline that remains relatively undeveloped at Spring Lake, including the large wetland system in the southwest (King County, 1993). This undoubtedly limits the nonpoint source nutrients reaching the lake. This entire sub-basin benefits from the moderating effects of its many wetlands and lakes, which act as detention ponds to reduce runoff “pulses.” However, as the number of nearshore houses has increased around Spring Lake, so has the clearing of buffering native vegetation along the shoreline to provide landscaping or to enhance lake access and views. Nonetheless, many of the residential properties have maintained a buffer strip, which helps to filter out nutrients and pollutants before they enter the lake, as well as providing habitat. The public boat launch area is the only point where a road actually reaches the water. Spring Lake Drive, which provides access to all of the homes on the lake, is set several hundred feet away from the water on the other side of the homes. The runoff from the road filters through the lakeside properties. An important source of nonpoint-source

pollution includes septic system failures, and Spring Lake has a reported failure rate of 11.5% from its 78 systems (King County, 1993). The average age for a repaired system is 20 years and non-repaired is 14 years, both of which are above the regional average. Two livestock-keeping locations were mapped in the Spring Lake watershed as of 1992. These locations are widely spaced within the watershed, include very small numbers of livestock, and are situated far from the lake. These two locations are unlikely to contribute significantly to the nonpoint nutrient source load for Spring Lake.

## Waterbody Characteristics

Spring Lake is a 68-acre lake located in the southern half of its watershed in south central King County. The lake has a mean depth of 19 feet and a maximum depth of 32 feet, with an estimated lake volume of 1,300 acre-ft. Spring Lake has 7695 ft. (1.45 mi.) of shoreline with a shoreline configuration value of 1.3. There are no surface inflows to Spring Lake, with outflow into Tributary 0328 occurring year round into the natural outlet channel with no manmade flood control structures. There is public boat access to the lake provided by a boat launch owned by the Washington Department of Fish & Wildlife (WDFW) located on the north edge of the King County Park. Spring Lake flushes an estimated 136 % of its volume annually. This number was calculated by multiplying the average annual rainfall (3.67 ft) by the watershed area (480 acres), then dividing by the estimated lake volume (1300 acre-feet). This value is an overestimate, as it does not account for water lost to evapotranspiration within the watershed.

**Figure 1: Spring Lake Bathymetric Map**



Lower Cedar River wetland 28 (LCR 28), adjacent to Spring Lake, is an 83-acre Class 1 system located within the 373 acre King County Park. Inventoried wetlands are rated from 1-3 according to specific criteria in the King County Sensitive Areas Ordinance. The wetland rating system is based on size, vegetative complexity, and the presence of threatened or endangered species. LCR 28 includes a large (69-acre), extraordinarily high quality *Sphagnum*/Labrador tea fen and hemlock swamp at the southeast shore of the lake. The primary productivity of peat wetlands is low although peat accumulations may be significant (Mitsch & Gosselink, 1993). Plants in these systems have evolved unique mechanisms to cope with a number of harsh growing conditions, including elevated bog/fen mat temperatures in summer, acidic

conditions, low nutrients and low oxygen supply to their roots. LCR 28 contains the plant species common to western Washington peatlands: *Sphagnum* and *Hypnum* mosses, Labrador tea (*Rhododendron groenlandicum*), bog laurel (*Kalmia microphylla*), bog cranberry (*Vaccinium oxycoccus*), sundew (*Drosera rotundifolia*), and hemlock (*Tsuga heterophylla*). The fen also contains unusually high densities of mature lodgepole pine (*Pinus contorta* var. *latifolia*) for this side of the Cascades (King County, 1993). Depth of the peat deposits indicate the wetland is more than 10,000 years old (Rigg, 1958). The National Wetlands Inventory found five wetland and deepwater habitat classifications associated with LCR 28 (Cowardin et. al., 1979). Four wetland habitats were classified: palustrine emergent, seasonally flooded (PEMC), palustrine forested, needle-leaved evergreen, temporarily flooded (PFO4A), palustrine scrub-shrub, temporarily flooded (PSSA), and palustrine forested, seasonally flooded (PFOC). Palustrine systems generally include all non-tidal wetlands dominated by trees, shrubs, emergents, mosses, or lichens. Seasonally flooded systems have surface water present for extended periods during the early growing season, but this water is usually absent by the end of the growing season in most years. Whereas temporarily flooded systems have surface water present for only brief periods during the growing season, but the water table usually lies well below the surface. There is also a deepwater habitat classified as lacustrine limnetic, unconsolidated bottom, permanently flooded (L1UBH). This lacustrine system is associated with Spring Lake proper.

Since almost half of the shoreline is undeveloped (as of 1993), LCR 28 is in better condition than any other wetlands within the Basin Planning Area. "Indeed it is arguably the most pristine wetland in the Surface Water Management service area" (King County, 1993). Small foot trails and a campsite were degrading the quality of the hemlock swamp, and use has now been officially discouraged by camouflaging the trailhead and posting signs asking that visitors stay out of the wetland. A small portion of the *Sphagnum* mat near the lake outlet at stream mile 2.7 is disintegrating and becoming colonized by acid-neutral species such as soft rush and sedges (King County, 1993). Both LCR 28 and Spring Lake are considered regionally significant resource areas. This is a designation used in King County Basin Plans to indicate areas that contribute to the resource base of the entire southern Puget Sound region by virtue of exceptional species and habitat diversity and abundance, when compared to aquatic and terrestrial systems of similar size and structure elsewhere in the region (King County, 1993). The sediments in Spring Lake are mainly loose and unconsolidated, with high silt and organic components. Some areas are very flocculent, especially in the undeveloped south end of the lake. The majority of the residential parcels also have loose sediment away from the shoreline. A few residents have added gravel to shallow areas.

While part of LCR 28's immediate subcatchment is protected as open space, the wetland was platted before the Sensitive Areas Ordinance (SAO) came into effect. This means that large areas of the wetland might be cleared and filled for homesites, roads, and utility lines under the reasonable use provisions of the SAO. Since fen plant communities are especially fragile, this wetland is especially vulnerable to impacts from future development. Portions of the lake shoreline are slated for build-out at densities that will increase from single- to medium-density, single-family residential development.

Continued *Sphagnum* disintegration could lead to an undesirable release of nutrients into the lake and possibly to irreversible invasion of the fen by hardhack spiraea and cattails.

## **Water Quality**

Since 1985, King County residents have participated in a volunteer monitoring program to create a long-term record of water quality for the region's small lakes. The volunteers from Spring Lake have contributed samples starting with the very first year (1985) of the program (King County, 2001). The data record for Spring Lake is largely complete with data missing for only one year, 1995. Prior to this time, the former Municipality of Metropolitan Seattle (METRO) performed annual lake monitoring in the time periods 1971-1972 and 1974-1977.

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 concentrations of algae are considered oligotrophic, lakes with high concentrations of algae 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. Lakes may be naturally eutrophic, mesotrophic, or oligotrophic based on the inherent character and stability of the surrounding watershed. Eutrophication or the increase in a lake's biological activity over time is a process that occurs naturally in some lakes and may be accelerated in others by human activities.

For Spring Lake, productivity is mesotrophic (moderate), characterized by moderate water clarity and chlorophyll *a* values, and low to moderate phosphorous levels. Data from the 16-year record from 1985 to 2000 are summarized in Table 1, taken from King County Lake Water Quality: A Trend Report on King County Small Lakes (November 2001)

**Table 1. Average Values for Select Trophic Parameters at Spring Lake**

Year	No. of Samples	Secchi (meter)	Chl <i>a</i> * (µg/L)	TP* (µg/L)	TSI* Secchi	TSI* Chl <i>a</i>	TSI* TP	TSI* Average
1985	11	2.7	3.5	14	46	43	42	44
1986	8	2.5	3.1	13	47	42	41	43
1987	11	2.8	3.0	13	45	41	42	43
1988	10	2.9	3.2	14	44	42	42	43
1989	10	3.0	3.0	13	44	41	41	42
1990	11	2.5	2.5	11	47	39	39	42
1991	11	2.3	3.8	16	48	44	44	45
1992	10	2.6	2.9	14	46	41	42	43
1993	10	2.5	4.7	19	47	46	46	46
1994	11	3.3	6.6	21	43	49	48	47
1995	---	---	---	---	---	---	---	---
1996	12	2.5	3.5	15	47	43	43	44
1997	12	2.1	4.4	16	49	45	44	46
1998	13	2.9	3.9	13	45	44	41	43
1999	13	2.7	4.6	10	46	46	37	43
2000	13	2.6	4.2	10	46	45	38	43

\*Chl *a* = chlorophyll *a*, TP = total phosphorus, and TSI = Trophic State Index

**Summary of water quality characteristics**

- water clarity (Secchi depth) ranged from 2.1 – 3.3 meters (May-October average)
- total phosphorous ranged from 10 – 21 µg/L (May-October average)
- Chlorophyll *a* ranged from 2.9 – 6.6 µg/L (May-October average), but most years were below 4.0
- TSI Secchi ranged from 43 – 49
- TSI Chl *a* ranged from 39 – 49

- TSI TP ranged from 37 – 48
- TSI annual average 43 – 47

Trend analysis (using the non-parametric Mann-Kendall's test for trend at the 95% confidence interval) was performed on the water quality data sets to evaluate whether statistically significant changes have occurred at Spring Lake (King County, 2001). A significant upward trend was noted for chlorophyll *a* (n=15; p=0.05, slope=0.098) suggesting a slight increase in algal levels has occurred at Spring Lake between 1985 and 2000. Overall, water quality at Spring Lake is good and is certainly influenced by a large wetland (LCR 28) to the southwest of the lake. Groundwater also plays an important role in maintaining good lake water quality. Long-term, local stewardship by lake residents remains important to ensure ongoing erosion and nutrient control measures take place as land is developed in the watershed or local shoreline alteration occurs.

## Fish and Wildlife Communities

Spring Lake and its surrounding habitats support a variety of fish, birds, and animals by providing nesting, forage, and cover. According to Washington Department of Fish and Wildlife (WDFW) the resident fish species in Spring Lake include rainbow trout (*Oncorhynchus gairdneri*), yellow perch (*Perca flavescens*), largemouth bass (*Micropterus salmoides*), pumpkinseed (*Lepomis gibbosus*), and brown bullhead (*Ictalurus nebulosus*) (Congleton et. al., 1977). Black crappie (*Pomoxis nigromaculatus*) has also been caught recently by a resident (K. Heikell, pers. comm.)

Spring Lake is managed as a mixed species fishery (C. Jackson, pers. comm.). Mixed species means that the WDFW manages for both warmwater (bass and sunfish) and coldwater (trout) angling opportunities. Warmwater species are self-maintaining, whereas coldwater species are augmented through annual stocking. Spring Lake has been planted with catchable trout (8-10" in length) since 1956. On average, Spring Lake receives about 4,500 rainbow trout, but plants have been as low as 3,000 and as high as 7,000. Stocking differences are attributed to annual variability in hatchery production.

Spring Lake is open all year to recreational angling and according to residents and WDFW, usually hosts several anglers per day between late March through October. However, most of the visits occur in early spring when the lake is stocked. Spring Lake falls under the General Statewide Regulations for limits and size restrictions set by WDFW.

A Limiting Factors Analysis for WRIA 8 found Coho salmon (*Oncorhynchus kisutch*) in Tributary 0328 as far up as the confluence with Tributary 0328B (stream mile 2.4), the outlet stream for Lake Desire (D. O'Connor, pers. comm.). Coho were present in Tributary 0328 up to the plateau that is below Spring Lake (King County, 1993). The section of Peterson Creek below Peterson Lake (stream mile 1.6-0.0) is used by all species of anadromous salmonids indigenous to the Cedar River Basin, which includes Coho, Sockeye (*Oncorhynchus nerka*), and fall Chinook (*Oncorhynchus tshawytscha*).

The residents of Spring Lake generated a list (Table 2) that includes 69 species of birds seen around the lake in casual observation. This list includes eight species of regulatory significance including the great blue heron, wood duck, bald eagle, osprey, common goldeneye, hooded merganser, pileated woodpecker, and bufflehead. The proximity to lakes and an open water component at wetlands increases bird richness (Richter & Azous, 2001b). This study identified a total of 90 bird species on at least two or more occasions over a three-year period at their study sites. No single wetland exhibited more than 69% (62) of species found across all wetlands. The diverse habitats at Spring Lake are obviously of essential importance to the bird communities in this area.

The high quality mixed forest and wetland plant communities provide excellent non-breeding habitat for a diverse assemblage of Puget Sound lowland amphibian species. The Pacific chorus frog (*Pseudacris regilla*) and Northern red-legged frog (*Rana aurora*) have often been seen or heard around Spring Lake, especially during the breeding season in early spring. These systems also provide excellent habitat for our common Ambystomid salamanders such as the Northwestern salamander (*Ambystoma gracile*) and long-toed salamander (*Ambystoma macrodactylum*). Unfortunately, the non-native bullfrog (*Rana catesbeiana*) is quite common at Spring Lake, and they can have a negative impact on our native amphibians through direct predation (Richter & Azous, 2001a). Beaver (*Castor canadensis*) are frequently seen and heard around the lake, whereas river otter (*Lutra canadensis*) are considered a rare treat to observe (T. Barnes, pers. comm.). Several other mammals supported by the adjacent forest include the mountain beaver (*Aplodontia rufa*), Douglas' squirrel (*Tamiasciurus douglasii*), and chipmunk (*Eutamias townsendii*).

**Table 2. Common Spring Lake Birds (\* = confirmed nesting)**

<p><b>Accipitridae</b> Bald Eagle Red Tail Hawk Cooper's Hawk Sharp Shinned Hawk Osprey</p> <p><b>Aegithalidae</b> Bushtit</p> <p><b>Alcedinidae</b> Belted Kingfisher</p> <p><b>Anatidae</b> Canada Goose* Wood Duck* Mallard* Common Goldeneye Bufflehead American Widgeon Northern Pintail Common Merganser Hooded Merganser Northern Shoveler Ring-necked Duck Ruddy Duck Lesser Scaup</p> <p><b>Ardeidae</b> Great Blue Heron</p> <p><b>Bombycillidae</b> Cedar Waxwing</p> <p><b>Cardinalidae</b> Black-headed Grosbeak*</p> <p><b>Certhiidae</b> Brown Creeper*</p> <p><b>Columbidae</b> Band-Tailed Pigeon</p> <p><b>Corvidae</b> Stellars Jay* American or Northwestern Crow*</p>	<p><b>Emberizidae</b> Spotted Towhee* Song Sparrow* Fox Sparrow Dark-Eyed Junco (OR &amp; Slate-Colored)*</p> <p><b>Icteridae</b> Red-Winged Blackbird* Brown Headed Cowbird</p> <p><b>Falconidae</b> Merlin</p> <p><b>Fringillidae</b> Evening Grosbeak Purple Finch House Finch Pine Siskin American Goldfinch</p> <p><b>Gaviidae</b> Common Loon</p> <p><b>Hirundinidae</b> Violet-Green Swallow* Tree Swallow Barn Swallow</p> <p><b>Laridae</b> Gull, species unknown</p> <p><b>Paridae</b> Black-Capped Chickadee* Mountain Chickadee Chestnut-Backed Chickadee*</p> <p><b>Picidae</b> Red Breasted Sapsucker Downy Woodpecker Hairy Woodpecker Northern Flicker* Pileated Woodpecker*</p> <p><b>Phalacrocoracidae</b> Double-Crested Cormorant</p>	<p><b>Podicipedidae</b> Pied-billed Grebe</p> <p><b>Rallidae</b> American Coot</p> <p><b>Regulidae</b> Golden-Crowned Kinglet* Ruby-Crowned Kinglet</p> <p><b>Sittidae</b> Red-Breasted Nuthatch*</p> <p><b>Strigidae</b> Barred Owl*</p> <p><b>Sturnidae</b> European Starling</p> <p><b>Thraupidae</b> Western Tanager</p> <p><b>Trochilidae</b> Anna's Hummingbird* Rufous Hummingbird</p> <p><b>Troglodytidae</b> House Wren* Winter Wren* Marsh Wren* Bewick's Wren</p> <p><b>Turdidae</b> Varied Thrush American Robin*</p>
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## **Beneficial and Recreational Uses**

Spring Lake and its surroundings support a variety of uses to humans. Recreational activities include swimming, fishing, boating (no combustion motors), bird watching, wildlife viewing, and hiking (see Figure 2). Residents access the lake for these activities from any of the small private docks around the lake associated with the residential parcels. A public boat launch maintained by Washington Department of Fish & Wildlife allows everybody to benefit from this beautiful resource as well. There are no official swimming beaches associated with the King County Park. However, the park has miles of trails that meander through a mixed forest system adjacent to the wetland complex that allow for botanizing and wildlife viewing opportunities. The Washington Trails Association continues to provide volunteer labor in keeping these trails open and enjoyable.

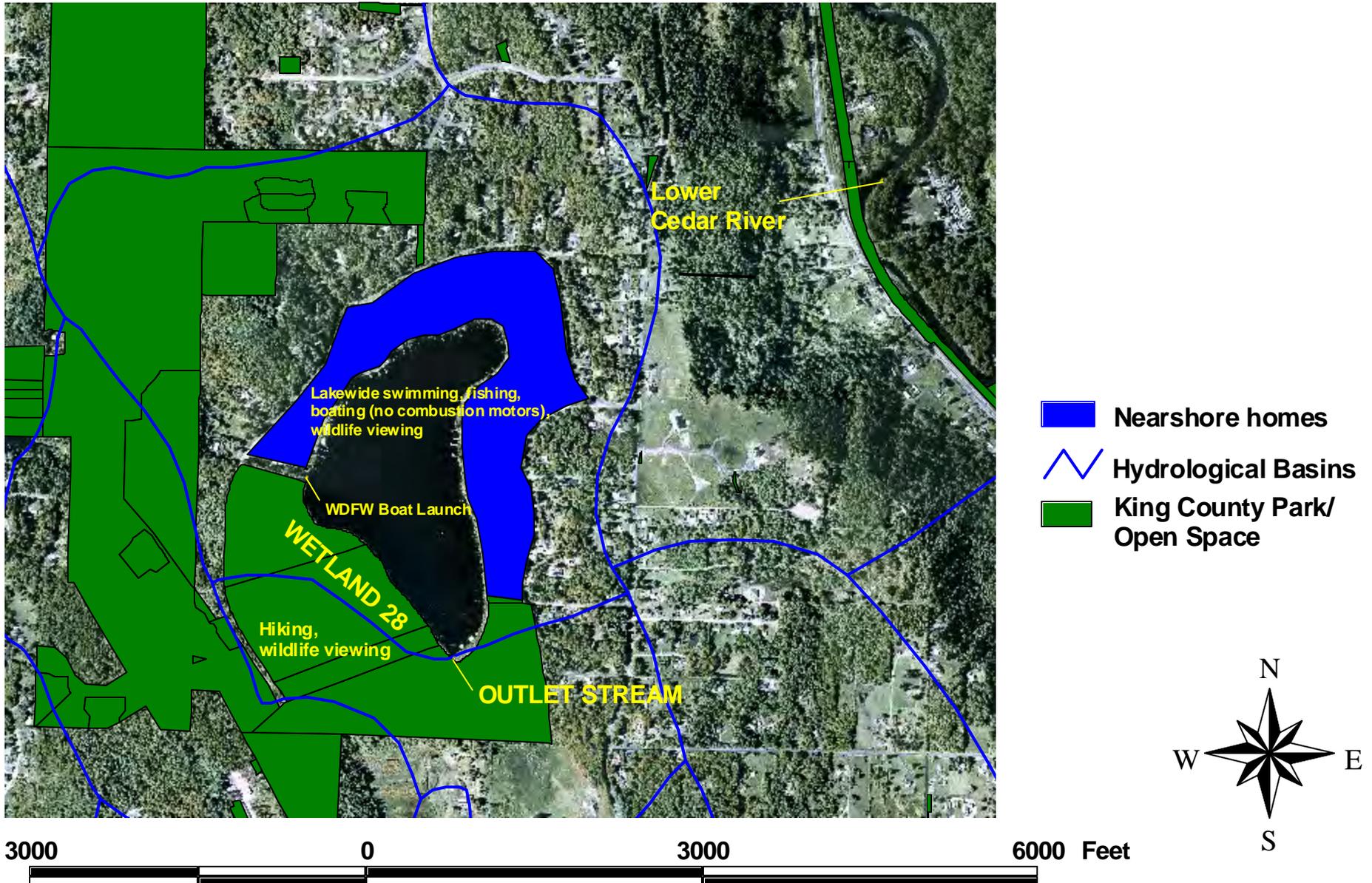
No internal combustion engines are allowed on the lake (KCC 12.44.330), consequently there are no activities such as water skiing or jet skiing. One consequence of this ban is that the natural character and integrity of the system have been preserved. Also, the system is spared potential pollution from petroleum releases and noise pollution. There is also no hunting allowed on Spring Lake or in the adjacent King County Park.

## **Characterization of Aquatic Plants in Spring Lake**

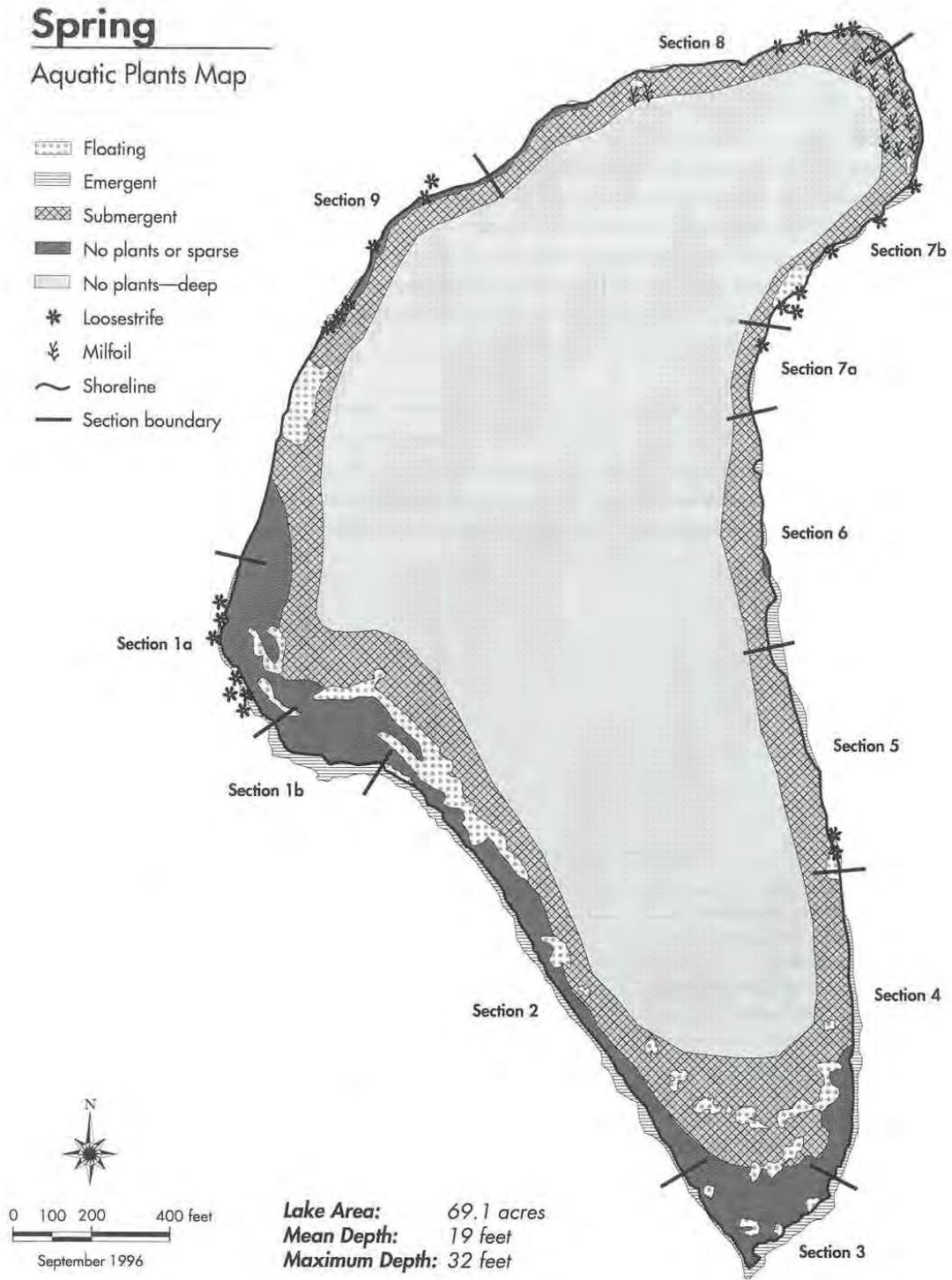
The plant communities in and around Spring Lake represent a diverse set of ecotypes. Hundreds of species occur in specific habitats represented in the area. Even the rocky bald atop Echo Mt. in the King County Park contains uncommon wetland plants due to the shallow subsurface hydrology. The aquatic vegetation serves a wide array of functions such as supporting food chains, providing habitat for a variety of animal species, intercepting sediment and removing toxic compounds from runoff, and providing erosion control/bank stabilization for lakes and streams.

The most recent comprehensive aquatic plant survey of Spring Lake occurred on July 22, 1994 as part of a plant-mapping project on 36 lakes carried out by King County's Lake Stewardship Program (King County, 1996). The surveys were conducted by boat using a two-person crew plus a volunteer (or volunteers) when available. Surveyors used GPS to establish shoreline sections between two fixed points. Each shoreline section was characterized by community type, species present, percent cover of community type, and relative species density within a community type. Community types were defined as emergent, floating, or submergent (Figure 3).

# Figure 2. Beneficial Uses



**Figure 3. Spring Lake Aquatic Plant Survey Results, reprinted from King County, 1996**



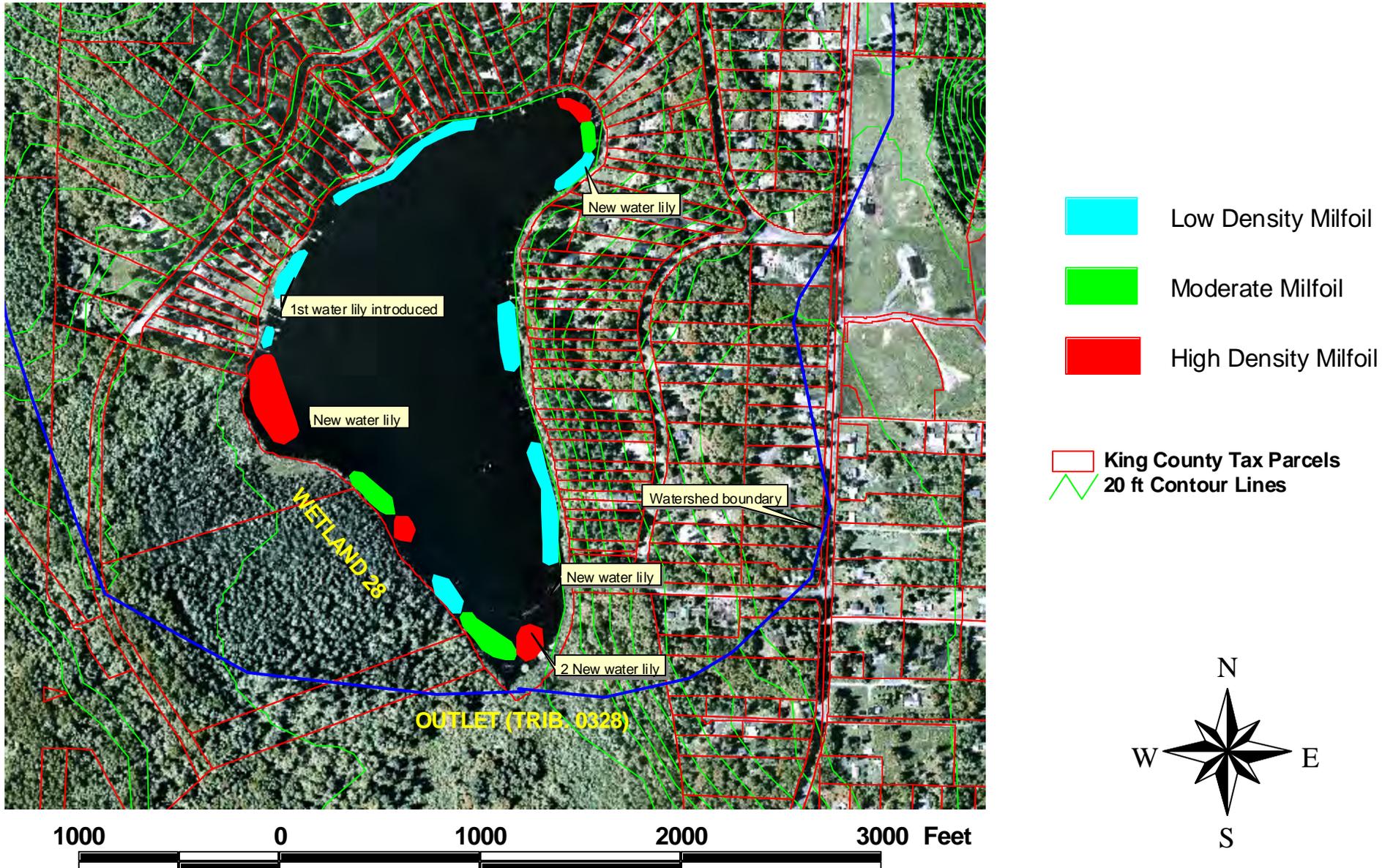
Twenty-six plant species (see Table 3) were identified at Spring Lake, including thirteen emergent types, four floating types, and nine submergent types. Emergents are plants that are rooted in the sediment at the water's edge but have stems and leaves which grow above the water surface. Floating rooted plants are rooted in the sediment and send leaves to the water's surface. Submergent plants are either freely-floating or are rooted in the lake bottom but grow within the water column. The floating plant coverage totaled 2.1 acres, the emergent plants totaled 1.8 acres, while the submergent community comprised 13.8 acres. Percent cover was variable throughout the lake for both the floating and submergent communities, with a total plant coverage of 23% for all three types. Plant coverage was greatest along the southwestern portion of the lake where LCR 28 (see Waterbody Characteristics) has been preserved along the shoreline. *Myriophyllum spicatum* was found only in the northern end of the lake in 1994, and several patches of *Lythrum salicaria* were also found along the shoreline.

On July 19, 2002, King County Aquatic Noxious Weed Specialist Drew Kerr and two members of the Steering Committee conducted a survey for aquatic noxious weeds. The survey was conducted by boat using a Global Positioning System (GPS) receiver. Approximated densities of *M. spicatum* were recorded as low, moderate, and high for the littoral zone of the lake. These individual points were connected into clusters of like-density in the post-processing using the Geographic Information System (GIS) program ArcView (Figure 4). New patches of *Nymphaea odorata* were also recorded based on the experience of the two community members. Parcels with *Lythrum salicaria* were also recorded. Both *M. spicatum* and *L. salicaria* appear to have greatly expanded their occurrence on the lake relative to the 1994 survey. *M. spicatum* is now found in higher concentrations around much of the littoral zone of the lake. There are new, low-density areas along the eastern and western shorelines, with higher densities from the boat launch south to the outlet, unlike the 1994 survey findings.

**Table 3.** Aquatic Plants Found in Spring Lake. Reformatted from King County, 1996.

Plant Species	Ab.	Common Name	Community	Sections Found
<i>Brasenia schreberi</i>	Bs	Water Shield	Floating	1a, 2, 3
<i>Carex sp.</i>	Ca	Sedge	Emergent	2
<i>Chara sp.</i>	Cs	Muskgrass	Submersed	unidentified
<i>Dulichium arundinaceum</i>	Da	Three-way Sedge	Emergent	2
<i>Elodea canadensis</i>	Ec	Water Weed	Submersed	1a, 2, 3, 4, 6, 7b, 8, 9
<i>Iris pseudacorus</i>	Ip	Yellow Flag Iris	Emergent	1a, 3, 6, 7a, 7b, 9
<i>Isoetes sp.</i>	Is	Quillwort	Submersed	6, 9
<i>Juncus sp.</i>	Ju	Rush	Emergent	1b, 2, 8
<i>Ledum groenlandicum</i>	Lg	Labrador Tea	Emergent	2
<i>Ludwigia palustris</i>	Lp	Water Purslane	Emergent	5, 6
<i>Lythrum salicaria</i>	Ls	Purple Loosestrife	Emergent	1a, 5, 7a, 7b, 9
<i>Myriophyllum spicatum</i>	Ms	Eurasian Watermilfoil	Submersed	7b, 8, 9
<i>Najas flexilis</i>	Nf	Slender Water-Nymph	Submersed	1a, 2, 3, 4, 7b, 9
<i>Nitella sp.</i>	Ni	Nitella	Submersed	4, 6, 7b, 8
<i>Nuphar luteum</i>	Nl	Yellow Water Lily	Floating	1a, 2, 3, 4, 5, 8
<i>Nymphaea odorata</i>	No	Fragrant Water Lily	Floating	3, 8, 9
<i>Polygonum sp.</i>	Pm	Smartweed	Emergent	5, 6
<i>Potamogeton pusillus</i>	Pb	Small Pondweed	Submersed	3, 4, 6, 7b, 8
<i>Potamogeton epihydrus</i>	Pe	Ribbonleaf Pondweed	Submersed	1a, 4, 7b
<i>Potentilla palustris</i>	Pp	Marsh Cinquefoil	Emergent	5, 6
<i>Sagittaria sp.</i>	Sa	Arrowhead	Emergent	1a
<i>Spiraea douglasii</i>	Sd	Spiraea	Emergent	1a, 1b, 2, 3, 4, 5, 6, 7b, 8
<i>Spirodela polyrrhiza</i>	Sp	Giant Duckweed	Floating	2
<i>Typha angustifolia</i>	Ta	Narrowleaf Cattail	Emergent	4
<i>Typha latifolia</i>	Tl	Cattail	Emergent	All
<i>Utricularia sp.</i>	Us	Bladderwort	Submersed	1a, 2

# Figure 4. Eurasian watermilfoil & new fragrant water lily distribution in Spring Lake (8/21/02)



The northern tip of Spring Lake continues to support milfoil throughout the littoral zone, including an area of dense concentration. *Lythrum salicaria* is now common in buffer shoreline vegetation, and there are additional stands along the shore of LCR 28 and east of the outlet channel. No significant infestations have been found in the core of the wetland. Populations and distribution of *L. salicaria* have been partially contained by community efforts to stop seed production through manual control efforts, but the plant has obviously continued to increase from 1994 through 2002 to be at the current levels despite these recent control efforts.

Historical plant surveys of Spring Lake were carried out in four of five consecutive years from 1976 to 1980 (King County, 1996). In 1976, the dominant plants in the lake included *Brasenia schreberi*, *Nitella* sp., and *Nymphaea odorata*. By 1980, after several intervening herbicide applications, *Elodea canadensis*, *Najas flexilis*, and *Potamogeton pusillus* were the dominant submergent plants present in the lake. These three species, along with *M. spicatum*, still comprise the majority of the submergent plant community. *M. spicatum* has been in the lake since before 1976 and herbicide has been used to control this noxious weed in the past. Records from the Spring Lake Community Club show that Aquathol granular was applied at 1.5 ppm in June 1978 to control aquatic plants in front of several lots (A & T Weed Service, 1978). In June of 1989, Sonar was applied to Spring Lake to control the submersed aquatic weeds and enhance the recreational value of the lake (Allied Aquatics, 1989). Records indicate that Allied Aquatics also performed an herbicide application for submersed aquatics in 1987.

Two species of aquatic plants occurred only in Spring Lake out of the 36 lakes surveyed in the 1996 report. *Spirodela polyrrhiza* is a native species of duckweed uncommon to the region, though found worldwide. *Typha angustifolia* (lesser cattail) is a non-native cattail currently establishing along the Pacific Coast that is native to Europe and possibly to the Atlantic Coast. It has narrower leaves and flowers than our native cattail (*Typha latifolia*) and is shorter in total height. The male flowers of lesser cattail are separated from the female flowers by a section of naked stem, whereas they are contiguous in the native species. It can grow in deeper water than *Typha latifolia*, and can form dense exclusive stands, which reduce plant biodiversity and the habitat functions supported by a mosaic of species. Allelopathic chemicals that inhibit the growth of other plants are produced by several cattail species. This may give it a competitive advantage over other wetland plants. Also, robust hybrids between the two plants will form, (called *T. x glauca*), which could potentially pollute the genetics of our native cattail. *Typha angustifolia*, although not currently widespread, is thought to be a potential invasive species problem in the future, and has been added as a Monitor Species to the Washington State Noxious Weed List. The stand on the Spring Lake shoreline is still fairly small and discrete and will be targeted for removal along with the four listed noxious weed species.

The Washington Natural Heritage Program (WNHP) performed a search of their Natural Heritage Information System database for rare plant species, select rare animal species, and high quality wetland and terrestrial ecosystems in the vicinity of Spring Lake (<http://www.wa.gov/dnr/htdocs/fr/nhp/wanhp.html>). This search did not find any endangered, threatened, or sensitive plant species recorded for Spring Lake, nor did it

find the presence of any animal species tracked by their system. Two high quality wetland ecosystems were found by the search, one a forested wetland ecosystem and the other a forested fen ecosystem. The fen, which is located adjacent to the southwest shoreline, contains western hemlock (*Tsuga heterophylla*), western redcedar (*Thuja plicata*), Labrador tea (*Rhododendron groenlandicum*), and *Sphagnum* spp. The forested wetland, which occurs between the fen and the mixed forest uplands, contains western hemlock and western redcedar, as well as skunk cabbage (*Lysichiton americanus*). Both of these systems are part of the large, Class 1 wetland LCR 28.

### **Noxious Aquatic Weeds in Spring Lake**

Table 3 shows the 26 species found in the 1994 plant survey, including four listed noxious weed species: Eurasian watermilfoil (*Myriophyllum spicatum*), purple loosestrife (*Lythrum salicaria*), fragrant water lily (*Nymphaea odorata*), and yellow flag iris (*Iris pseudacorus*). These species will be the focus of the plant management efforts on Spring Lake. The term “noxious weed” refers to those non-native 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 usually been introduced accidentally as a contaminant, or as ornamentals. Non-native plants often do not have natural predators (i.e. herbivores, pathogens) or strong competitors to control their numbers as they may have had in their home range. WAC 16.750 sets out three classes (A, B, C) of noxious weeds based on their distribution in the state, each class having different control requirements. County Weed Boards are given some discretion as to setting control priorities for Class B and C weeds. Eurasian watermilfoil and purple loosestrife are both Class B Noxious Weeds, while fragrant water lily and yellow flag iris are Class C Noxious Weeds.

#### **Eurasian watermilfoil (*Myriophyllum spicatum*)**

Eurasian watermilfoil is native to Europe, Asia, and North Africa and also occurs in Greenland (Washington State Noxious Weed Control Board, 1995). The oldest record of Eurasian watermilfoil in Washington is from a 1965 herbarium specimen collected from Lake Meridian, King County. It was first identified causing problems in the 1970s in Lake Washington and proceeded to move down the I-5 corridor, probably transported to new lakes on boats and trailers. Eurasian watermilfoil is among the worst aquatic pests in North America. *M. spicatum* is a submersed, perennial aquatic plant with feather-like leaves. It usually has 12 to 16 leaflets (usually more than 14) on each leaf arranged in whorls of 4 around the stem. Leaves near the surface may be reddish or brown. Sometimes there are emergent flower stalks during the summers that have tiny emergent leaves. In western Washington, Eurasian watermilfoil frequently over-winters in an evergreen form and may maintain considerable winter biomass (K. Hamel, pers. comm.). This plant forms dense mats of vegetation just below the water’s surface. In the late summer and fall, the plants break into fragments with attached roots that float with the currents, infesting new areas. Disturbed plants will also fragment at other times of the year. A new plant can start from a tiny piece of a milfoil plant. *M. spicatum* was not

previously thought to reproduce from seed in this region. However, aquatic plant experts are beginning to think that milfoil seeds might be playing a bigger role in repopulating lakes than was previously hoped (K. Hamel, pers. comm.). This is especially true if the lake dewater. Milfoil starts spring growth earlier than native aquatic plants, and thereby gets a “head start” on other plants. Eurasian watermilfoil can degrade the ecological integrity of a water body in just a few growing seasons.

Dense stands of milfoil crowd out native aquatic vegetation, which in turn alters predator-prey relationships among fish and other aquatic animals. Eurasian watermilfoil can also reduce dissolved oxygen – first by inhibiting water mixing in areas where it grows, and then as oxygen is consumed by bacteria during decomposition of dead plant material. Decomposition of *M. spicatum* also releases phosphorus and nitrogen to the water that could increase algal growth. Further, dense mats of Eurasian watermilfoil can increase water temperature by absorbing sunlight, raise the pH, and create stagnant water mosquito breeding areas. Eurasian watermilfoil will negatively affect recreational activities such as swimming, fishing, and boating. The dense beds of vegetation make swimming dangerous, snag fish hooks on every cast, and inhibit boating by entangling propellers or paddles and slowing the movement of boats across the water.

At Spring Lake, *M. spicatum* is generally moderate in density. The infestation is still patchy with only a few high-density milfoil stands. Most of the patches are still moderate to low density, and therefore are not yet causing enormous impacts. The infestation has grown significantly since the last measurement in 1994, both in size and distribution. It is likely that the milfoil infestation will continue to expand if left untreated, dramatically increasing negative impacts to the beneficial uses of Spring Lake.

### **Purple loosestrife (*Lythrum salicaria*)**

Purple loosestrife is native to Europe and Asia and was introduced through ship ballast water to the Atlantic Coast in the mid-1800s (Washington State Noxious Weed Control Board, 1997). In Washington, purple loosestrife was first collected from the Seattle area in 1929 from Lake Washington. Purple loosestrife is a perennial that can reach 9 feet tall with long spikes of magenta flowers. The flowers usually have 6 petals, and the stems are squared-off. Purple loosestrife is considered a facultative wetland (+) species (FACW+), with a 67-99% probability of occurring in wetlands as opposed to upland areas (Reed, 1988). Vigorous plants can produce over 2 million tiny, lightweight seeds (120,000 per spike) that are easily spread by waterfowl and other animals (Washington State Noxious Weed Control Board, 1997). Although a prolific seeder, purple loosestrife can also spread through vegetative production by shoots and rhizomes as well as by root fragmentation. It has a woody taproot with a fibrous root system that forms a dense mat, keeping other plants from establishing in a space.

Purple loosestrife disrupts wetland ecosystems by displacing native or beneficial plants and animals. Waterfowl, fur-bearing animals, and birds vacate wetland habitat when native vegetation is displaced by purple loosestrife. Loss of native vegetation results in decreased sources of food, nesting material, and shelter. Economic impacts are high in agricultural communities when irrigation systems are clogged or when wet pastures are

unavailable for grazing. Purple loosestrife is aggressive and competitive, taking full advantage of disturbance to natural wetland vegetation caused by anthropogenic alterations of the landscape. Seed banks build for years since seeds may remain viable for up to 3 years. Monospecific stands are long-lived in North America as compared to European stands, illustrating the competitive edge loosestrife has over other plant species.

Purple loosestrife has already colonized the shoreline of the fragile fen system in LCR 28 and will disperse further up into the wetland if not controlled. Purple loosestrife has not been found yet one mile downstream at the Peterson Lake Park Natural Area (King County, 1999). However, this species could easily be transported downstream from Spring Lake by seed to invade this valuable resource area.

### **Fragrant water lily (*Nymphaea odorata*)**

This noxious weed is native to the eastern half of North America (Washington State Noxious Weed Control Board, 2001b). It was probably introduced into Washington during the Alaska Pacific Yukon Exposition in Seattle in the late 1800's. It has often been introduced to ponds and lakes because of its beautiful, large white or pink (occasionally light yellow), many-petaled flowers that float on the water's surface, surrounded by large, round green leaves. The leaves are attached to flexible underwater stalks rising from thick fleshy rhizomes. Adventitious roots attach the horizontal creeping and branching rhizomes.

This aquatic perennial herb spreads aggressively, rooting in murky or silty sediments in water up to 7 feet deep. It prefers quiet waters such as ponds, lake margins and slow streams and will grow in a wide range of pH. Shallow lakes are particularly vulnerable to being totally covered by fragrant water lilies. Water lily spreads by seeds and by rhizome fragments. A planted rhizome will cover about a 15-foot diameter circle in five years (Washington State Noxious Weed Control Board, 2001b). This can reduce the important open water component in the littoral zone of Spring Lake.

Fragrant water lily (*Nymphaea odorata*), first introduced by a homeowner, is quickly expanding its distribution on Spring Lake (T. Barnes, pers. comm.). 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 water lily beds in the summer. Water lilies can restrict lakefront access and hinder swimming, boating, and other recreational activity. They may also limit our native water lily (*Nuphar luteum*) with which it overlaps in distribution. The fragrant water lily is still expanding in patches on Spring Lake, and so its future impacts are not clear. As soon as these patches connect, recreational activities such as boating, fishing, and swimming will become more difficult. Even canoes can have great difficulty moving across dense floating mats of fragrant water lily, not to mention entanglement with propellers of boat motors.

### **Yellow flag iris (*Iris pseudacorus*)**

Yellow flag iris is native to mainland Europe, the British Isles, and the Mediterranean region of North Africa (Washington State Noxious Weed Control Board, 2001a). This plant was introduced widely as a garden ornamental. It has also been used for erosion control. The earliest collection in Washington is from Lake McMurray in Skagit County in 1948 (Washington State Noxious Weed Control Board, 2001a). The yellow flowers are a distinguishing characteristic, but when not flowering it may be confused with cattail (*Typha sp.*) or broad-fruited bur-reed (*Sparganium eurycarpum*).

Yellow flag iris is considered an obligate wetland species (OBL), with a >99% probability of occurring in wetlands as opposed to upland areas (Reed, 1988). The plants produce large fruit capsules and corky seeds in the late summer. Yellow flag iris spreads by rhizomes and seeds. Up to several hundred flowering plants may be connected rhizomatously. Rhizome fragments can form new plants. Yellow flag iris can spread by rhizome growth to form dense stands that can exclude even the toughest of our native wetland species, such as *Typha latifolia* (cattail). This noxious weed has already colonized the shoreline of the fragile fen system in LCR 28 and threatens to disperse further up into the wetland if not controlled. In addition to threatening to lower plant diversity, this noxious weed can also alter hydrologic dynamics through sediment accretion along the shoreline. Yellow flag iris has not yet been observed downstream at the Peterson Lake Park Natural Area (King County, 1999). This species produces prolific seed that could easily be transported downstream to invade this valuable resource area.

## AQUATIC PLANT CONTROL ALTERNATIVES

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This section outlines common methods used to control aquatic weeds. Much of the information in this section is quoted directly from the Ecology's website:

<http://www.ecy.wa.gov/programs/wq/plants/management/index.html>

Additional information is derived from the field experience of the King County Noxious Weed Control Program, in particular from Drew Kerr, Aquatic Noxious Weed Specialist and WSDA licensed aquatic herbicide applicator. Recommendations found in the 2001 draft version of the "King County Regional Milfoil Plan" have also been taken into consideration.

Control/eradication methods discussed herein include Aquatic Herbicide, Manual Methods, Bottom Screens, Diver Dredging, Biological Control, Rotovation, Cutting, Harvesting, and Drawdown.

## AQUATIC HERBICIDES

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### Description of Method

<http://www.ecy.wa.gov/programs/wq/plants/management/aqua028.html>

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 is 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 (chemical mowing). 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).

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. In addition, because of a March 2001 court decision (Federal 9<sup>th</sup> Circuit District Court), coverage under a discharge permit called a National Pollutant Discharge Elimination System (NPDES) permit must be obtained before aquatic herbicides can be applied to some waters of the U.S. This ruling, referred to as the Talent Irrigation District decision, has further defined Section 402 of the Clean Water Act. Ecology has developed a general NPDES permit which is available for coverage under the Washington Department of Agriculture for the management of noxious weeds growing in an aquatic situation and a separate general permit for nuisance aquatic weeds (native plants) and algae control. For nuisance weeds (native species also referred to as beneficial vegetation) and algae, applicators and the local sponsor of the project must obtain a NPDES permit from the Washington Department of Ecology before applying herbicides to Washington water bodies.

Although there are a number of EPA registered aquatic herbicides, the Department of Ecology currently issues permits for four aquatic herbicides (as of 2002 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. As an example, Renovate® (Triclopyr) has been approved by the U.S. EPA for aquatic use in November 2002, making it the first aquatic herbicide to receive registration since 1988. Renovate® was designed to be effective on both emergent and submersed plants. This herbicide formulation still needs to be evaluated by the Department of Ecology's Environmental Impact Statement (EIS) process before it can be approved for use in Washington. It

should prove very effective on Eurasian watermilfoil, purple loosestrife, and yellow flag iris, and may be used on Spring Lake in future years once approved.

The chemicals that are currently permitted for use in 2002 are:

**Aquatic Herbicides (see Appendix D for herbicide labels)**

- **Rodeo® or Aquamaster®** - Active ingredient **glyphosate**. This systemic non-selective herbicide is used to control floating-leaved plants like water lilies and shoreline plants like purple loosestrife and yellow flag iris. It is generally applied as a liquid to the leaves. Rodeo® or Aquamaster® does not work on underwater plants such as Eurasian watermilfoil. Although glyphosate is a non-selective herbicide, a good applicator can somewhat selectively remove targeted plants by focusing the spray only on the plants to be removed. Plants take several weeks to die. A repeat application is often necessary to remove plants that were missed during the first application. Note: there are now other glyphosate products available, like Aquamaster®, with the exact formulation as Rodeo® but with different trade names now that the patent has expired. Additional surfactants are always added by the applicator for the aquatic formulations to improve the penetration of the leaf cuticle and help the herbicide stay on the plant long enough to be effective. Those that may be used for emergent weed control include X-77, LI-700, and R-11 as approved by the SEPA process. Only LI-700 is approved for fragrant water lily control under the NPDES permit.
- **2,4-D** – 2,4-D is a systemic, selective herbicide used for the control of Eurasian watermilfoil and other broad-leaved species.
  - **Navigate® and AquaKleen®** - Active ingredient **2,4-D BEE**. These granular products contain the low-volatile butoxyethyl-ester (BEE) formulation of 2,4-D. 2,4-D is a relatively fast acting selective, systemic herbicide. It is applied in a granular formulation and can be effective for spot treatment of Eurasian watermilfoil. When used at a rate of 100 pounds per acre, 2,4-D has shown to be selective to Eurasian watermilfoil, leaving native aquatic species relatively unaffected.
  - **DMA\*4IVM®** - Dimethylamine Salt of **2,4-D**. This is a liquid formulation that is labeled for aquatic weed control. Since 2,4-D DMA (like 2,4-D BEE) is rapidly converted to 2,4-D acid, the two products should be equally effective in controlling Eurasian watermilfoil. Previously, 2,4-D DMA was only registered for this use in dams and reservoirs of the Tennessee Valley Authority (TVA) System, but is now approved for use in Washington and other states. It has recently been used to successfully control Eurasian watermilfoil in parts of Lake Washington, King County (Dorling, pers. comm.).
- **Sonar®** Active ingredient **fluridone**. Sonar® is a slow-acting systemic herbicide used to control Eurasian watermilfoil and other underwater plants. It may be applied in pelleted form or as a liquid. Fluridone can show good control of

submersed plants where there is little water movement and an extended time for the treatment. Its use is most applicable to whole-lake or isolated bay treatments where dilution can be minimized. It is not effective for spot treatments. It may take six to twelve weeks before the dying plants fall to the sediment and decompose. When used to manage Eurasian watermilfoil, Sonar® is applied several times during the summer to maintain a low, but consistent concentration in the water. Although fluridone is considered to be a non-selective herbicide, when used at low concentrations, it can be used to selectively remove Eurasian watermilfoil. Some native aquatic plants, especially pondweeds, are minimally affected by low concentrations of fluridone.

- **Aquathol®** - Active ingredient the dipotassium salt of **endothall**. Aquathol® is a fast-acting non-selective contact herbicide, which destroys the vegetative part of the plant but does not kill the roots. Aquathol® may be applied in a granular or liquid form. Generally endothall compounds are used primarily for short-term (one season) control of a variety of aquatic plants. However, there has been some recent research that indicates that when used in low concentrations, Aquathol® can be used to selectively remove exotic weeds, leaving some native species relatively unaffected. Because it is fast acting, Aquathol® can be used to treat smaller areas effectively. There are water use restrictions associated with the use of Aquathol® in Washington. Generally, most aquatic herbicides have use restrictions, with irrigation restrictions being the most common.

## Advantages

- Aquatic herbicide application can be less expensive than other aquatic plant control methods.
- Aquatic herbicides are easily applied around docks and underwater obstructions.
- 2,4-D DMA & 2,4-D BEE have been shown to be effective in controlling smaller infestations (not lake-wide) of Eurasian watermilfoil in Washington, and could also be used on the purple loosestrife and yellow flag iris.
- Washington has had some success in eradicating Eurasian watermilfoil from some smaller lakes (320 acres or less) using Sonar®.
- Glyphosate is the recommended chemical for fragrant water lily control

## 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.
- Rapid-acting herbicides like Aquathol® may cause low oxygen conditions to develop as plants decompose. Low oxygen can cause fish kills.
- To be most effective, generally herbicides must be applied to rapidly growing plants.
- Some expertise in using herbicides is necessary in order to be successful and to avoid unwanted impacts.
- Many people have strong feelings against using chemicals in water.
- Some cities or counties may have policies forbidding or discouraging the use of aquatic herbicides.

## Permits

A NPDES permit is needed. Both the noxious and nuisance NPDES permits require the development of Integrated Aquatic Vegetation Management Plans (IAVMP) by the third year of control work. Monitoring of herbicide levels in the water is required starting in 2003, whether the chemical has been applied directly to the water or along the shoreline where it may have gotten into the adjacent water. For noxious weed control, the applicator must apply to the Washington Department of Agriculture (WSDA) for coverage under their NPDES permit each treatment season. There is no permit or application fee to obtain NPDES coverage under Agriculture's permit for Noxious Weeds. Since Spring Lake is in unincorporated King County, the King County Department of Development and Environmental Services (DDES) will require a permit for application of herbicide in Sensitive Areas to submergent, floating and emergent aquatic plants. This falls under their Clearing and Grading Permit.

## Costs

Approximate costs for one-acre herbicide treatment (costs will vary from site to site):

- DMA\*4IVM®: \$500-700
- Navigate® and AquaKleen®: \$500-700
- Rodeo® or Aquamaster® : \$250
- Sonar®: \$900 to \$1,000

## Other Considerations

The focus of the discussion below are the active ingredients 2,4-D and Glyphosate since the Steering Committee, with input from the watershed-wide public meetings, have chosen these two chemicals as the best options for the start of the Integrated Treatment Strategy (see pg. 55) for Spring Lake. Since fluridone (Sonar®) would have required a whole lake treatment and costs much more per unit than 2,4-D, it was not chosen as a viable option and is not discussed in further detail.

EPA studies yield the parameters LD<sub>50</sub> (acute lethal dose to 50% of a test population), NOEL (No Observable Effect Level, which is the highest test dosage causing no adverse responses), and RfD (EPA Reference Dose determined by applying at least a 100-fold uncertainty factor to the NOEL). The EPA defines the RfD as the level that a human could be exposed to daily with reasonable certainty of no adverse effect from any cause, in other words, a "safe" dose. Exposures to bystanders or consumers are deemed safe when the RfD is not exceeded (Felsot, 1998). Since all substances, natural or manmade, may prove toxic at a sufficiently high dose, one should remember the old adage "dose makes the poison." The LD<sub>50</sub> value is useful for comparing one compound with another and for grouping compounds into general hazard classes.

According to Felsot (1998), any pesticide, such as 2,4-D or glyphosate, that does not produce adverse effects on aquatic organisms until levels in water reach milligram per liter (i.e., mg/L, equivalent to a part per million, ppm) would be considered of comparatively low hazard. Substances that are biologically active in water at levels one-thousand-fold less, (i.e., µg/L, parts per billion, ppb), are considered highly hazardous to aquatic life. Most pesticides falling in the latter category are insecticides rather than herbicides.

Also, compounds that have half-lives less than 100 days are considered non-persistent compared to compounds having half-lives approaching one year or longer (for example, DDT). The half-life of 2,4-D is about 7 days in water, while that of glyphosate is about 12 days in water. Since there are multiple factors that modulate the pesticides' hazard, just focusing on the half-life itself is a bit misleading for hazard assessment. It is now known that the longer a residue remains in soil/sediment, the less likely it will be taken up by plants, leach, or runoff (Felsot, 1998). This phenomenon is called residue aging and involves changes in the forces governing interactions of the chemical with the soil matrix over time.

## 2,4-D

As far as restrictions for aquatic 2,4-D applications, there is no fishing restriction, and three to five days after treatment the water is generally below the drinking water standard (70ppb, irrigation standard is 100ppb for broad-leafed plants). Although 2,4-D should not damage grass or other monocots, it is not recommended that one use treated water to water lawns during this first three to five days since over-spray will kill ornamentals or plants such as tomatoes and grapes that are very sensitive to 2,4-D. There is no swimming restriction for 2,4-D use. Ecology advises that swimmers wait for 24 hours

after application before swimming in the treatment area, but that is an advisory only. The choice is up to the individual.

### **Human and general mammalian health**

The oral LD<sub>50</sub> for 2,4-D (acid) is 764 mg/kg and the dermal LD<sub>50</sub> is >2000 mg/kg. This chemical has a low acute toxicity (from an LD<sub>50</sub> standpoint, is less toxic than caffeine and slightly more toxic than aspirin). The RfD for 2,4-D (acid) is 0.01 mg/kg/d. Recent, state-of-the-art EPA studies continue to find that it is not considered a carcinogen or mutagen, nor does it cause birth defects. It has a relatively short persistence in water, since it tends to bind to organic matter in the sediments. The herbicide 2,4-D generally does not bioaccumulate to a great extent, and the small amounts which do accumulate are rapidly eliminated once exposure ceases (Washington State Department of Ecology, 2001b).

The risks to human health from exposure to aquatic 2,4-D applications were evaluated in terms of the most likely forms of contact between humans and the water to which the herbicide was applied. Ecology's Risk Assessment results indicate that 2,4-D should present little or no risk to the public from acute (one time) exposures via dermal contact with the sediment, dermal contact with water (swimming), or ingestion of fish (Washington State Department of Ecology, 2001b). Based on the low dermal absorption of the chemical, the dose of 2,4-D received from skin contact with treated water is not considered significant. Dose levels used in studies are often far beyond what an animal or human would experience as a result of an aquatic application. Many experiments have examined the potential for contact by the herbicide applicator, although these concentrations have little relevance to environmental exposure by those not directly involved with the herbicide application. Once the herbicide has entered the water, its concentration will quickly decline because of turbulence associated mixing and dilution, volatilization, and degradation by sunlight and secondarily by microorganisms (Felsot, 1998).

Results of chronic exposure assessments indicate that human health should not be adversely impacted by chronic 2,4-D exposure via ingestion of fish, ingestion of surface water while swimming, incidental ingestion of sediments, dermal contact with sediments, or dermal contact with water (Washington State Department of Ecology, 2001b). Pharmacokinetic investigations have demonstrated that 2,4-D is rapidly absorbed from the gastrointestinal tract and is quickly excreted. Animal toxicological investigations carried out at high doses showed a reduction in the ability of the kidneys to excrete the chemical, and resulted in some systemic toxicity. However, the high doses tested may not be relevant to the typical low dose human exposures resulting from labeled use. A review of the scientific and medical literature failed to provide any human case reports of systemic toxicity or poisoning following overexposure to these herbicide products when used according to label instructions (Washington State Department of Ecology, 2001b). The risks to mammalian pets and wildlife should be closely related to these reported human risks, especially since many of the toxicity experiments are carried out on test animals by necessity.

The potential hazard to pregnant women and to the reproductive health of both men and women was evaluated. The results of the 2,4-D developmental or teratology (birth defects) and multigenerational reproduction studies indicate that the chemical is not considered to be a reproductive hazard or cause birth defects (teratogen) when administered below maternally toxic doses (Washington State Department of Ecology, 2001b). A review of the histopathological sections of various 2,4-D subchronic and chronic studies provides further support that the chemical does not affect the reproductive organs, except in some higher dose groups beyond the potential level of incidental exposure after an aquatic weed application.

### **Fish health**

Based on laboratory data reported in the Department of Ecology's Risk Assessment of 2,4-D, 2,4-D DMA has a low acute toxicity to fish ( $LC_{50} \geq 100$  to 524 mg a.i./L for the rainbow trout and bluegill sunfish respectively). No Federally sensitive, threatened or endangered species were tested with 2,4-D DMA. However, it is likely that endangered salmonids would not exhibit higher toxic effects to 2,4-D DMA than those seen in rainbow trout. Since the maximum use rate of 2,4-D DMA would be no higher than the maximum labeled use rate (4.8 mg a.i./L) even the most sensitive fish species within the biota should not suffer adverse impacts from the effects of 2,4-D DMA. In conclusion, 2,4-D DMA will not effect fish or free-swimming invertebrate biota acutely or chronically when applied at typical use rates of 1.36 to 4.8 mg a.i./L (Washington State Dept. of Ecology, 2001b). However, more sensitive species of benthic invertebrates like glass shrimp may be affected by 2,4-D DMA, but 80 and 90% of the benthic species should be safe when exposed to 2,4-D DMA acutely or chronically at rates recommended on the label. Field work indicates that 2,4-D has no significant adverse impacts on fish, free-swimming invertebrates and benthic invertebrates, but well designed field studies are in short supply.

According to the Department of Ecology's Risk Assessment of 2,4-D, in the United States, 2,4-D BEE is the most common herbicide used to control aquatic weeds. 2,4-D BEE, has a high laboratory acute toxicity to fish ( $LC_{50} = 0.3$  to 5.6 mg a.i./L for rainbow trout fry and fathead minnow fingerlings, respectively). Formal risk assessment indicates that short-term exposure to 2,4-D BEE should cause adverse impact to fish since the risk quotient is above the acute level of concern of 0.01 ( $RQ = 0.1 \text{ ppm}/0.3 \text{ ppm} = 0.33$ ). However, the low solubility of 2,4-D BEE and its rapid hydrolysis to 2,4-D acid means fish are more likely to be exposed to the much less toxic 2,4-D acid. 2,4-D acid has a toxicity similar to 2,4-D DMA to fish ( $LC_{50} = 20$  mg to 358 mg a.i./L for the common carp and rainbow trout, respectively). In contrast, formal risk assessment with 2,4-D acid indicates that short-term exposure to 2,4-D BEE should not cause adverse impact to fish since the risk quotient is below the federal level of concern of 0.01 ( $RQ = 0.1 \text{ ppm}/20 \text{ ppm} = 0.005$ ). To conclude, 2,4-D BEE will have no significant impact on the animal biota acutely or chronically when using applied rates recommended on the label (Washington State Dept. of Ecology, 2001b). Although laboratory data indicates that 2,4-D BEE may be toxic to fish, free-swimming invertebrates and benthic invertebrates, data indicates that its toxic potential is not realized under typical concentrations and

conditions found in the field. This lack of field toxicity is likely due to the low solubility of 2,4-D BEE and its rapid hydrolysis to the practically non-toxic 2,4-D acid within a few hours to a day following the application.

## **Glyphosate**

Examination of mammalian toxicity has shown that the acute oral and dermal toxicity of glyphosate would fall into EPA's toxicity category III. This category characterizes slightly to moderately toxic compounds. Glyphosate is practically nontoxic by ingestion, with a reported acute oral LD<sub>50</sub> of 5600 mg/kg in tested rats. The risks of incidental contact from swimming in treated water have also been judged as low with a dermal LD<sub>50</sub> of 7940 mg/kg, a very high threshold. The RfD for glyphosate is 0.1 mg/kg/d. To place the level of hazard to humans in perspective, the commonly consumed chemicals caffeine (present in coffee, tea, and certain soft drinks), aspirin (acetylsalicylic acid), and nicotine (the neuroactive ingredient in tobacco) have acute oral LD<sub>50</sub>'s of 192, 1683, and 53 mg/kg, respectively. Thus, the herbicides for the most part are comparatively less toxic than chemicals to which consumers voluntarily expose themselves (Felsot, 1998).

Since the shikimic acid pathway does not exist in animals, the acute toxicity of glyphosate is very low. Animal studies, which the Environmental Protection Agency has evaluated in support of the registration of glyphosate, can be used to make inferences relative to human health. The U.S. Forest Service's glyphosate fact sheet reports that the EPA has concluded that glyphosate should be classified as a compound with evidence of non-carcinogenicity for humans (Information Ventures, Inc.). This conclusion is based on the lack of convincing carcinogenicity evidence in adequate studies in two animal species. Laboratory studies on glyphosate using pregnant rats (dose levels up to 3500 mg/kg per day) and rabbits (dose levels up to 350 mg/kg per day), indicated no evidence of teratology (birth defects). A three-generation reproduction study in rats did not show any adverse effects on fertility or reproduction at doses up to 30 mg/kg per day. Glyphosate was negative in all tests for mutagenicity (the ability to cause genetic damage).

Technically, glyphosate acid is practically nontoxic to fish and may be slightly toxic to aquatic invertebrates (EXTOXNET, 1996). Some formulations may be more toxic to fish and aquatic species due to differences in toxicity between the salts and the parent acid, or to surfactants used in the formulation. There is a very low potential for the compound to build up in the tissues of aquatic invertebrates or other aquatic organisms. In water, glyphosate is strongly adsorbed to suspended organic and mineral matter and is broken down primarily by microorganisms.

In relation to shoreline applications, glyphosate is moderately persistent in soil, with an estimated average half-life of 47 days. It is strongly adsorbed to most soils, even those with lower organic and clay content. Thus, even though it is highly soluble in water, field and laboratory studies show it does not leach appreciably, and has low potential for runoff (except as adsorbed to colloidal matter). One estimate indicated that less than 2% of the applied chemical is lost to runoff (Malik et. al., 1989). Microbes are primarily

responsible for the breakdown of the product, and volatilization or photodegradation losses will be negligible.

The manufacturer of Rodeo®, one of the aquatic formulations of glyphosate, recommends use of a nonionic surfactant with all applications to improve efficacy. Of the approved surfactants for aquatic use in Washington, only LI-700 (Loveland Industries, Inc.) may be used for fragrant water lily control and will therefore be applied directly to the water. Based on the results of searches of the published literature and the Toxic Substances Control Act Test Submission (TSCATS) database, little data are available regarding the toxicity of the surfactant formulations (Diamond & Durkin, 1997). The oral LD<sub>50</sub> was >5000 and 5900 mg/kg in male and female rats, respectively, and the dermal LD<sub>50</sub> for a 24-hour exposure was >5000 mg/kg in rabbits. These values are in the same range as glyphosate alone, EPA's toxicity category III, which puts LI-700 in a category of lower risk to mammals.

### **Suitability for Spring Lake**

Aquatic herbicides can provide an effective method for control and eventual eradication of noxious weeds. The use of a formulation of 2,4-D should provide excellent initial control of the Eurasian watermilfoil while allowing for the more-appropriate spot treatments in this scattered infestation. We should be able to avoid an expensive, lake-wide treatment with fluridone for control of Eurasian watermilfoil.

The loose sediments in Spring Lake are high in organic content and are flocculent around much of the lake's littoral zone. There is some concern that the granular formulations of 2,4-D BEE found in Navigate® and AquaKleen® may settle by gravity into these sediments, which could inhibit the release of the 2,4-D to the water column. Obviously, if this was the case, we may not achieve the predicted level of control of Eurasian watermilfoil because the concentrations released to the water column may not be high enough to kill the plants. Since the liquid formulation 2,4-D DMA is now available for use in Washington State, this may provide better control than the granular formulation. The 2,4-D DMA also carries with it the reduced acute toxicity reported above, which could mitigate any potential harm to fish and their food web. The cost of 2,4-D DMA is about the same as 2,4-D BEE, so there are no cost considerations. In addition, work in 2002 with 2,4-D DMA in Lake Washington resulted in excellent control of milfoil with almost no regrowth (D. Dorling, pers. comm.). Spring Lake does not appear to have anadromous salmonids, but Tributary 0328 does receive use by Coho salmon. Neither formulation of the herbicide (2,4-D BEE or 2,4-D DMA) should have any downstream effects since the rapid hydrolysis to 2,4-D acid produces a chemical that is practically non-toxic.

Glyphosate should be very effective on the other target species: purple loosestrife, fragrant water lily, and yellow flag iris. Westerdahl and Getsinger (1988) report excellent control of the fragrant water lily with glyphosate. Generally glyphosate is the recommended herbicide for water lily control because it can be applied directly to the floating leaves, unlike fluridone or endothall 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 water lily is easy to measure through visual surveys due to the floating leaves.

Glyphosate should provide excellent systemic control of mature purple loosestrife plants and seedlings. This herbicide is very effective on purple loosestrife and we can expect better than 70-80% control on existing plants after Year 1. Seeds of purple loosestrife can remain viable for three years in the laboratory, but may remain viable for a much shorter time in the natural environment (Washington State Noxious Weed Control Board, 1997). Therefore, the existing mature plants and seedbank may be exhausted within the time frame of the project. Finally, Glyphosate should also provide excellent systemic control of yellow flag iris. This species has an abundant leaf surface area to absorb the chemical for translocation to the rhizome. The use of an herbicide will enable the elimination of the mature plants without potentially destructive disturbance of the shoreline by excavation. The herbicide used for milfoil control, 2,4-D, may also be an effective alternative for the purple loosestrife and yellow flag iris control efforts. However, this chemical is more expensive, so an evaluation of the effectiveness of glyphosate on these species will determine whether a change in herbicide would be beneficial.

One of the main reasons to eradicate milfoil and fragrant water lily is to maintain the health of the native aquatic plant community for all of the species that utilize them in their life cycles, as well as to maintain the viability of the lake for human recreational uses. The nature of the control methods to be implemented will minimize impacts to native aquatic vegetation. The control of the Eurasian watermilfoil and fragrant water lily will be conducted by methods designed to preserve (and eventually enhance or conserve) the native plant communities. Herbicide selective to Eurasian watermilfoil will be used for its control and will not require a whole-lake treatment that would expose all the submersed plants to the herbicide. The herbicide for the fragrant water lily will be applied to the floating leaves, and therefore should be easily focused to kill only the target vegetation. Follow-up control methods (diver hand pulling and/or diver dredging) will focus specifically on these two target species and should also leave beneficial plants intact. With these constraints in place, conservation areas should not need to be established to serve vital ecosystem functions until native plants re-establish. The application of herbicide to the emergent species (purple loosestrife and yellow flag iris) will also be conducted by manual spot applications. An experienced herbicide applicator can selectively target individual weed species and limit collateral damage to other species to a minimum. 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 Spring Lake are still confined largely to the shoreline, it should be relatively simple for the control applicator to avoid collateral damage and preserve the native plant community.

We do not anticipate any need to revegetate after controlling the milfoil and fragrant water lily since only about 23% of the lake is currently colonized with aquatic plants. In the terrestrial environment in the Pacific Northwest, bare ground will often be colonized rapidly by invasive species, but this is not usually a problem in lacustrine areas. A

drawback of using herbicides is the “uplifting” of mats of decomposing water lily roots that can form large floating islands in the waterbody after the herbicides have killed the plants. Most of the water lilies are in small, discrete circular patches as opposed to large monospecific stands. These smaller areas may not generate floating sediment mats because of their size, but there are several places in Spring Lake with a larger area covered with fragrant water lily. Volunteers from the community will remove any sediment mats created in these areas, for which we will need to get Hydraulic Project Approval from Washington Fish & Wildlife. For smaller mats, we may tow them to shore and remove the sediment with hand tools. If larger mats occur, we will have to investigate machinery mounted on a barge to dig or dredge out the sediment mat.

Past community efforts at Spring Lake have used aquatic herbicides, so we do not anticipate disagreement with this recommendation from the community. Initial support has been documented in the form of signatures on a Letter of Support distributed after the second watershed-wide meeting on September 19, 2002.

Many of the residences on Spring Lake have water rights, although finding a comprehensive list of water right holders has proven difficult. For a list of know water rights, refer to Appendix E. To ensure that all residents who might draw water from the lake are aware of water use restrictions, there will be announcements sent to all lakeside residents prior to each herbicide treatment. One announcement will be sent at the beginning of the summer with approximate dates of planned treatments, and subsequent announcements will be sent 7-10 days prior to each treatment, with exact dates of treatment and use restrictions.

## **MANUAL METHODS**

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### **Hand-Pulling**

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 three 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.

### **Cutting**

Cutting 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 – 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 that 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.

## **Raking**

A sturdy rake makes a useful tool 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.

## **Cleanup**

All of the manual control methods create plant fragments. It's important to remove all fragments from the water to prevent them from re-rooting or drifting onshore. Plants and fragments can be composted or added directly to a garden.

## **Advantages**

- Manual methods are easy to use around docks and swimming areas.
- The equipment is inexpensive.
- Hand-pulling allows the flexibility to remove undesirable aquatic plants while leaving desirable plants.
- These methods are environmentally safe.
- 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 *Aquatic Plants and Fish* (publication #APF-1-98) available from the Washington Department of Fish & Wildlife

## **Disadvantages**

- As plants re-grow or fragments re-colonize the cleared area, the treatment may need to be repeated several times each summer.
- Because these methods are labor intensive, they may not be practical for large areas or for thick weed beds.
- Even with the best containment efforts, it is difficult to collect all plant fragments, leading to re-colonization.
- Some plants, like water lilies which have massive rhizomes, are difficult to remove by hand pulling.

- Pulling weeds and raking stirs up the sediment and makes 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

Permits are required for many types of manual projects in lakes and streams. The Washington State Department of Fish and Wildlife requires a *Hydraulic Project Approval* permit for all activities taking place in the water including hand pulling, raking, and cutting of aquatic plants.

## Costs

- 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 35-75 cents per foot).

## Other Considerations

Does community want to invest in weed rakes, other equipment?

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

## Suitability for Spring Lake

- These methods will be important beginning at the end of Year 1, after the chemical control methods have been evaluated for their effectiveness. At this point, diver hand-pulling should be sufficient to remove all of the remaining Eurasian watermilfoil plants.
- Manual methods will also be vital in combating new infestations of Eurasian watermilfoil in subsequent years, especially around the boat launch
- The currently infested areas are too large (and will be even bigger summer 2003) to use manual techniques as the sole source of control for Eurasian watermilfoil and fragrant water lily. Costs would be much higher than for an integrated approach.
- Manual methods have the potential for missing Eurasian watermilfoil plants, especially after stirring up sediments.
- Manual methods have the potential for fragmentation, exacerbating the existing Eurasian watermilfoil problem

- Cutting can be used to control small areas of fragrant water lily, especially those close to the shoreline. Using this method out in the open water would require a stable boat (not canoe) and great care not to injure oneself or another passenger. Since repeated cutting over several seasons may be required to starve the roots, this would fit best as a supplement to other control methods.
- Many landowners have already been manually removing their loosestrife for several seasons. This does not kill the mature perennial plants, but does halt seed production and can contain the infestation at current levels. If done repeatedly over several seasons it should starve the roots and kill the plants.
- Many of the purple loosestrife plants, especially along the fen, have been weakened by repeated cutting several times a season but continue to flower each year. Access to these plants requires traversing mud flat areas and trampling of wetland vegetation. In the short term, areas bounce back from these impacts, but repeated access can create permanent damage to complete the manual control efforts.
- Manual removal of seedlings (pulling) of purple loosestrife is much easier than the removal of well-rooted, mature plants. This technique can be used to exhaust the seed bank and supplement other eradication efforts.
- Manual efforts are much more difficult on yellow flag iris since the plants don't emerge from simple stems that can be cut, and they arise from massive rhizomes inhibiting pulling or digging. The area is also dangerous for volunteers due to the deep muck along the lakeshore. The area south of the boat launch at the north end of LCR 28 has an especially heavy concentration of yellow flag iris. There is a large amount of root mass associated with the iris in this area that would take a significant effort to remove by excavation, while potentially disturbing part of the fen plant communities. This would also expose the face of the peatland, which could contribute to desiccation and disintegration of the fen edge. This could lead to water quality problems.

### **DIVER DREDGING**

Diver dredging (suction dredging) is 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 Eurasian watermilfoil, 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 back 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 acres per day to one 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, milfoil plants tend to break off leaving the roots behind and defeating the purpose of diver dredging.

Diver dredging has been used in British Columbia, Washington, and Idaho to remove early infestations of Eurasian watermilfoil [site source]. In a large-scale operation in western Washington, two years of diver dredging reduced the population of milfoil by 80 percent (Silver Lake, Everett). Diver dredging is less effective on plants where seeds, turions, or tubers remain in the sediments to sprout the next growing season. For that reason, Eurasian watermilfoil is generally the target plant for removal during diver dredging operations.

### **Advantages**

- Diver dredging can be a very selective technique for removing pioneer colonies of Eurasian watermilfoil.
- Divers can remove plants around docks and in other difficult to reach areas.
- Diver dredging can be used in situations where herbicide use 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 or long-buried toxic materials into the water column.
- Only the tops of plants growing in rocky 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**

Permits are required for many types of projects in lakes and streams. Diver dredging requires Hydraulic Approval from the Department of Fish and Wildlife. Check with your city or county for any local requirements before proceeding with a diver-dredging project. Also diver dredging may require a Section 404 permit from the U.S. Army Corps of Engineers.

### **Costs**

Depending on the density of the plants, specific equipment used, number of divers and disposal requirements, costs can range from a minimum of \$1,500 to \$2,000 per day.

### **Other Considerations**

- Might be good spot control method in subsequent years (coordinated with diver survey)

## Suitability for Spring Lake

- As with diver hand pulling, diver dredging could be used after the initial herbicide applications to remove plants that were missed or unaffected by the herbicide. The soft organic sediments in Spring Lake should make this method effective. However, permit costs may warrant having this work done as diver hand pulling since the roots should be largely removed from the loose sediments without the need for dredging.
- Diver dredging greatly disturbs sediments and can affect nutrient concentrations and algal production in the lake (see Disadvantages above). If other techniques of removal are suitable, this should not be considered.

## **BOTTOM SCREENS**

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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, and woven synthetics can all be used as bottom screens. Some people report success using pond liner materials. There is also a commercial bottom screen fabric called Texel, a heavy, felt-like polyester material, which is specifically designed for aquatic plant control.

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 window screen, 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 two years, plants can grow through window screening material, and can grow on top of felt-like Texel fabric. Regular maintenance is essential and can extend the life of most bottom barriers.

Bottom screens will control most aquatic plants, however freely-floating species such as the bladderworts or coontail will not be controlled by bottom screens. Plants like Eurasian watermilfoil will send out lateral surface shoots and may canopy over the area that has been screened giving less than adequate control.

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. For these projects, we suggest using burlap with rocks or burlap sandbags for anchors. By the time the material decomposes, the milfoil patches will be dead as long as all plants were completely covered. Snohomish County staff reported native aquatic plants colonizing burlap areas that covered pioneering patches of Eurasian watermilfoil. When using this technique for Eurasian watermilfoil eradication projects, divers should recheck the screen within a few weeks to make sure that all milfoil plants remain covered and that no new fragments have taken root nearby.

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 (see instructions for constructing and installing bottom screens).

### **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 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 screens 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**

Bottom screening in Washington 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.

## **Costs**

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.

## **Other Considerations**

- None

## **Suitability for Spring Lake**

- The Eurasian watermilfoil infestation at Spring Lake is too advanced to consider this method for large-scale eradication.
- Most of the lakeshore residences have only small infestations and the bottom barrier would just reduce habitat by covering the sediment.
- Infested areas are too scattered or are too large to use a bottom barrier without becoming cost prohibitive.
- Barriers could be effective at the boat ramp to prevent re-infestation after initial control, or in areas that have dense milfoil and have shown resistance to the herbicide. We plan to install a bottom barrier at the boat launch to provide these benefits.
- Since there is not a swimming beach at Spring Lake, the boat launch seems the only appropriate place to install a bottom barrier to enhance the recreational potential of the lake.

## **BIOLOGICAL CONTROL**

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### **General Overview**

Many problematic aquatic plants in the western United States are non-indigenous species. Plants like Eurasian watermilfoil, Brazilian elodea, and purple loosestrife have been introduced to North America from other continents. Here they grow extremely aggressively, forming monocultures that exclude native aquatic plants and degrade fish and wildlife habitat. Yet, often these same species are not aggressive or invasive in their native range. This may be in part because their populations are kept under control by insects, diseases, or other factors not found in areas new to them.

The biological control of aquatic plants focuses on the selection and introduction of other organisms that have an impact on the growth or reproduction of a target plant, usually from their native ranges. Theoretically, by stocking an infested waterbody or wetland with these organisms, the target plant can be controlled and native plants can recover.

**Classic biological control** uses control agents that are host specific. These organisms attack only the species targeted for control. Generally these biocontrol agents are found in the native range of the nuisance aquatic plants and, like the targeted plant, these biocontrol agents are also non-indigenous species. With classic biological control an exotic species is introduced to control another exotic species. However, extensive research must be conducted before release to ensure that biological control agents are host specific and will not harm the environment in other ways. The authors of *Biological Control of Weeds – A World Catalogue of Agents and Their Target Weeds* state that after 100 years of using biocontrol agents, there are only eight examples, world-wide, of damage to non-target plants, “none of which has caused serious economic or environmental damage...”.

Search for a classical biological control agent typically starts in the region of the world that is home to the nuisance aquatic plant. Researchers collect and rear insects and/or pathogens that appear to have an impact on the growth or reproduction of the target species. Those insects/pathogens that appear to be generalists (feeding or impacting other aquatic plant species) are rejected as biological control agents. Insects that impact the target species (or very closely related species) exclusively are considered for release.

Once collected, these insects are reared and tested for host specificity and other parameters. Only extensively researched, host-specific organisms are cleared by the United States for release. It generally takes a number of years of study and specific testing before a biological control agent is approved.

Even with an approved host-specific bio-control agent, control can be difficult to achieve. Some biological control organisms are very successful in controlling exotic species and others are of little value. A number of factors come into play. It is sometimes difficult to establish reproducing populations of a bio-control agent. The ease of collection of the biocontrol and placement on the target species can also have a role in the effectiveness. Climate or other factors may prevent its establishment, with some species not proving capable of over-wintering in their new setting. Sometimes the bio-control insects become prey for native predator species, and sometimes the impact of the insect on the target plant just isn't enough to control the growth and reproduction of the species.

People who work in this field say that the more biological control species that you can put to work on a problem plant, the better success you will have in controlling the targeted species. There are some good examples where numerous biological control agents have had little effect on a targeted species, and other examples where one bio-control agent was responsible for the complete control of a problem species.

However, even when biological control works, a classic biological control agent generally does not totally eliminate all target plants. A predator-prey cycle establishes

where increasing predator populations will reduce the targeted species. In response to decreased food supply (the target plant is the sole food source for the predator), the predator species will decline. The target plant species rebounds due to the decline of the predator species. The cycle continues with the predator populations building in response to an increased food supply.

Although a successful biological control agent rarely eradicates a problem species, it can reduce populations substantially, allowing native species to return. Used in an integrated approach with other control techniques, biological agents can stress target plants making them more susceptible to other control methods.

A number of exotic aquatic species have approved classic biological control agents available for release in the US. These species include Hydrilla, water hyacinth, alligator weed, and purple loosestrife.

In 1992 three beetles were released in Washington for purple loosestrife control. Their damaging impact on purple loosestrife populations was evident in the Winchester Wasteway area of Grant County in 1996. In 1998, 1999, and 2000, the Washington State Noxious Weed Control Board organized insect collection for state, local, and federal staff. Thousands of insects were collected and distributed to purple loosestrife sites throughout the state and even the United States. The King County Noxious Weed Control Program has placed *Galerucella* sp. from the Winchester Wasteway on a number of purple loosestrife sites. These sites were chosen because of a high density of the target plant and the fact that other control methods were impractical. The sites were in complex wetland habitats with a high presence of native vegetation that would be damaged by chemical applications or repeated foot traffic through the wetland to implement manual control methods.

Another type of biological control uses **general agents** such as grass carp (see below) to manage problem plants. Unlike classical bio-control agents, these fish are not host specific and will not target specific species. Although grass carp do have food preferences, under some circumstances, they can eliminate all submersed vegetation in a waterbody. Like classic biological control agents, grass carp are exotic species and originate from Asia. In Washington, all grass carp must be certified sterile before they can be imported into the state. There are many waterbodies in Washington (mostly smaller sites) where grass carp are being used to control the growth of aquatic plants.

During the past decade a third type of control agent has emerged. In this case, a native insect that feeds and reproduces on northern milfoil (*Myriophyllum sibiricum*) which is native to North America, was found to also utilize the non-native Eurasian watermilfoil (*Myriophyllum spicatum*). Vermont government scientists first noticed that Eurasian watermilfoil had declined in some lakes and brought this to the attention of researchers. It was discovered that a native watermilfoil weevil (*Euhrychiopsis lecontei*) feeding on Eurasian watermilfoil caused the stems to collapse. Because native milfoil has thicker stems than Eurasian watermilfoil, the mining activity of the larvae does not cause it the same kind of damage. A number of declines of Eurasian watermilfoil have been documented around the United States and researchers believe that weevils may be implicated in many of these declines.

Several researchers around the United States (Vermont, Minnesota, Wisconsin, Ohio, & Washington) have been working to determine the suitability of this insect as a bio-control agent. The University of Washington is conducting research into the suitability of the milfoil weevil for the biological control of milfoil in Washington lakes and rivers. Surveys have shown that in Washington the weevil is found more often in eastern Washington lakes and it seems to prefer more alkaline waters. However, it is also present in cooler, wetter western Washington. The most likely candidates for use as biological controls are discussed in the following section.

## **Grass Carp**

<http://www.ecy.wa.gov/programs/wq/plants/management/aqua024.html>

The grass carp (*Cteno pharynogodon*), also known as the white amur, is a vegetarian fish native to the Amur River in Asia. Because this fish feeds on aquatic plants, it can be used as a biological tool to control nuisance aquatic plant growth. In some situations, sterile (triploid) grass carp may be permitted for introduction into Washington waters.

Permits are most readily obtained if the lake or pond is privately owned, has no inlet or outlet, and is fairly small. The objective of using grass carp to control aquatic plant growth is to end up with a lake that has about 20 to 40 percent plant cover, not a lake devoid of plants. In practice, grass carp often fail to control the plants, or in cases of overstocking, all the submersed plants are eliminated from the waterbody.

The Washington Department of Fish and Wildlife determines the appropriate stocking rate for each waterbody when they issue the grass carp-stocking permit. Stocking rates for Washington lakes generally range from 9 to 25 eight- to eleven-inch fish per vegetated acre. This number will depend on the amount and type of plants in the lake as well as spring and summer water temperatures. To prevent stocked grass carp from migrating out of the lake and into streams and rivers, all inlets and outlets to the pond or lake must be screened. For this reason, residents on waterbodies that support a salmon or steelhead run are rarely allowed to stock grass carp into these systems.

Once grass carp are stocked in a lake, it may take from two to five years for them to control nuisance plants. Survival rates of the fish will vary depending on factors like presence of otters, birds of prey, or fish disease. A lake will probably need restocking about every ten years.

Success with grass carp in Washington has been varied. Sometimes the same stocking rate results in no control, control, or even complete elimination of all underwater plants. Bonar *et. Al.* Found that only 18 percent of 98 Washington lakes stocked with grass carp at a median level of 24 fish per vegetated acre had aquatic plants controlled to an intermediate level. In 39 percent of the lakes, all submersed plant species were eradicated. It has become the consensus among researchers and aquatic plant managers around the country that grass carp are an all or nothing control option. They should be stocked only in waterbodies where complete elimination of all submersed plant species can be tolerated.

Grass carp exhibit definite food preferences and some aquatic plant species will be consumed more readily than others. Pauley and Bonar performed experiments to evaluate the importance of 20 Pacific Northwest aquatic plant species as food items for grass carp. Grass carp did not remove plants in a preferred species-by-species sequence in multi-species plant communities. Instead they grazed simultaneously on palatable plants of similar preference before gradually switching to less preferred groups of plants. The relative preference of many plants was dependent upon what other plants were associated with them. The relative preference rank for the 20 aquatic plants tested was as follows: *Potamogeton crispus* (curly leaf pondweed) = *P. pectinatus* (sago pondweed) > *P. zosteriformes* (flat-stemmed pondweed) > *Chara* sp.(muskgrasses) = *Elodea canadensis* (American waterweed) = thin-leaved pondweeds *Potamogeton* spp. > *Egeria densa* (Brazilian elodea) (large fish only) > *P. praelongus* (white-stemmed pondweed) = *Vallisneria americana* (water celery) > ***Myriophyllum spicatum* (Eurasian watermilfoil)** > *Ceratophyllum demersum* (coontail) > *Utricularia vulgaris* (bladderwort) > *Polygonum amphibium* (water smartweed) > *P. natans* (floating leaved pondweed) > *P. amplifolius* (big leaf pondweed) > *Brasenia schreberi* (watershield) = *Juncus* sp.(rush) > *Egeria densa* (Brazilian elodea) (fingerling fish only) > *Nymphaea* sp. (fragrant water lily) > *Typha* sp. (cattail) > *Nuphar* sp. (spatterdock).

Generally in Washington, grass carp do not consume emergent wetland vegetation or water lilies even when the waterbody is heavily stocked or over stocked. A heavy stocking rate of triploid grass carp in Chambers Lake, Thurston County resulted in the loss of most submersed species, whereas the fragrant water lilies, bog bean, and spatterdock remained at pre-stocking levels. A stocking of 83,000 triploid grass carp into Silver Lake Washington resulted in the total eradication of all submersed species, including Eurasian watermilfoil, Brazilian elodea, and swollen bladderwort. However, the extensive wetlands surrounding Silver Lake have generally remained intact. In southern states, grass carp have been shown to consume some emergent vegetation (Washington State Department of Ecology, 2002).

Grass carp stocked into Washington lakes must be certified disease free and sterile. Sterile fish, called triploids because they have an extra chromosome, are created when the fish eggs are subjected to a temperature or pressure shock. Fish are verified sterile by collecting and testing a blood sample. Triploid fish have slightly larger blood cells and can be differentiated from diploid (fertile) fish by this characteristic. Grass carp imported into Washington must be tested to ensure that they are sterile.

Because Washington does not allow fertile fish within the state, all grass carp are imported into Washington from out of state locations. Most grass carp farms are located in the southern United States where warmer weather allows for fast fish growth rates. Large shipments are transported in special trucks and small shipments arrive via air.

Here are some facts about grass carp:

- Are only distantly related to the undesirable European carp, and share few of its habits.
- Generally live for at least ten years and possibly much longer in Washington State waters.

- Will grow rapidly and reach at least ten pounds. They have been known to reach 40 pounds in the southern United States.
- Feed only on plants at the age they are stocked into Washington waters.
- Will not eat fish eggs, young fish or invertebrates, although baby grass carp are omnivorous.
- Feed from the top of the plant down so that mud is not stirred up. However, in ponds and lakes where grass carp have eliminated all submersed vegetation the water becomes turbid. Hungry fish will eat organic material out of the sediments.
- Have definite taste preferences. Plants like Eurasian milfoil and coontail are **not** preferred. American waterweed and thin leaved pondweeds are preferred. Water lilies are rarely consumed in Washington waters.
- Are dormant during the winter. Intensive feeding starts when water temperatures reach 68° F.
- Prefer flowing water to still waters (original habitat is fluvial).
- Are difficult to recapture once released.
- They may not feed in swimming areas, docks, boating areas, or other sites where there is heavy human activity.

### **Advantages**

- Grass carp are inexpensive compared to some other control methods and offer long-term control, but fish may need to be restocked at intervals.
- Grass carp offer a biological alternative to aquatic plant control.

### **Disadvantages**

- Depending on plant densities and types, it may take several years to achieve plant control using grass carp and in many cases control may not occur.
- If the waterbody is overstocked, all submersed aquatic plants may be eliminated. Removing excess fish is difficult and expensive.
- The type of plants grass carp prefer may also be those most important for habitat and for waterfowl food.
- If not enough fish are stocked, less-favored plants, such as Eurasian milfoil, may take over the lake.
- Stocking grass carp may lead to algae blooms.
- All inlets and outlets to the lake or pond must be screened to prevent grass carp from escaping into streams, rivers, or other lakes.

## **Permits**

Stocking grass carp requires a fish-stocking permit from the Washington Department of Fish and Wildlife. Also, if inlets or outlets need to be screened, an Hydraulic Project Approval application must be completed for the screening project.

## **Costs**

In quantities of 10,000 or more, 8 to 12 inch sterile grass carp can be purchased for about \$5.00 each for truck delivery. The cost of small air freighted orders will vary and is estimated at \$8 to \$10 per fish.

The costs for researchers to locate, culture, and test bio-control agents is high. Once approved for use, insects can sell for \$1.00 or more per insect. Sometimes it is possible to establish nurseries where weed specialists can collect insects for reestablishment elsewhere.

## **Other Considerations**

- Would not achieve immediate results – takes time and is not guaranteed to work.
- Community may have concerns with introduced species
- Potential damage to the native plant community of the lake, which could result in the establishment of other aggressive plant species as pioneers
- Concerns from fishermen about grass carp
- Initial investment very expensive
- The introduction of grass carp has generally been discouraged by State agencies, especially in systems like Spring Lake.

## **Suitability for Spring Lake**

- Grass carp are not suitable for aquatic plant control in Spring Lake. The infestation of milfoil has not reached a level where a bio-control such as grass carp would be necessary.
- Their preferred food species include the dominant submersed aquatic species in Spring Lake, which might be grazed before the milfoil. They could remove all the beneficial plants that support a healthy fish population. Without cover and the invertebrates associated with beneficial native aquatic vegetation, the system would be degraded and some species (invertebrates, fish, etc.) may be extirpated.
- The lake also has an outlet stream that eventually flows into another lake, Peterson Lake, making it much more difficult to obtain the permits necessary to stock grass carp.

## Watermilfoil Weevil

The following information and citations on the watermilfoil weevil are taken from the Washington State Department of Ecology's website on Aquatic Plant Management.

<http://www.ecy.wa.gov/programs/wq/plants/management/weevil.html>

The milfoil weevil, *Euhrychiopsis lecontei*, has been associated with declines of Eurasian watermilfoil (*Myriophyllum spicatum*) in the United States (e.g. Illinois, Minnesota, Vermont, and Wisconsin). Researchers in Vermont found that the milfoil weevil can negatively impact Eurasian watermilfoil by suppressing the plants growth and reducing its buoyancy (Creed and Sheldon 1995). In 1989, state biologists reported that Eurasian watermilfoil in Brownington Pond, Vermont had declined from approximately 10 hectares (in 1986) to less than 0.5 hectares. Researchers from Middlebury College, Vermont hypothesized that the milfoil weevil, which was present in Brownington Pond, played a role in reducing Eurasian watermilfoil (Creed and Sheldon 1995). During 1990 through 1992, researchers monitored the populations of Eurasian watermilfoil and the milfoil weevil in Brownington Pond. They found that by 1991 Eurasian watermilfoil cover had increased to approximately 2.5 hectares (approximately 55-65 g/m<sup>2</sup>) and then decreased to about 1 hectare (<15 g/m<sup>2</sup>) in 1992. Weevil abundance began increasing in 1990 and peaked in June of 1992, where 3 – 4 weevils (adults and larvae) per stem were detected (Creed and Sheldon 1995). These results supported the hypothesis that the milfoil weevil played a role in reducing Eurasian watermilfoil in Brownington Pond.

Another documented example where a crash of Eurasian watermilfoil has been attributed to the milfoil weevil is in Cenaiko Lake, Minnesota. Researchers from the University of Minnesota reported a decline in the density of Eurasian watermilfoil from 123 g/m<sup>2</sup> in July of 1996 to 14 g/m<sup>2</sup> in September of 1996. Eurasian watermilfoil remained below 5 g/m<sup>2</sup> in 1997, then increased to 44 g/m<sup>2</sup> in June and July of 1998 and declined again to 12 g/m<sup>2</sup> in September of 1998 (Newman and Biesboer, in press). In contrast, researchers found that weevil abundance in Cenaiko Lake was 1.6 weevils (adults and larvae) per stem in July of 1996. Weevil abundance, however, decreased with declining densities of Eurasian watermilfoil in 1996 and by September 1997 weevils were undetectable. In September of 1998 weevil abundance had increased to >2 weevils per stem (Newman and Biesboer, in press). Based on observations made by researchers in Vermont, Ohio and Wisconsin it seems that having 2 weevils (or more) per stem is adequate to control Eurasian watermilfoil. However, as indicated by the study conducted in Cenaiko Lake, Minnesota, an abundance of 1.5 weevils per stem may be sufficient in some cases (Newman and Biesboer, in press).

In Washington State, the milfoil weevil is present primarily in eastern Washington and occurs on both Eurasian and northern watermilfoil (*M. sibiricum*), the latter plant being native to the state (Tamayo et. Al. 1999). During the summer of 1999, researchers from the University of Washington determined the abundance of the milfoil weevil in 11 lakes in Washington. They found, that weevil abundance ranged from undetectable levels to 0.3 weevils (adults and larvae) per stem. Fan Lake, Pend Oreille County had the greatest density per stem of 0.6 weevils (adults, larvae and eggs per stem). The weevils were present on northern watermilfoil. These abundance results are well below the recommendations made by other researchers in Minnesota, Ohio, Vermont, and

Wisconsin of having at least 1.5 – 2.0 weevils per stem in order to control Eurasian watermilfoil.

To date, there have not been any documented declines of Eurasian watermilfoil in Washington State that can be attributed to the milfoil weevil, although Creed speculated that declines of Eurasian watermilfoil in Lake Osoyoos and the Okanogan River may have been caused by the milfoil weevil. In Minnesota, Cernaiko Lake is the only lake in that state that has had a Eurasian watermilfoil crash due to the weevil; other weevil lakes are yet to show declines in Eurasian watermilfoil.

Researchers in Minnesota have suggested that sunfish predation may be limiting weevil densities in some lakes (Sutter and Newman 1997). The latter may be true for Washington State, as sunfish populations are present in many lakes in the state, including those with weevils. In addition, other environmental factors that may be keeping weevil populations in check in Washington, but have yet to be studied, include over-wintering survival and habitat quality and quantity (Jester et. Al. 1997; Tamayo et. Al., in press). Although the milfoil weevil shows potential as a biological control for Eurasian watermilfoil more work is needed to determine which factors limit weevil densities and what lakes are suitable candidates for weevil treatments in order to implement a cost and control effective program.

### **Advantages**

- Milfoil weevils offer a biological alternative to aquatic plant control.
- They may be cheaper than other control strategies.
- Biocontrols enable weed control in hard-to-access areas and can become self-supporting in some systems.
- If they are capable of reaching a critical mass, biocontrols can decimate a weed population.

### **Disadvantages**

- There are many uncertainties as to the effectiveness of this biocontrol in western Washington waters.
- There have not been any documented declines of Eurasian watermilfoil in Washington State that can be attributed to the milfoil weevil.
- Many of our lakes, including Spring Lake, have introduced sunfish populations that may predate on the milfoil weevils.
- Bio-controls often don't eradicate the target plant species, and there would be population fluctuations as the milfoil and weevil follow predator-prey cycles.

## **Permits**

The milfoil weevil is native to Washington and is present in a number of lakes and rivers. It is found associated with both native northern milfoil and Eurasian watermilfoil. A company is selling milfoil weevils commercially. However, to import these out-of-state weevils into Washington requires a permit from the Washington Department of Agriculture. As of October 1, 2002 no permits have been issued for Washington.

## **Suitability for Spring Lake**

- Since the milfoil weevil is a new bio-control agent, it has not been released yet intentionally in western Washington to control Eurasian watermilfoil. It is uncertain how effective the weevil will be and whether populations per stem can be maintained at levels high enough to eradicate Eurasian watermilfoil.
- Also, as with the grass carp, the infestation of milfoil in Spring Lake is not heavy enough to warrant bio-control introduction when other methods are still available.

## **ROTOVATION, HARVESTING, AND CUTTING**

### **Rotovation**

Rotovators use underwater rototiller-like blades to uproot Eurasian watermilfoil plants. The rotating blades churn seven to nine 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.

### **Harvesting**

Mechanical harvesters are large machines which both cut and collect aquatic plants. Cut plants are removed from the water by a conveyor belt system and stored on the harvester until disposal. 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.

### **Cutting**

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

## **Suitability for Spring Lake**

None of these options are suitable for the level of infestation at Spring Lake. They are not eradication tools, but rather are used to manage and control heavy, widespread infestations of aquatic weeds. These processes create plant fragments, and therefore should not be used in systems where milfoil is not already widespread. In a moderate infestation such as Spring Lake, these methods would probably serve to spread and expand the infestation. According to Ecology, "There is little or no reduction in plant density with mechanical harvesting." Since the aim of this project is to eliminate milfoil from the system, 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 a system that does not already receive dredging for navigability.

## **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 waterbody for extended periods of time. Water level drawdown often occurs regularly in reservoirs for power generation, flood control, or irrigation; a side benefit being the control of some aquatic plant species. However, regular drawdowns can also make it difficult to establish native aquatic plants for fish, wildlife, and waterfowl habitat in some reservoirs.

## **Suitability for Spring Lake**

Drawdown is not a viable control strategy for Spring Lake. The outlet from Spring Lake is a natural stream through a wetland system 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. The amount of drawdown required to impact milfoil would dry out the littoral zone of the lake. This would damage native plants and animals in both the lake and the adjacent wetland and have many negative consequences for residents living around the lake. Without a surface inflow to the system, returning the water level to a previous state would be both cost and time prohibitive.

## **NUTRIENT REDUCTION**

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### **Nutrient Reduction Alternative**

At lakes in watersheds with identifiable sources of excess nutrients, a program to reduce nutrients entering the lake could possibly be an effective method of controlling aquatic vegetation. Sources of excessive nutrients might include failing septic tanks, other accidental or planned wastewater effluent, or runoff from agricultural lands. If nutrient reduction were enacted as the primary method of weed control, extensive research would be necessary to determine the current nutrient budget for the lake and surrounding

watershed, whether nutrient reduction would result in milfoil reduction, and to identify and mitigate the natural and human-mediated nutrient sources.

### **Suitability for Spring Lake**

Nutrient reduction is not an appropriate control measure for Spring Lake for several reasons. First, there are few identified sources of high nutrient input. The rate of septic tank failure was estimated to be 11.5%, only slightly above the 8.8% average for the entire Cedar River Basin Planning area. (King County, 1993) While there are a number of small noncommercial farms in the Peterson Creek subbasin that have the potential to contribute nutrients to the system, stormwater samples taken at the mouth of Peterson Creek do not indicate current septic or agricultural nonpoint pollution problems. Conditions reported in 1993 are very similar to current conditions in the Peterson Creek subbasin, due in part to wetland catchments within the subbasin being designated as Wetland Management Areas in the Cedar River Basin Plan (A. Biklé, pers. comm. 2003).

Second, recent water quality data collected through the King County Lake Stewardship Program's volunteer monitoring program, (Tables 1 and 4), do not show phosphorus and nitrogen levels to be inordinately high (King County, 2003).

And finally, nutrient reduction measures are not likely to be an effective control on milfoil. Milfoil has the ability to live in various environmental conditions; it can withstand a broad range of aquatic environments, from oligotrophic to eutrophic waters, and it grows in water depths from as shallow as 0.5 meters to as deep as 8 meters. It also can grow in substrates ranging from poor, sandy sediment to highly organic soils and can survive in wide ranges of salinity, pH, and temperature conditions (Aiken et al., 1979; Nichols and Shaw, 1986; Smith Barko, 1990, as cited in Sheldon and Creed, 1995).

Neither the data from the *Cedar River Current and Future Conditions Report*, nor the water quality data from the King County volunteer monitoring program (Tables 1 and 4), suggest a need to reduce significantly the external nutrient loads to Spring Lake.

While water quality improvements would likely result if each watershed resident reduced or eliminated sources of nutrient input to the lake, this would not be likely to be an effective primary method of controlling aquatic weeds. Nutrients in the sediments would be more likely to have an impact, since milfoil and other targeted aquatic weed species obtain more than 85% of their nutrients from the sediment (Jonathan Frodge, pers. comm. 2003). Such an effort would be beyond the scope of any project that could be undertaken at Spring Lake.

Table 4: Recent Spring Lake Water Quality data  
From the King County Volunteer Monitoring Program

Date	Secchi Depth (m)	Chl-a (ug/l)	Total Phosphorus (ug/l)	Total Nitrogen (ug/l)
30-Apr-00	2.3	3.00	12.4	752
14-May-00	2.0	2.20	10.8	674
29-May-00	2.3	7.10	13.6	572
11-Jun-00	2.3	7.30	12.0	510
25-Jun-00	2.0	5.60	10.5	431
9-Jul-00	2.0	6.90	9.8	381
23-Jul-00	2.3	3.10	7.8	360
6-Aug-00	2.8	1.60	6.1	334
20-Aug-00	2.5	1.90	8.1	370
4-Sep-00	2.8	2.20	9.7	415
1 oct 00	3.0	3.80	13.6	355
15-Oct-00	2.5	7.60	10.6	311
6-May-01	2.0	6.6	11.9	469
20-May-01	2.8	5.25	11.1	409
3-Jun-01*	2.5	6.57	64.1	358
17-Jun-01	2.0	4.95	16.3	364
1-Jul-01	2.3	3.4	8.7	353
15-Jul-01	2.8	3.16	9.1	350
29-Jul-01	2.5	3.42	5.2	345
12-Aug-01	2.5	1.54	6.5	355
26-Aug-01	3.0	2.79	7.5	370
9-Sep-01	3.0	1.74	10.2	378
23-Sep-01	3.3	1.86	8.8	313
7-Oct-01	3.0	3.16	11.4	361
21-Oct-01	2.8	5.51	10.8	348
21-Apr-02	2.0	4.49	13.8	708
5-May-02	2.0	2.36	27.9	761
19-May-02	1.8	3.36	9.9	605
2-Jun-02	1.8	5.44	12.1	535
16-Jun-02	1.8	5.93	11.7	498
30-Jun-02	2.0	5.85	13.1	365
15-Jul-02	2.4	4.61	10.9	371
28-Jul-02	2.8	3.36	8.7	376
11-Aug-02	2.3	3.20	6.8	352
25-Aug-02	3.3	3.36	12.3	390
8-Sep-02	4.0	3.89	18.5	452
22-Sep-02	3.3	2.40	8.9	342
6-Oct-02	3.8	2.85	11.6	296
20-Oct-02	3.3	5.16	11.3	335
<b>Mean</b>	<b>2.6</b>	<b>4.06</b>	<b>12.4</b>	<b>426</b>
<b>Max</b>	<b>4.0</b>	<b>7.60</b>	<b>64.1</b>	<b>761</b>
<b>Min</b>	<b>1.8</b>	<b>1.54</b>	<b>5.2</b>	<b>296</b>

\* TP values unusually high for most lakes in program on 3-Jun-01; possible laboratory error.

## **NO ACTION ALTERNATIVE**

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One option for managing aquatic weeds in Spring 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.

### **Suitability for Spring Lake**

The milfoil infestation is currently moderate in density; unless control measures are enacted, it is likely to increase each growing season in the future until the entire littoral zone of the lake is dominated by milfoil. Based on results of informal surveys by residents and King County staff, the infestations of milfoil, purple loosestrife, and fragrant water lily have greatly increased since the last comprehensive plant survey in 1994 (King County, 1996). If there is no control effort, it is likely that weed infestations will continue to grow, making Spring Lake a prime source of milfoil fragments for other nearby lakes with public access and boat launch facilities, as well as a potential source of seed spread by purple loosestrife. Even if some of the residents chose to control the aquatic weeds near their properties, pockets of milfoil would remain. The surviving plants would fragment each autumn, spreading to other areas of the lake, including those that were treated by residents. The no action alternative is not preferred by members of the Spring Lake community, or the King County Department of Natural Resources and Parks.

## **INTEGRATED TREATMENT PLAN**

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Spring Lake and its associated shoreline contain four listed noxious weed species that should have control measures implemented to halt the spread of their invasions and reverse the degradation currently occurring. The four target species are the Eurasian watermilfoil (*Myriophyllum spicatum*), fragrant water lily (*Nymphaea odorata*), purple loosestrife (*Lythrum salicaria*), and yellow flag iris (*Iris pseudacorus*). Although all four species at Spring Lake are highly aggressive and are difficult to control/eradicate, we believe that the goal of eradication is reasonable for all of them, and we can be successful within the time frame of the project.

### **Eurasian watermilfoil (*Myriophyllum spicatum*)**

Initial control of Eurasian watermilfoil will be accomplished using an aquatic formulation of 2,4-D (DMA\*4IVM®, Aquakleen® or Navigate®) in late May to early June over approximately 12 acres of milfoil-infested area as found in surveys for the King County Regional Milfoil Plan. The contractor surveys the entire lake with divers using a GPS and

marking all the points that need treatment. The areas are marked on the water's surface with buoys and then the application is performed from a boat using trailing hoses to disperse the herbicide underwater. Due to the nature of the sediments in Spring Lake (as described in Aquatic Plant Control Alternatives), 2,4-D DMA is the preferred formulation. Eradication of Eurasian watermilfoil is the end goal. A follow-up application in Year 1, about three weeks after the first will aim to pick up missed plants or late emergents. We will plan for a maximum of 25% of the original area of 12 acres to need the second treatment. Diver hand-pulling (or diver dredging) will clean up any remaining milfoil found after both herbicide applications have had time to take effect (i.e. two to three weeks after the second herbicide treatment).

We will be installing a bottom barrier at the boat launch in the winter of Year 1 to ensure eradication in the vicinity, and to aid in preventing new introductions. We will continue community education efforts, including training in milfoil identification and survey methods. There will also be an increase in the signage at the boat launch.

The NPDES permit coverage from WSDA requires notification and posting of the waterbody, and these specific protocols will be followed. The NPDES permit also requires monitoring of the herbicide levels in the lake after treatment. Independent samples will be collected at the time of the application and again five days post treatment. A baseline sample will also be taken before the application, since Water Quality experts at Ecology report heightened levels of 2,4-D in our surface waters due to runoff after heavy storm events (K. Hamel, pers. comm.) One sample is taken from within the treatment area, and one from outside. These four samples (per application) will be sent to an independent, Ecology-accredited laboratory for the analysis. As more of these samples need to be analyzed to meet NPDES requirements, some companies may get an ELIZA test accredited through Ecology which will be less expensive. As the permit stands in 2003, this procedure will be performed each year an application for milfoil is conducted. 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 milfoil control for Year 1 (and subsequent years).

Problems may arise if the same firm that conducted the herbicide application also surveys for the success of the effort. We plan to hire a separate, independent firm to conduct these surveys to overcome this potential problem. Volunteers from the Spring Lake community will be directly involved with overseeing the implementation of control work to keep the contractors accountable.

Year 2 will begin with diver surveys of the lake to check the status of the infestation. Spot herbicide treatment with 2,4-D (DMA\*4IVM®, Aquakleen® or Navigate®) will begin in late May to early June over an estimated maximum of 50% of the original milfoil infested area (max. six acres). Obviously, if the diver surveys find greater than six acres need to be treated, the real infestation size will be accommodated. At this point we will have a sense as to whether the 2,4-D has eliminated a significant amount of the Eurasian watermilfoil, or whether it has seemed to become less effective. By late summer 2004, Triclopyr (Garlon 3A) should be fully approved for aquatic use by U.S. EPA and by the State of Washington. We may a shift from 2,4-D to Triclopyr if we find that the milfoil has build up an herbicide resistance.

After the first herbicide application in Year 2, we will conduct the first diver hand-pulling/ diver dredging about three to four weeks after the herbicide treatment. We plan for a maximum of 25% of the original area (or three acres) to need the first manual removal. We will follow this with a second hand-pulling/diver dredging in late August as needed. At this point, we hope that less than 10% of the original area (or one acre) will be involved. Annual maintenance of the bottom barrier at the boat launch will consist of removal of rooted plants and sediment accumulations, as well as securing the barrier to the bottom to ensure safety and effectiveness. Continued community education will complete our Eurasian watermilfoil efforts for Year 2 (see Continuing Community Education, p. 10).

Year 3 will again begin with diver surveys of the lake to assess the milfoil distribution. If herbicide is needed, and the 2,4-D has been effective and we have not found the need to switch to Triclopyr, we will stay with the original active ingredient for the herbicide treatment in Year 3. However, if we have seen signs of herbicide resistance and the Triclopyr application from Year 2 was completed and was effective, we will use Triclopyr to initiate our control program for Year 3. We project that no more than an acre total of Eurasian watermilfoil will need this treatment. We will then use diver hand-pulling/ diver dredging as necessary if individual plants are discovered in our mid-summer survey. Annual maintenance of the bottom barrier at the boat launch and continued community education will complete our Eurasian watermilfoil efforts for Year 3.

In Years 4-7 (and beyond), diver and surface surveys will occur at least twice during the growing season. Because permits for herbicide applications must be acquired far in advance, we plan to rely on diver hand-pulling as the control method. If at any point we find that we are losing ground on eradication efforts, we will apply for the appropriate permits and perform spot applications with either 2,4-D (or Triclopyr) based on cost-benefit analysis. We will need to continue the bottom barrier maintenance annually.

There should be no need to revegetate the areas of Eurasian watermilfoil after treatment. Most of the native submersed species are monocots (*Potamogeton* sp.) that should be relatively unaffected by either the 2,4-D (or Triclopyr) application. Removing the noxious invaders will halt the degradation of the system and allow the dynamic natural equilibrium to be maintained.

Eurasian watermilfoil (*Myriophyllum spicatum*) should be eliminated by this outlined integrated approach. Two herbicide applications per season in the first year(s), followed by manual methods, should ensure that no milfoil plants survive. Once the established plants are eradicated, and follow up surveys have verified their absence for several seasons, potential reintroduction will be a remaining challenge. Any areas that dewater will be checked for milfoil seedlings. Since Spring Lake does not currently have prolific plant growth, milfoil plants should be found easily and manual control methods should prove more effective than in a lake with dense beds of native vegetation.

### **Fragrant water lily (*Nymphaea odorata*)**

Control efforts on the fragrant water lily will begin in the mid-summer of Year 1. The intensity of control will be equal across the entire lake, with eradication as the end goal. The 2,4-D application for the milfoil might have some effect on the fragrant water lily, since it is also a broad-leaved plant and there is some overlap in the distribution of these plants in Spring Lake. However, 2,4-D is reported as not being very effective on this species (K. Hamel, pers. comm.). At the same time as the second herbicide application for the Eurasian watermilfoil in Year 1, we will use Glyphosate (Rodeo® or Aquamaster®) on the fragrant water lilies around the lake. In addition to posting requirements, the NPDES permit requires monitoring of the glyphosate levels in the lake after treatment. Independent samples will be collected about one hour after the application and again 24 hours post treatment. One sample is taken from within the treatment area, and one from outside. These four samples (per application) will be sent to an independent, Ecology-accredited laboratory for the analysis.

Year 2 will undoubtedly include another Glyphosate application. Since the milfoil will be receiving an herbicide treatment, we may again get some control on the water lily from the 2,4-D. However, since the 2,4-D will be applied in spot applications, there may be less and less overlap between the milfoil and fragrant water lily. In either case, a Glyphosate application will be performed when floating leaves have formed on the water lily (approximately the same time as Year 1). One Glyphosate application is planned in Year 2 and will be followed by cutting and removing any plants not killed by the herbicide. This manual control will be performed by the end of the summer before the plants set seed.

In future years, we may need to eliminate returning plants or new infestations. We have planned for a “final” herbicide application in Year 3 as a contingency. Cutting will be used to control small areas of water lily. If the level of water lily infestation again gets to the point where manual control is no longer feasible, we will plan for an herbicide application the following summer. This lead-time is required to get the necessary permits. The native water lily (*Nuphar luteum*) is well represented in the south end of the lake where much of the fragrant water lily is currently found and is likely to expand its distribution. The selective nature of spot applications of Glyphosate should minimize impacts to non-target vegetation, and may allow the native water lily to rebound or expand.

### **Purple loosestrife (*Lythrum salicaria*)**

Control efforts on purple loosestrife will begin on the shoreline along the fen and rest of the Class 1 wetland because of its fragile nature. This is the area south of the boat launch and on both sides of the outlet channel to Tributary 0328. Secondly, we will focus on parcels that have remnant patches of wetland vegetation. Finally, we will work with the rest of the residential parcels with purple loosestrife on their shoreline. We will secure permission from all of the individual landowners before any work proceeds on their land.

One Glyphosate application per year is planned for Years 1-3. Plants will be rechecked 1 month after herbicide application, and any that have produced flowers will be manually controlled before they set seed. These plants will be cut at the base and disposed of as

garbage. Since these purple loosestrife plants are mainly along the shoreline in wetland areas with a dense concentration of native plants, there should be no need to revegetate in LCR28.

Guidance will be provided to residential landowners as to native plants or non-aggressive exotics that would serve well to perform the desired functions of buffer vegetation along their shorelines. Some landowners are concerned with aesthetic elements and would like to replace the beautiful floral display of purple loosestrife, whereas others have ecological concerns about buffering a waterbody with wetland vegetation to help maintain the health of the system. Part of the community education process will be bringing these two different views together to establish more natural landscapes on the residential parcels around the lake, and develop sustainable, noxious-weed-free systems. Purple loosestrife has decreased slightly due to four years of manual control methods, especially along the lake edge of the fen.

### **Yellow flag iris (*Iris pseudacorus*)**

Control efforts on the yellow flag iris will focus initially on just the lakeshore along the fen and Class 1 wetland area. We plan to use a treatment with glyphosate (Rodeo® or Aquamaster®), which should be done at the same time as the purple loosestrife and fragrant water lily control. We would make one herbicide application in each of the first 3 years, restricting these efforts to the shoreline along LCR 28.

Control efforts around the remainder of the lake will be accomplished through educational outreach. We will begin by asking residents to continue taking seed heads off the plants in late summer before they expand the infestation. We will also encourage landowners to start digging out the individual plants on their shoreline. Permission from all of the individual landowners will be necessary before any herbicide work can proceed on their land. These efforts will be ongoing. Since these yellow flag iris plants are mainly along the shoreline in wetland areas with a dense concentration of native plants, there should be no need to revegetate in LCR28. Suggestions will be provided to residential landowners as to native plants or non-aggressive exotics that would serve well to perform the desired functions of buffer vegetation along their shorelines.

### **Lesser cattail (*Typha angustifolia*)**

The infestation of *Typha angustifolia*, a Monitor Species on the Washington State Noxious Weed List, is still in the pioneering stage at Spring Lake. There appears to be just one, discrete stand on the southeastern shoreline. This infestation will be surveyed and recorded with GPS to determine its scope and how many properties are involved. The property owners will be notified about the weed's presence and its potential negative impacts on our native vegetation. The Spring Lake Community Club will work with these landowners to encourage the control/eradication of this infestation through manual, mechanical or chemical means. This species will become part of our plant identification workshops so residents may identify any other pockets on the lake during our annual surveys for the four other target noxious weeds. Herbarium samples will be taken for the

King County Noxious Weed Control Program, Lake Stewardship Program, and the University of Washington Herbarium.

## **PLAN ELEMENTS, COSTS, AND FUNDING**

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Table 5 outlines the tasks and estimated costs of implementation on an annual basis. Implementation of the Spring Lake IAVMP will span at least seven years, at a total estimated cost of \$86,716. The majority of the costs accrue in the first several years, which is the period of most aggressive treatment. Beyond that, costs are directed at detecting and controlling re-introduction of noxious aquatic plant species.

**Table 5. Spring Lake Milfoil Project Budget**

<b>Task</b>	<b>Year 1</b>	<b>Year 2</b>	<b>Year 3</b>	<b>Year 4</b>	<b>Year 5</b>	<b>Year 6</b>	<b>Year 7</b>	<b>7 Yr Total</b>
<b>Herbicide-milfoil</b>	\$9,759	\$3,900						<b>\$13,659</b>
<b>Herbicide - water lily</b>	\$1,000	\$750	\$750					<b>\$2,500</b>
<b>Herbicide-Loosestrife</b>	\$750	\$750	\$500					<b>\$2,000</b>
<b>Herbicide-Yellow Iris</b>	\$750	\$750	\$500					<b>\$2,000</b>
<b>Herbicide Application Permit</b>	\$2,000	\$2,000	\$1,000					<b>\$5,000</b>
<b>Post-treatment monitoring</b>	\$1,200	\$600	\$600					<b>\$2,400</b>
<b>Diver Survey</b>	\$1,600	\$1,600	\$1,600	\$1,600	\$1,600	\$800	\$800	<b>\$9,600</b>
<b>Diver Hand Pull/Diver Dredge</b>	\$7,680	\$10,240	\$1,280	\$1,280	\$1,280	\$640	\$640	<b>\$23,040</b>
<b>Boatlaunch Bottom Barrier</b>	\$1,250	\$215	\$215	\$215	\$215	\$215	\$215	<b>\$2,540</b>
<b>Education and Outreach</b>	\$1,500	\$1,500	\$750	\$750	\$500	\$500	\$500	<b>\$6,000</b>
<b>Printing Costs</b>	\$2,000	\$250	\$250	\$250				<b>\$2,750</b>
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	7 Year Total
<b>Totals</b>	<b>\$ 29,489</b>	<b>\$22,555</b>	<b>\$7,445</b>	<b>\$4,095</b>	<b>\$3,595</b>	<b>\$2,155</b>	<b>\$2,155</b>	<b>\$71,489</b>
					<b>8.8% tax</b>			<b>\$ 6,291.03</b>
					<b>12.5% contingency</b>			<b>\$ 8,936.13</b>
					<b>Project Total</b>			<b>\$ 86,716.16</b>

## **Sources of Funding**

There are several likely sources of funding available for project implementation:

### **Grants**

The Washington State Department of Ecology has an Aquatic Weeds Management Fund (AWMF). This IAVMP was developed to be consistent with all AWMF guidelines and requirements. Given the relatively low-level infestation, outstanding ecological value of Spring Lake and its watershed, and the potential for infestation of neighboring lakes, it is hoped that Ecology and other grant programs will offer funding. Other possible funding sources include King County's WaterWorks and the Natural Resources Stewardship Network.

### **Dedicated non-grant funds from King County**

The King County Noxious Weed Program has limited funds available to contribute to weed control projects. While this can not be considered an ongoing source of funding, \$1000 is promised to the project in the first year of implementation.

### **Community-Based Funding**

There is a proposal before the Spring Lake Community Club to raise annual dues by \$10 or more, with the additional revenue to be dedicated to projects and programs designed to improve lake and watershed conditions. This could generate several thousand dollars over the first five years of the project. Noxious aquatic weed management currently tops the list of threats to the lake.

If funds raised by increasing Community Club dues prove insufficient, community members have discussed forming a Lake Management District. If implemented, a LMD would collect an annual fee from all watershed property owners. Fees would be weighted based on property size and proximity to the lake. Money collected through a LMD must be dedicated to addressing specific problems facing the lake and watershed. This IAVMP will provide some guidance should watershed residents choose to pursue a LMD.

Although not yet researched, one community member offered the idea of purchasing a community bond, the interest of which could be used to fund lake and watershed improvement projects.

### **Matching Funds**

Table 6 shows the matching requirements outlined by Ecology's AWMF and the estimated in-kind match and cash match provided by King county and the Spring Lake Community.

**Table 6. Total Matching Funds**

<b>Total Project cost =</b>		<b>\$ 86,716.16</b>			
		<b>Amt. over required match</b>		<b>Budgeted</b>	<b>% of Total</b>
<b>75% of total project</b>	\$ 65,037.12				
<b>Required in-kind match</b>	\$ 10,839.52	\$735.48		\$11,575.00	13.3%
<b>Required cash match</b>	\$ 10,839.52	\$4,004.08		\$14,843.60	17.1%
		<b>Ecology \$ after match</b>		<b>\$60,297.56</b>	<b>69.5%</b>

**Table 7. In-kind Matching Funds**

<b>Item</b>	<b>Cost</b>	<b>Units</b>	<b>Units/ year</b>	<b>Years</b>	<b>Notes</b>	<b>Total</b>
Volunteer hours	\$ 12.50	per hour	140	5	12-15 very active community members. ~10 certified divers on lake. Time estimates include boat surveys, diver training, bottom barrier maintenance, steering committee meetings, ID workshops, educational flyer development.	\$ 8,750.00
Educational Materials Development and Presentation	\$ 250.00	per year	1	5	Community member time spent developing materials and presenting materials to youth groups and other organizations	\$ 1,250.00
Website	\$ 75.00	per year	1	5	Estimated ISP charges. Development and content update time included in volunteer hours.	\$ 375.00
Boat rental	\$ 40.00	per day	6	5		\$ 1,200.00
<b>Total est. in-kind match</b>						<b>\$ 11,575.00</b>

**Table 8. Cash Matching Funds**

Item	Cost	Units	Units/ year	Years	Notes	Total
Community self-tax	\$ 500.00	per year	1	5	Based on implementation of one or more community-based funding strategies outlined in IAVMP. Will be assessed annually into future (indefinitely).	\$ 2,500.00
KC DNRP Noxious Weed Control Program Cost Share	\$ 1,000.00	per year	1	1	Dedicated cost share funds from Noxious Weed Control Program	\$ 1,000.00
Grants	\$ 1,500.00	per year	1	2	Estimate based on likely sources.	\$ 3,000.00
KC Staff - Environmental Scientist	\$ 38.75	per hour	40	3	See below for salary and burden rates as of 2002.	\$ 4,650.00
KC Staff - Aquatic Noxious Weed Specialist	\$ 30.78	per hour	40	3		\$ 3,693.60
<b>Total est. cash match</b>						<b>\$ 14,843.60</b>

**Table 9. KC Staff Salary and Burden Rates**

Position	Hourly Rate	Benefits - 33%	Paid Time Off - 15%	Overhead - 25% (State allowed rate)	Hourly Burdened Rate
Environmental Scientist	\$ 22.40	\$ 7.39	\$ 3.36	\$ 5.60	<b>\$38.75</b>
Aquatic Weeds Specialist	\$ 17.79	\$ 5.87	\$ 2.67	\$ 4.45	<b>\$30.78</b>

## IMPLEMENTATION AND EVALUATION

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

1. **Convene a project Implementation Committee.** Many Steering Committee members have indicated their willingness to transition into this role.
2. **Review proposed plan and develop timeline with specific tasks.** The IAVMP will guide this process.
3. **Assign tasks to Implementation Committee members.**
4. **Issue a Request for Proposals for weed survey and control work.**
5. **Secure necessary permits.** Permit application will be coordinated with the contracted applicator.
6. **Implement community education plan.**
7. **Apply herbicide treatment.** Application will be completed as prescribed in IAVMP, unless consultation with Ecology and the applicator leads to defensible changes in the plan.
8. **Conduct follow-up surveys.** Professional contractors and community members who have received adequate training can complete this work, with community participation under supervision of King County staff.
9. **Apply follow-up herbicide treatment if necessary.** Follow-up surveys will determine the extent to which this work is necessary.
10. **Conduct diver surveys and hand-pulling as necessary.** Professional contractors and community members who have received adequate training can complete this work, with community participation under supervision of King County staff.

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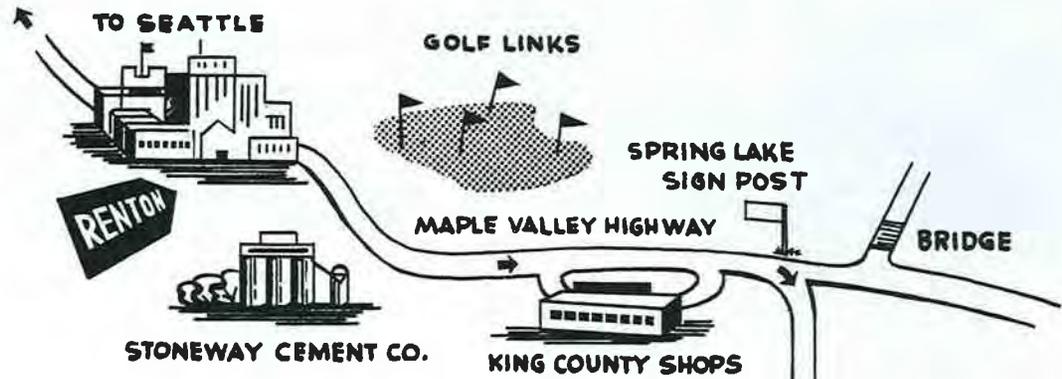
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## APPENDIX A

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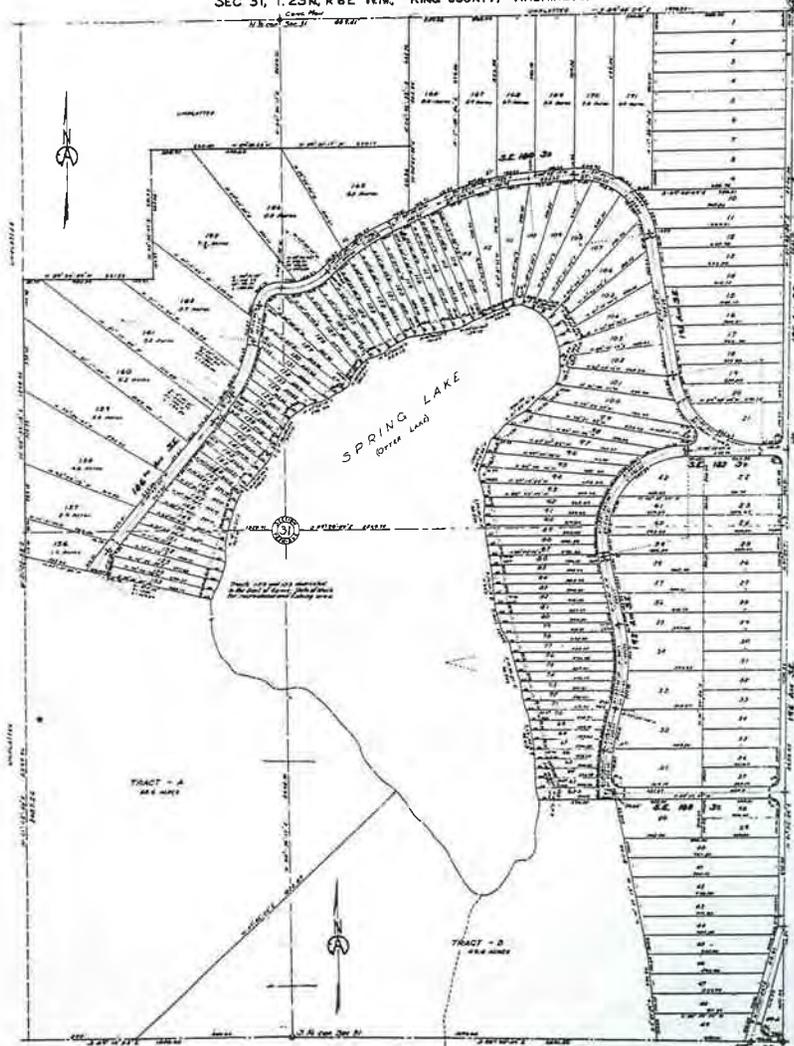
Appendix A contains historical documents compiled from the files of Spring Lake Steering Committee members. The documents are arranged chronologically, beginning with what is believed to be the original plat map from 1949. The appendix also includes invoices from the aquatic herbicide treatment in 1979 as well as promotional literature, letters, and news articles related to the planned development that was never constructed (mid 1960s). This appendix concludes with a letter to the community from Allied Aquatics following the second documented herbicide treatment at Spring Lake in 1989.



### SPRING LAKE

SEC 31, T. 23N, R. 6E WM, KING COUNTY, WASHINGTON

E. A. Duffy  
Engineer  
Jan - 1949



FROM RENTON, DRIVE  
6 MILES ON MAPLE  
VALLEY HIGHWAY.

TURN RIGHT AT HIGH-  
WAY SIGN-POST  
MARKED SPRING LAKE,  
1¼ MILES TO SPRING  
LAKE ENTRANCE  
GATE.



1949

STATE OF WASHINGTON  
ALBERT D. ROSELLINI, Governor



COMMISSIONERS:  
FRANCIS PEARSON, CHAIRMAN  
PATRICK D. SUTHERLAND  
DAYTON A. WITTEN

ADDRESS ALL COMMUNICATIONS TO

~~DAN DONOVAN~~  
~~EXECUTIVE SECRETARY~~

WASHINGTON UTILITIES AND TRANSPORTATION COMMISSION  
OLYMPIA

November 19, 1962

File No. UT-6416

Mr. Henry H. Osthus, President  
Spring Lake Community Club  
18214 186th S. E.  
Renton, Washington

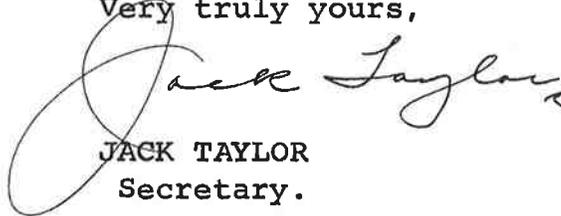
Reference:  
20T-45C-1127

Dear Mr. Osthus:

This will acknowledge receipt by the Commission of the petition of the Spring Lake Community Club to have the Maple Valley-Renton telephone exchange boundary moved in order that the Spring Hill area would be in the Renton Exchange.

We will contact the Pacific Northwest Bell Telephone Company on this matter and as soon as we receive an answer we will advise you of our findings.

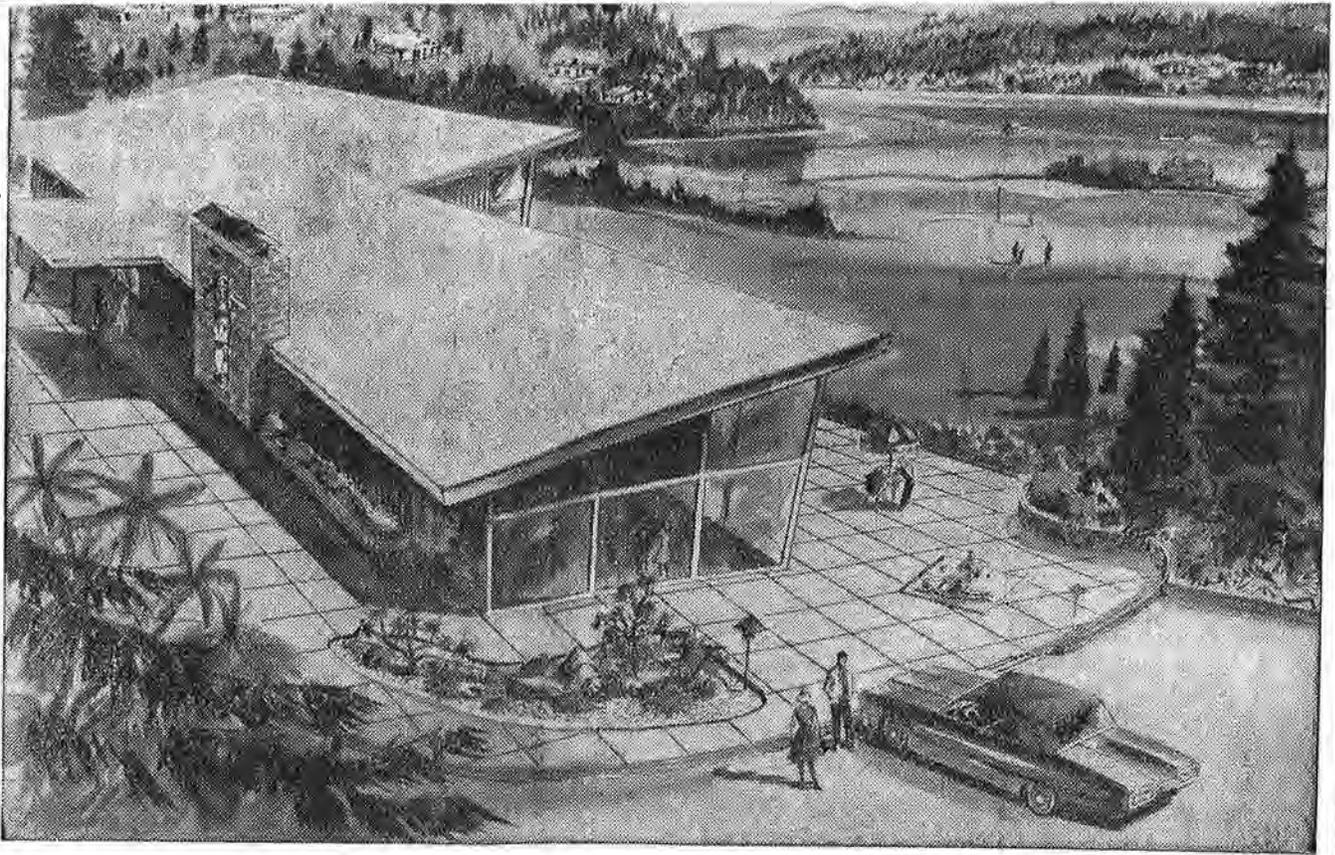
Very truly yours,



JACK TAYLOR  
Secretary.

**OWN A  
CITY  
BLOCK**

**Spring Lake  
Golf and  
Country Club**



**A  
GUARANTEED  
RETURN**

**10 25 and even 100%**

**PROFITS POSSIBLE!**

Now you can participate in the profits of King County's first permanent recreational and residential planned-unit development! Your choice of golf course, waterfront or view blocks. You own the land, we will finance and develop it.

This land is only 30 minutes from downtown Seattle—5½ miles southeast of Renton. Whether you have \$1,000 or \$20,000 to invest, by using leverage, 100% and 200% profits are possible within one or two years.

*Cut out coupon for full information. No obligation.*

**ONLY A LIMITED NUMBER  
BLOCKS AVAILABLE!**

**MAIL NOW FOR EVEN**

**INVESTORS ASSOCIATED, INC.**  
1118-4th Avenue  
Seattle 1, Wash.

Gentlemen: Without obligation show me, how it is possible to double or even triple my investment in LAND, at Spring Lake Golf and Country Club.

Name .....

King County's Greatest Community Newspaper

# Record-Chronicle

A Merger of THE RENTON CHRONICLE and THE RENTON NEWS RECORD

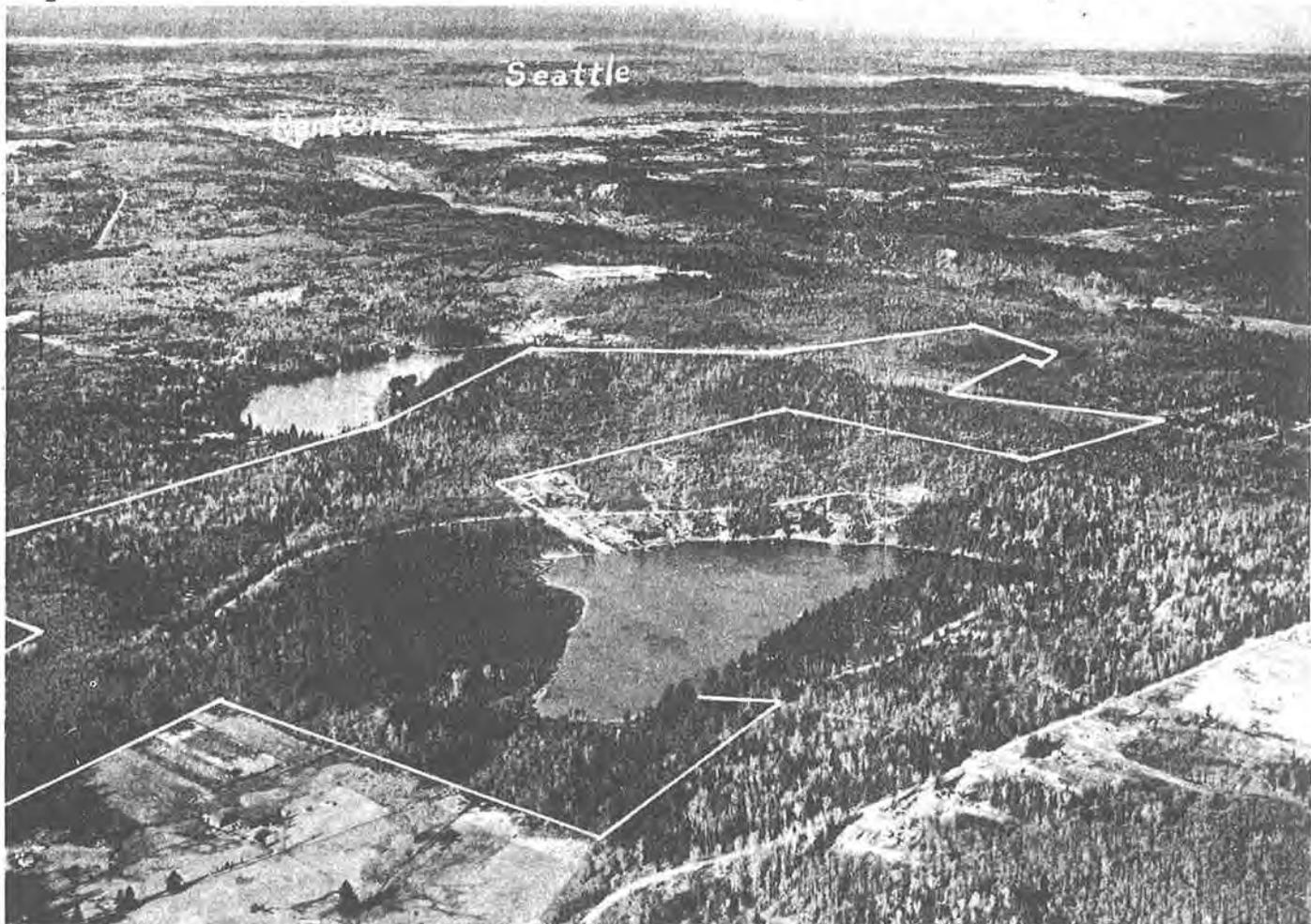
Section One

Single Copy 10c — \$4.00 per year



Renton, King County

## Sylvan Lakeland Center of Development



**VIEW OF THE FUTURE** — Aerial view shows boundaries of Spring Lake Golf and Country Club, under development by Investors Associated of Seattle. Spring Lake is in the foreground, with Lake Desire beyond. Area is at the east end of the Lake Youngs reservoir, to the left and just out of the picture. Underground utility lines will be installed in about two years. The de-

velopers estimate the "planned-unit" development, the first in King County, will be completed in five to seven years. Select community will include over 900 home sites, an 18-hole golf course, five-acre shopping center, modern clubhouse with pro-shop, heated pool and modern treatment plant for sewage.

# Spring Lake Planned Development Will Be First of Kind in County

By Bob Roberts

King County's first "planned-unit" development will be completed in five to seven years, and dominate more than 500 acres of the triangle formed by Spring Lake, Shady Lake and Lake Desire, about six miles east of Renton.

Despite early misgivings of area residents, the proposal by Investors Associated of Seattle to construct a select residential community seems now to have won the approval of most of them.

When it is completed the community, called tentatively the Spring Lake Golf and Country Club, will comprise 918 homes, 440 apartment units, a golf course (the first nine fairways of which will soon be ready for seeding), a five-acre shopping center, club house with pro shop and heated swimming pool, and connection between Spring Lake and Lake Desire to enhance the pleasure and improve the chances of fishermen.

Developers say the layout of streets and installation of underground utilities should be completed in about two years.

The community will be served with water by King County Water District No. 108. It will have sanitary sewers and underground power and telephone service. Concrete curb and gutter and asphaltic streets — with storm sewers will be provided.

Investors Associated holds an option on another 40 acres of nearby land for the location of a sewage plant to serve the community. Plans for this plant already have been cleared with the Washington State Pollution Control Commission.

The Spring Lake development began to take form last year when Investors Associated entered into a contract with Manuel Lott and the Coast Investment Co. who had pur-

chased from Albert Spring in 1962 some 300 acres of property around the lakes.

Spring acquired the land in 1948 from the Weyerhaeuser Co. Spring Lake, Lake Desire and Shady Lake are historically Otter Lake, Echo Lake and Mud Lake, respectively.

The Spring family maintained the seclusion of the property, selling only individual tracts, mostly at the north-eastern end of Spring Lake, and binding them with covenants that guaranteed the beauty and placidity of the region.

It was in the misapprehension that these guarantees were somehow jeopardized when Spring sold the property that opposition developed to the Investors Associated plan.

This, coupled with a misconception of a "planned-unit development" led to fearful speculation that graders and bulldozers were all-but-poised to level the gentle slopes to the lakes to make way for high-rise apartment, laundromats and bowling alleys.

As a matter of fact the terms under which Spring sold the land bind the new owners to the type of development envisioned in the concept of

Spring Lake Golf and Country Club.

Both Albert Spring and his son, Harold, who still lives at Spring Lake, told this writer they believe the Spring Lake Golf and Country Club will prove the means of insuring for the future the pristine loveliness of one of southern King County's real beauty spots.

Property at Spring Lake Golf and Country Club is not cheap. View lots begin at about \$5,000; lots abutting the golf course fairways, about \$7,500, and lake-front lots even higher.

Probably the most controversial of Investors Associated's current plans involves dredging the bed and clearing the debris from a small stream that once formed a natural channel between Spring Lake and Lake Desire.

The developers say restoring this channel will permit the drainage necessary to reclaim marshy land at the ends of and between both lakes.

Engineers describe as "far-fetched" the fear of some that connecting the lakes will either alter the level of water in them or affect its purity. They point out that all five lakes in the area — Spring Lake, Shady

(Continued On Page 2)

# Spring Lakes Development Receives OK

The King County Planning Commission gave preliminary approval yesterday to the plat for the Spring Lakes development—a huge proposed subdivision six miles east of Renton.

Many neighbors were on hand to get all the facts on the 500-acre development, which will have a golf course, shopping center, 918 single-home lots, and 440 apartment units.

**THE PLANNING** Commission decided to require that the developer, Investors Associated, Inc., put in a public sewer system to serve the development, and get Seattle water.

The surrounding residents, among them King County Coroner Leo Sowers, who already have their own water wells and septic tank waste-disposal systems, made it plain they wouldn't want to be assessed for any share of the costs of these improvements to serve the new subdivision.

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# \$25 Million Project Near Renton O. K.'d

A \$25 million housing and land development southeast of Renton got preliminary approval from the King County Planning Commission yesterday.

The commission approved a 600-acre planned unit development around Spring and Shady Lakes proposed by Investors Associated, Inc.

Gerald Rogers, firm president, told the planners that the project, to be completed in five years, will include shopping-center and park developments.

Rogers said plans call for construction of about 900 homes in the \$20,000-to-\$40,000 class. Also planned is construction of 440 apartment-house units.

All residents will be able to use an 18-hole golf course swimming pools and tennis courts.

The project is the first to be approved by the commission as a planned-unit development. The unit method allows developers to concentrate residential properties, such as apartments, in one area if overall land densities are maintained.

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## Winter Storm Pushes Across Plains States

CHICAGO, Feb. 25.—(AP)—A storm pushed across the

## Planners OK Big Housing Project Near Kent

BY FOREST WILLIAMS

The immense new home-development projected for a 500-acre rolling tract east of Kent over a five-year period got the green light yesterday from the King County Planning Commission.

It had been held up from last month when a group of local residents, somewhat amazed at the big things planned for their rural community, came down to the hearing to find out what it was all about.

**YESTERDAY** the Planning Commission was assured that phases of the proposal which had worried their planning staff have been adjusted. There no longer is too much area proposed for apartment houses, nor too much proposed for business.

The lots will average 12,500 square feet in size; the smallest will be 9,600 square feet.

There will be a private golf links and clubhouse, tennis courts, and swimming pool. The Planning Commission was told. It will recommend approval to the County Commissioners.

**THE AREA** lies along SE 172nd and 196th Streets and along Petrovitsky Road to 192nd Avenue SE. The north-south slopes range up to 50 per cent of perpendicular, the southerly half, in excess of 20 per cent.

**STYMIED**—The Sherwood Corporation was turned down in a request to be allowed to erect an apartment house on the east side of 32nd Avenue

There are 137 feet south of NE 149th Street across from Acacia Cemetery. Neighbors in single-family homes objected, though there already is an apartment house, a half-block east, fronting on Bothell Way NE.

**THE MEMBERS** of the Planning Commission, citizens who give their time as a public service, without pay, wound up their day-long session at 5:15 p.m. instead of running to as late as 11 p.m., as has happened in the past.

Asked how this was accomplished, County Planning Director Edward B. Sand, grinned and answered: "Just good planning."

Seattle Post-Intelligencer  
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Wed., Feb. 26, 1964

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# Federal Agency Charges Spring Lake Developers

Four men connected with the controversial Spring Lake development near Renton have been charged in Federal Court in Seattle with "various untrue representations" in the sale of bonds to finance the development and two other projects.

Named in a charge by the Securities and Exchange Commission are Gerald L. Rogers, Thomas B. Moore, Lonzo L. Tackett and Wayne E. Holm, officers and directors of Investors Associated Inc., as well as Securities Sales Co.

The SEC charges that the four defendants and their companies oversold the amount of bonds they were authorized to sell by more than \$500,000. A total of some \$1,200,000 is involved.

The defendants, the SEC said, sold bonds ostensibly to build a nursing and convalescent home in Seattle and a hotel in Mount Vernon as well as the Spring Lake development.

Some of the money was used to purchase "speculative, high-risk stocks" in violation of the company's state permit, the complaint says. The SEC also said the company lacked sufficient liquid assets to redeem the bonds on demand and "had in fact stalled and refused to cash out investors who demanded return of their funds."

The government also claims that periodic returns paid out constituted a repayment of the investors' own funds.

Also named in the complaint are two other corporations, the Hartford Mortgage & Trust Co., an Arizona firm controlled by Rogers and his associates, and Continental Properties of Utah.

The government attorneys asked the court to enjoin the defendants and to appoint a receiver for the defendant corporations.

The Spring Lake development

stirred protests from many 500 acres five miles southeast of Renton.

Protesting the plan were residents of the Spring Lake-Lake Desire area, who said the development would disturb the country atmosphere afforded by the secluded lake properties. The development was to include more than

## Injunction Issued in Case Against Development Firm

The U.S. District Court in Seattle has enjoined developers of the controversial Spring Lake project near Renton from selling securities not listed by the Securities Exchange Commission and has appointed a receiver and three-man advisory board in the case.

Judge William J. Lindberg named Dr. Fred A. Clifton, Des Moines dentist, as receiver for Investors Associated Inc., Securities Sales Co., Hartford Mortgage & Trust Co. and Continental Properties Inc. Offi-

cers of these corporations are Gerald L. Rogers, Thomas B. Moore, Lonzo L. Tackett and Wayne E. Holm.

The injunction and receivership were asked by the SEC in a complaint brought in federal court recently.

The SEC charges that the defendants sold bonds ostensibly to build a nursing home in Seattle, and a hotel in Mount Vernon as well as the Spring Lake development. The agency claims that they oversold the amount of bonds they were

authorized to sell by \$568,000. Dr. Clifton, as receiver, will be advised by Attorney Victor D. Lawrence. An advisory board appointed by Judge Lindberg will supervise the operations of the four firms.

The court case is of special interest here because of the objections that followed announcement of the Spring Lake project last spring. Many residents of the Spring Lake-Lake Desire area objected to the elaborate plan.

WRIGHT, WENDELLS, FROELICH & POWER

LAWYERS

ARTHUR T. WENDELLS  
WAYNE W. WRIGHT  
ALAN L. FROELICH  
LAYTON A. POWER

485 OLYMPIC NATIONAL LIFE BUILDING  
920 SECOND AVENUE  
SEATTLE, WASHINGTON 98104  
MUTUAL 2-1780

IN REPLY REFER TO

OUR FILE NO. 64-144

February 26, 1964

King County Planning Commission  
King County Court House  
Seattle, Washington 98104

Re: ZA 64-016

Gentlemen:

On February 25, the Planning Commission unanimously gave preliminary approval Planned Unit Development Application under the above number. The undersigned represents Spring Lake Community Club, which is vitally interested in the progress of the Planned Unit Development. We have met with the applicants on several occasions, conferred with the Planning Staff, and appeared at two Planning Commission hearings.

As we read Resolution No. 25979, being Subsection 27.01:3, the applicants, after having been granted preliminary approval, shall within one year of this date submit a final development plan for approval by the Planning Commission. This letter is to notify you that the undersigned desires notification of this development at such time as the final plan is submitted. The Resolution is not completely clear on this point, but seems to indicate a second public hearing by the Planning Commission.

We desire to stay informed on the progress of this application and therefore ask that you note this request, file this letter in the application file and inform the undersigned at such time as the final development plan is filed for final Planning Commission approval.

Thank you for your cooperation in this matter.

Yours very truly,

WRIGHT, WENDELLS, FROELICH & POWER

By

Alan L. Froelich

ALF/sk

bcc: Mr. Henry H. Osthus ✓

COPY

# Spring Lake Hassle Apparently Settled

An extended controversy over a proposed water-district annexation in the general region of Spring and Shadow Lakes apparently has been resolved.

Commissioners of King County Water District 108 voted last Wednesday night to annex to the district approximately 1,800 acres running due south to Southeast 224th Street from the district's present southern boundary at Southeast 172nd Street.

Lateral boundaries of the annexation will extend from approximately 180th Avenue Southeast on the west to 196th Avenue Southeast on the east.

Both Shadow Lake and Spring Lake are included in the area, although a small section around the north shore of Spring Lake was deleted. Property owners there have a water supply through wells.

The annexation lies just to

## Another Declined

A proposal to annex another 600 acres lying roughly between Lake Desire and Shady Lake was declined by the commissioners because of opposition by property owners.

The question of annexation has been the subject of a series of hearings, at times heated, that began last December 8.

Much of the controversy seemed to have its genesis in the proposal by Investors Associated, Inc., of Seattle to build a planned-unit development at the south end of Spring Lake.

The King County Planning Commission has since given preliminary approval to the \$25,000,000 land development.

Impartial observers felt opposition to annexation of the area by Water District 108 was tied directly to protests by Spring Lake residents against Investors Associated plans calling for rezoning the south end of the lake.

Rezoning would permit the development firm to construct four - six - and ten-story apartment houses on the steep hillside near the south end of the lake.

## Dredge Plan Hit

Drawing fire also was a proposal to connect Spring Lake and Lake Desire by dredging and widening the bed of a small stream between the two. Since Spring Lake water tests pure, residents feared roiling the marshy south end might contaminate it, and that connecting the lakes might drop the Spring Lake water level to a point where beaches would be impaired or destroyed.

A spokesman for Water District 108 said commissioners will meet Thursday with Henry Osthus, president of the Spring Lake Community Club, in an effort to resolve any differences or misunderstandings still remaining as a result of the protracted controversy.

In addition, the water district has scheduled another special meeting of the board of commissioners March 24.

The meeting will be held at the district office, 19047 S.E. 161st St., at 7:30 p.m.

A & T WEED SERVICE  
 2813-192nd E.  
 Tacoma, Wash. 98445

INVOICE NO.

5731

SOLD TO <i>Henry Osthur</i>		SHIPPED TO	
STREET & NO. <i>18214 W. Sp. Lake Dr. S. E.</i>		STREET & NO.	
CITY <i>Renton, Wash.</i>	STATE <i>WA</i>	ZIP <i>98055</i>	CITY STATE ZIP

INVOICE

CUSTOMER'S ORDER	SALESMAN	TERMS	F.O.B.	DATE
	<i>Jim C</i>	<i>Net 30 day</i>		<i>6/19/78</i>
<i>Initial treatment for Control            of Aquatic Plants in front of            East 141, 142 for Control            with Aquathol granular at            1.5 ppm</i>				<i>\$ 41 30</i>
<i>Thank you</i>				<i>18</i>
<i>Total Due</i>				<i>\$ 41 30</i>

Redifprm  
 7H 721

**A & T WEED SERVICE**  
 2813 192nd E.  
 Tacoma, WA 98445  
 847-6058

CUSTOMER	
* <u>Henry Osthus</u>	
* <u>18214 W. Spring Lake Dr. S.E.</u>	
* <u>Renton, Washington 98055</u>	

**INVOICE**

INVOICE NO. <b>Nº 1040</b>
DATE <u>9/1/78</u>
ACCOUNT NO.
YOUR P. O. NUMBER
TERMS <b>Upon receipt of invoice</b>
SHIP VIA
FOB
SALESMAN <b>Jim C.</b>

QTY.	UNIT	DESCRIPTION	UNIT PRICE	AMOUNT
		Balance due on Lots # 141 - 142 for Spring Lake		
		Management Program		41 31
PLEASE PAY FROM THIS INVOICE			SUB TOTAL	
AN INTEREST CHARGE OF 1% PER MONTH WILL BE APPLIED TO ALL PAST DUE ACCOUNTS.			TAX	
			TOTAL +	41 31

*pd 9/16/78*

ALLIED AQUATICS OF WA INC  
4426 BUSH MTN DR SW  
OLYMPIA, WA 98502

I N V O I C E

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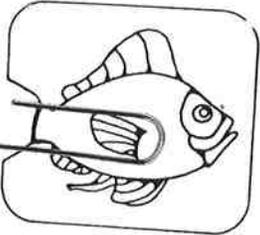
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10/23/89

TO: OSTHUS, HENRY & JOYCE  
18214 W SPR LK DR SE  
RENTON, WA 98058

Memo : 1989 Weed Control

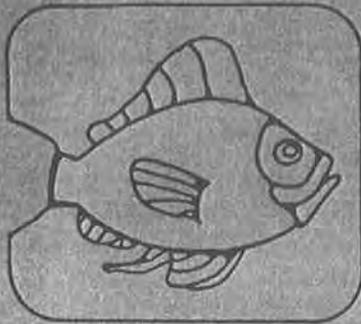
QUANTITY	DESCRIPTION	UNIT PRICE	AMOUNT
	WEED TREATMENT		118.11
	Total Project Cost	\$236.24	
	Paid On Account	(\$118.13)	
	Balance Now Due	\$118.11	
		TOTAL	118.11



ALLIED AQUATICS  
OF WASHINGTON, INC.  
4426 BUSH MOUNTAIN DR. S.W.  
OLYMPIA, WASHINGTON 98502



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ALLIED AQUATICS  
OF WASHINGTON, INC.

## ALLIED AQUATICS

6830 115TH AVE. S.W.  
OLYMPIA, WA 98502  
(206) 357-3285

### 1989 AQUATIC PLANT MANAGEMENT PROGRAM

After a vigorous battle to obtain the necessary permits required to manage your lake for the 1989 season, I am pleased to announce that we currently have a permit in hand. During the 1989 season aquatic weed control will be necessary to maintain your lake at its fullest recreational potential. In controlling the aquatic macrophytes (weeds), the material called Sonar will be used. THERE ARE NO WATER USE RESTRICTIONS WITH ITS USE. We do recommend that the treated areas not be used for irrigation for seven days following application. Your lake is scheduled for treatment during the weeks of 6-5-89, 6-12-89. Approximately seven days prior to treatment the shoreline area will be posted stating the treatment date and water restrictions. The posting will be done along the roadside, mailboxes and driveway areas of abutting lakefront property owners. At the time of application (the actual day of treatment) all shoreline areas will be reposted stating that on \_\_\_\_\_ the lake waters were treated to control weed growth. At this time the water restrictions posted on the signs will be in effect. Treatments will be coordinated so that no swimming or fishing restrictions will be in effect during any weekend during the summer months.

Please keep this notification as reference. If throughout the summer, questions arise please feel free to contact our office at 357-3285 or the Department of Ecology (Mark Hicks) at 438-7087.

Your help in understanding the treatments required to maintain your lake is appreciated. Have an enjoyable summer.

Sincerely,

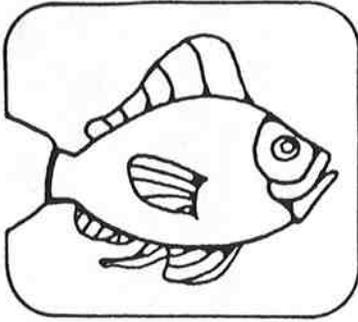
Douglas Dorring  
President

If you are interested in participating in the spraying of the lake this year, please fill out the form stating the actual front footage of your property. Then figure it times \$3.15 a foot, ~~plus 8.1% tax~~. Return it to me along with your check for half of the total cost as that is all that is necessary to get the spraying done. The remainder must be paid by September 30th as stated on the contract. I would appreciate receiving them by May 1st which will give me time to do what I must do to co-ordinate the operation and send the contracts along to Allied Aquatics. Please DO NOT return the contract direct to Allied Aquatics as I will be unable to see that your property is adequately marked for spraying.

Thank you,

Joan Eley  
17820 W. Spring Lk. Dr. S.E.  
432-4679

236.25  
Pd 118.13 5/1/89  
118.12 11/7/89  
Pd balance by Sept 30<sup>th</sup>



ALLIED AQUATICS  
OF WASHINGTON, INC.

ALLIED AQUATICS

~~OLYMPIA, WA 98502~~  
OLYMPIA, WA 98502  
(206) 357-3285

ALLIED AQUATICS OF WA., INC.  
4426 Bush Mtn. Dr., SW  
Olympia, WA 98502

September 27, 1989

Dear Spring Lake Resident,

There appears to be some questions concerning the 1989 treatment program at your lake this year. After discussing the situation with several residents involved with this years program there appears to have been a communication problem concerning what was to be accomplished during this year. Briefly, we were under the assumption that the 1989 program would be identical to the one incorporated during 1987. The program dealt solely with the control of submersed weed species located throughout the designated treatment site. The prior program did not address shoreline emergent vegetation.

After receiving various phone calls concerning weed problems within the lake starting in late August our firm had thoroughly surveyed the lake three times addressing concerns of "weed problems". Each survey revealed no submersed weeds within the designated treatment sites. We then received another call concerning "weed problems". At this time we made arrangements to meet with one of the residents abutting the lake and survey the area with us. It was during this survey that the shoreline emergent weed problem was brought to our attention. The weed problems that were being reported to our office were emergent plant species located along the shallow water land interface around the lake. We were than informed that all the residents were under the assumption that these plants would be included in the weed treatment for this year.

When we became aware of what was expected by the residents this year, we frantically tried to get approval by the state to control these shoreline weeds. However, the material required to control these plants was not included in the permit issued by the State. Addition of the material to the permit was not possible due to time restraints and reprocessing time required for approval.

We are proposing the following solution to this unfortunate situation we are now faced with. During 1990 we will acquire the proper permits to allow spraying of the shoreline emergent vegetation at Spring Lake. We will control the emergent vegetation at no charge to those residents during 1990 currently under contract for the 1989 season. In return for this service contract obligations (costs for the 1989 program) must be met by all residents associated with the 1989 program.

I feel this is a fare and amiable way to solve the problem without any one party sustaining undo hardship. We see no need to try and

---

"THE LAKE MANAGEMENT SPECIALIST"

---

point the finger at any one party. Our goal here is to try and reach common ground whereby the service your group was anticipating is delivered and our firm is not put into a position of sustaining a considerable loss by not receiving final payment. I am truly sorry for any frustration or inconvenience this has caused you during the summer. Allied Aquatics is a reputable firm and we will do whatever is necessary to maintain a friendly working relationship with your group.

Please inform our office of your next board meeting if you feel a more thorough discussion on the problem is required.

Sincerely,



Douglas Dorling  
President

DD/mkd

## APPENDIX B

---

Appendix B contains two documents produced by King County Staff prior to the first Steering Committee meeting. These documents were referred to throughout the process of educating the community and developing the Integrated Aquatic Vegetation Management Plan.

### **Spring Lake Community Education and Outreach**

Steering committee will drive this aspect of project. Documentation throughout is very important.

#### **Overarching goals for education and outreach:**

- inform community members of the problem aquatic weeds present,
- outline the available control methods and pros/cons of each option
- solicit community member input on most appropriate control options
- document community support for an aquatic weed eradication project

Need to include documentation of our efforts in the IAVMP we submit to Ecology.

#### **First community meeting**

Small audience of already interested volunteers  
Discuss project goals and challenges  
Form steering committee

#### **First Steering Committee meeting (July 17)**

- Review scope of work for entire project
- Define goals of steering committee
- Outline scope of work and timeline
- Develop “problem statement”
- Develop outreach/education strategy
- Determine roles and assign work items

#### **Information to community:**

Educational flyer/meeting announcement distributed  
Ad in local paper  
Laminated signs at boat launch and park  
Sandwich board announcing meeting (3 days out)

#### **Second Steering Comm. Meeting**

Prepare for watershed-wide community meeting  
Detailed review/discussion of treatment options  
(<http://www.ecy.wa.gov/programs/wq/plants/management/aqua028.html>)  
Discuss long-term funding options

### **Mail flyer announcing watershed-wide community meeting**

**Canvass neighborhood/watershed** (evenings in week prior to watershed-wide meeting)

Invite community members to watershed-wide meeting

Have people sign petition of support

### **First Watershed-wide community meeting** (August 22)

Project overview, including

- Problem statement
- Benefits of control
- Detailed discussion of treatment options
- Funding opportunities for initial control efforts (Ecology, grants)
- Long-term funding options (Comm Club dues, LMD, other ideas)
- Project timeline
- Questions and Answers

### **Third Steering Committee meeting**

Review results of watershed-wide meeting

Reassess progress on IAVMP

Address necessary issues

**Continue documentation of community support (circulate petition?)**

**Further canvassing?**

**Signs in community, at boat ramp?**

### **Final community meeting**

- Review proposed project specifics and timeline
- Answer questions about the proposed project
- Conclude documentation of community support
- Last call for questions, concerns, and dissensions

**Incorporate all above information into IAVMP before Submittal to Ecology for review and approval (September)**

## Timeline

<b>Task</b>	<b>Complete by</b>	<b>Who</b>	<b>Notes</b>
Define scope of project and outline specific tasks	June 15	Murph , Drew	
Review Draft KC Regional Milfoil Plan and extract sections relevant to Spring Lake Project application	Early July		
Community Meeting: project overview, fact finding, initial questions from community members, discussion of timeline, responsibilities	June 27	Drew	
Form Steering Committee	July 12		6-10 people; diverse interests represented See document "Spring Lake Steering Committee"
First Steering Committee Meeting	July 17		Develop problem statement Outline community education and outreach plan Assign tasks
Meet with DOE re: IAVMP requirements	July 23	Murph , Sally	
Steering Comm. progress on community outreach, education, problem statement	Ongoing prior to 1 <sup>st</sup> community mtg		Mailing to residents Recruitment ID interested parties
Research: <ul style="list-style-type: none"> <li>• Treatment options</li> <li>• Adding Shady Lake treatment to the project</li> <li>• Prior successful projects</li> <li>• Other KC mngmt plans?</li> </ul>	August 1	Murph , Drew	
Cost estimates	August 1	Murph , Drew	Will require researching past projects; put out bids for sonar treatment?
Steering committee meeting	Mid August		Review progress and prepare for community meeting
Community meeting: discuss grant proposal progress, pros and cons of available treatment	Late August		Educational meeting for wide audience. Guest speaker: resident from lake with recent weed eradication project. Ask attendees to share news with neighbors,

options, long term project components, timeline, project costs			look for petition in near future
Complete IAVMP requirements, and submit to DOE for review	Sept 1	Murph , Drew	See <a href="http://www.ecy.wa.gov/programs/wq/plants/grants/appendixc.html">http://www.ecy.wa.gov/programs/wq/plants/grants/appendixc.html</a> for minimum IAVMP requirements
Identify Matching \$\$ from King County. Other possible \$\$ sources (LMD, KC Parks, local business, WDFW)?	Sept 1		DOE will fund 75% KC-25% (12.5% cash, 12.5% in-kind)
Select preferred treatment option	mid-Sept.		
Community Meeting – arrive at consensus (or at least majority) vote on desired treatment option	mid –late Sept		Share details of final proposal, gather final signatures showing support
Application due to Ecology	Mid-October 2002	KC DNRP	Actual deadline may be later

## APPENDIX C

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Appendix C contains a copy of the Letter of Support distributed at the watershed-wide community meeting. Prior to distributing the letter and the signature sheets at the end of the watershed-wide meeting on September 19, 2002, King County staff and Steering Committee members presented full details of the proposed treatment strategy and answered questions from those present at the meeting. In addition to signatures of support gathered at the end of the meeting, several Steering Committee members took sheets with them so they could explain the proposal to their neighbors and have them sign in support if they supported the proposal. Of the 10 pages of signatures, all but page 4 have been submitted. In all there are 102 signatures in support of the proposed treatment plan presented in details at the watershed wide meeting and summarized in the Letter of Support.

# Spring Lake Milfoil Project

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## Letter of Community Support

September 19, 2002

**By signing this letter, we, the members of the Spring Lake community, agree**

- ❖ that Eurasian watermilfoil and other listed noxious aquatic weeds present a serious threat to the natural beauty, ecological integrity, and safe recreational activities on Spring Lake.
- ❖ that controlling the noxious weeds is an immediate priority and that ongoing monitoring and control should be a continuing priority into the future
- ❖ that community-based funding will be necessary to maintain a milfoil-free lake after initial eradication efforts
- ❖ that the proposed treatment strategy outlined below is reasonable but may be altered by experts at the Department of Ecology to achieve the greatest likelihood of success

### **Recommended Treatment Strategy**

#### **Initial Treatment (Year 1)**

Treat infested areas with 2, 4 D

Diver-dredging

Install bottom barrier at boat ramp

Community education – milfoil ID and survey methods training

#### **Year 2**

Diver surveys

2,4 D for spot control as necessary

Diver hand-pulling and dredging as necessary

Bottom barrier maintenance

Continued community education

#### **Ongoing management**

Continued community education

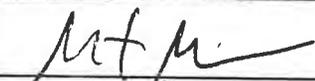
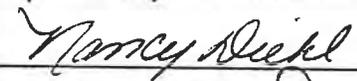
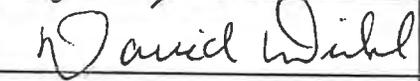
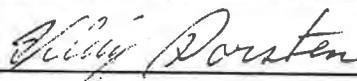
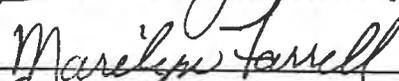
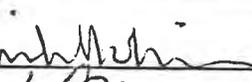
Community survey

Diver survey

Diver hand-pulling as necessary

Bottom barrier maintenance

# Spring Lake Community Letter of Support

	Name	Address	Signature	Date
1.	Robert Kellar	18032 W. Spring Lake Dr SE		9/19/02
2.	Nancy Diehl	17836 W. Spring Lk Dr SE		9/19/02
3.	DAVID DIEHL	17836 W. Spring Lk Dr SE		9/19/02
4.	Susan Barnes	18302 W. Spring Lake Dr SE		9/19/02
5.	H. Lily TORSTEN	18308 W. Spring Lake Dr. SE		9/19/02
6.	<del>BARBARA JANISCH</del>	<del>18028 W. SPRING LAKE DR S.E.</del>	<del>Barbara Janisch</del>	<del>9/19/02</del>
7.	Marilyn Farrell	19202 SE 184		9/19/02
8.	Caren Adams	17928 W. Spring Lk. Dr. SE		9/19/02
9.				
10.	Patricia + Michelle Kuehman # Boerj	18324 W Spring Lake Dr SE		9/29/02
	Kelly Geller	18401 W. Spring Lk. Dr. SE		9/29/02
11.				
12.				
13.				
14.				
15.				

# Spring Lake Community Letter of Support

	NAME	ADDRESS	SIGNATURE	DATE
16.	BARBARA SECORIS	18113 E. SPLK DR SE 98057 <small>RENTON WA</small>		9-19-02
17.	ROBERT STEVENS	18026-W SPRING LAKE DR SE		9-19-02
18.	Sharon Stevens	18026 W SPLK DR SE, Rtn WA 98035		9-19-02
19.	R.H. Naughton	18109 W. Springlake Dr SE		9/19/02
20.	Jami Pienay	18515 E Springlake Dr SE		9-19-02
21.	Dale W. HSL	18010 E Spring Lk Dr SE		9-19-02
22.	HARVEY FERRIN	19317 SE 178 <sup>th</sup> PL		9/19/02
23.	DICK NIEMIEC	19302-SE 178 <sup>TH</sup> PL.		9-19-02
24.	AMY PALMER	17972 W. SPRING LK DR SE		9-19-02
25.	Elaine Brinkhank	12978 W. Springlake Dr SE		9/19/02
26.	BARRY PALMER	17972 W. Spring Lake Dr SE		9-19-02
27.	Chris Imaino	18333 E. Springlake DR SE		9-19-02
28.	Eva Imaino	18333 E Spring Lk Dr SE		9-19-02
29.	Daniel Imaino	18333 E Spring Lk Dr SE		9/19/02
30.	Julia Nagaoaka	18625 E Spring Lake Dr SE		9/19/02

# Spring Lake Community Letter of Support

31.	Michael A. Jones	19216 SE 184th Pl	(425) 432-706	
32.	Jeff Winter	18404 W Spring Lake Dr SE	425 432 0130	
33.	Lewis Winter	18404 W Spring Lake Dr SE	425 432 0130	
34.	Joyce Leikell	17856 W. Spring LK Dr SE	425-432-0507	
35.	Kennig. Kuren	17963 W Spring Lake Dr SE Renton, WA 98059	425-432-7092	
36.	Ronald Kuren	17963 W Spring LK Dr SE Renton, WA 98059	425-432-7092	
37.	Jerry Williams	18210 W. Spring LK Dr SE Renton, WA 98058	425-432-7104	
38.	Linda Perry	18210 W SPLK DR SE Renton WA 98058	425 432 7104	
39.				
40.	Steve Leikell	17880 W SPRING LAKE DR SE RENTON, WA 98059	(425) 432-0507	
41.	Leah Mickelson	18214 W Spring Lake Drive SE	425 432-2798	
42.	Michael O'Brien	18214 W Spring Lake Dr SE	425-432-2798	
43.	KAREN Hori	18316 W. SPRING LAKE DR. SE	425-432-1973	
44.	MICHAEL HORI	18316 W. SPRING LK DR SE	425-432-1973	
45.	Ellon Jarvis	18118 W Spring LK Dr SE <sup>RENTON</sup>	425-432-4885	

# Spring Lake Community Letter of Support

	NAME	ADDRESS	SIGNATURE	DATE
61.	SCOTT Jarvis	18118 W Spring Lk Dr SE	425-432-4888	9/19/02
62.	Arlina Calderon	18210 W Spring Lake Dr SE	425-432-7164	9/19/02
63.	Jake Niehaus	18210 W. Springlake Dr SE	425-432-7104	9/19/02
64.	Peggy Venger	18715 E. Springlake Dr SE	425-432-8463	9/19/02
65.	Ted Barnes	18302 W Spring Lakes Dr SE	<sup>T. H. Barnes</sup> 425-413-7873	9/19/02
66.	Cathi Bauer	18335 E. <sup>BAUER</sup> Springlake Dr SE	425 432 4768	9/19/02
67.	Alan W Bauer	18335 E Springlake Dr SE	425 432-4768	9/19/02
68.				
69.				
70.				
71.				
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73.				
74.				
75.				

# Spring Lake Community Letter of Support

	NAME (SIG)	ADDRESS	(SIGNATURE)	(DATE)
76.	Doug Saathoff	17904 W. SPRING LAKE DR. SE.	RENTON, WA	98058
77.	Mike Mullay	18015 E Springlake Dr. S.E.	Renton, WA	98058
78.	Bob Mann	17916 W. Spring Lk. Dr.	Renton, WA	98058
79.	Jerry Brown	18338 W SPRING LK DR SE	RENTON, WA	98058
80.	Ken Withelm	17906 E Spring Lk DR SE	Renton	98058
81.	Richard Farrell	19202 SE 184 <sup>th</sup> ST	RENTON, WA	98058
82.	NAME Walter Aspelund	ADDRESS 17918 - E. Springlake Dr. SE. Renton	SIGNATURE Walter Aspelund	DATE 9/25/02 98058
83.	Marcia Aspelund	17918 E. Spring Lk Dr SE	Marcia Aspelund	9/25/02
84.	Angela Wilhelm	17906 E Spring Lake Drive SE	Angela Wilhelm	9/25/02
85.	Robert D Bell	18607 E. Spring Lake Dr. SE Renton WA	Robert D Bell	9/25/02
86.	HELEN A. BELL	18607 E. SPRING LK. DR. SE. RENTON	Helen A. Bell	9/25/02
87.	SUSAN S. TILL	17166 W. Spring Lk DR SE Renton	Susan S. Till	9/25/02
88.	Raymond F. Till	17966 W. Spring Lake Dr SE, Renton	Raymond F. Till	9/25/02
89.	Sheila Farley	18215 E. Spring Lk DR SE. Renton	Sheila Farley	9/27/02
90.	RODMAN K. CROSS	18104 E SPR LK DR SE RENTON	Rodman K. Cross	10/02/02

# Spring Lake Community Letter of Support

	NAME	ADDRESS	SIGNATURE	DATE
91.	JERRY & EVA ODSTRAL	18329 E SPRING LAKE DR. SE, RENTON, WA, 98058	<i>[Signature]</i>	9-29-02
92.	Jeanne Clark	18315 E. Spring Lake Dr SE WA 98058 Renton	<i>[Signature]</i>	9-29-02
93.	Ted Clank	18315 E. Spring Lk. Dr. S.E. Renton WA 98058	<i>[Signature]</i>	9-29-02
94.	Gordon Trainor	18333 E Spring LK Dr SE 98058 Renton WA	<i>[Signature]</i>	9-28-02
95.	Tara Dail	18636 E. Spring Lk. Dr. SE Renton, WA 98058	<i>[Signature]</i>	9-29-02
96.	Chris Dail	-11-	<i>[Signature]</i>	9-29-02
97.	KELLI DINGWIDDE	18608 E Spring Lk Dr SE	<i>[Signature]</i>	9/29/02
98.	<i>[Signature]</i>			
99.				
100.				
101.				
102.				
103.				
104.				
105.				

# Spring Lake Community Letter of Support

106.	<p>Len Hansen  <i>Len Hansen</i></p>	<p>19206 SE 184<sup>th</sup></p>	<p>Renton</p>	<p>98058</p>
107.	<p>Kenneth Farrell  <i>Kenneth Farrell</i></p>	<p>19210 SE 184<sup>th</sup> St</p>	<p>Renton</p>	<p>98058</p>
108.	<p>Laryce Farrell  <i>Laryce Farrell</i></p>	<p>19210 SE 184<sup>th</sup> St</p>	<p>Renton</p>	<p>98058</p>
109.	<p>Shari Hansen  <i>Shari Hansen</i></p>	<p>19206 SE 184<sup>th</sup> St</p>	<p>Renton</p>	<p>98058</p>
110.	<p>Lillian Freeman  <i>Lillian Freeman</i></p>	<p>19222 SE 184<sup>th</sup> Pl</p>	<p>Renton</p>	<p>98058</p>
111.	<p>Elizabeth Toner  <i>Elizabeth Toner</i></p>	<p>19216 SE 184<sup>th</sup> Pl</p>	<p>Renton</p>	<p>98058</p>
112.				
113.				
114.				
115.				
116.				
117.				
118.				
119.				
120.				

Spring Lake Community Letter of Support

	NAME	ADDRESS	SIGNATURE	DATE
121.	Neil Slater	17910 W. Spring LK Dr. S.E.	Neil W. Slater	10/1/2002
122.	Dorothy SLATER Dorothy Slater	17910 W Spring LK DR SE	Dorothy Slater	10-1-2002
123.	SUSAN EDWARDS Susan Edwards	17820 W Spring LK Dr SE	Susan Edwards	10/2/2002
124.	FANCES GILBERT Frances Gilbert	17927 E Spring LK DR S.E.	Frances Gilbert	10/2/02
125.	RAYMOND J. PARKER	18028 187th Ave SE.	Raymond J. Parker	10/3/02
126.	MARTHA L. PARKER	18028. 187th Ave SE	Martha L. Parker	10/3/02
127.	GREGG GARSON Gregg Garson	18516 E Spring Lake Dr SE	Gregg Garson	10/3/02
128.	Linda Harold	18101 E Springlake Dr. SE	Linda C Harold	10/5/02
129.	NEAL HAROLD	18101 E Spring Lake Dr SE	Neal C Harold	10/5/02
130.	Steve Smith	18410 W. Spring Lake Dr SE	Steve Smith	10/5/02
131.	Dixie Smith	18410 W. Spring Lk. Dr SE.	Dixie Smith	10/9/02
132.				
133.				
134.				
135.				

# Spring Lake Community Letter of Support

	NAME	ADDRESS	SIGNATURE	DATE
136.	DAN CUMMINS	18127 W SPR LK <sup>RENTON WA</sup> DR SE 98058	Dan Cummins	9/22/02
137.	Cleo Ann Cummins	18127 W. Sp. LK. Dr SE Renton WA 98058	Cleo Ann Cummins	9/22/02
138.	Marion Fearn	19317 SE 178 <sup>th</sup> PL Renton, WA 98058	Marion E Fearn	9/24/02
139.	DONNA KYRISS	18410 E. SPRING LK. DR SE	Donna Kyriass	9/23/02
140.	Jami Berry	18515 E Spring Lake Dr SE	Jami Berry	9-23-02
141.	Curt Heikell	18023 E SPRING LK DR SE	Curt Heikell	9/23/02
142.	Diane Heikell	18023 E Spring Lk Dr SE <sup>Renton</sup> 98058	Diane Heikell	9/23/02
143.	MARY A. SHOLDRA	18415 W. SPRING LK. SE <sup>RENTON</sup> 98058	Mary A. Sholdra	9/23/02
144.	THEODORE SHOLDRA	18415 W. SPRING LAKE DR SE	Theodore Sholdra	9-23-02
145.	ROBERT L. JANISCH	18028 W. SPRING LK. DR. SE	Robert L Janisch	9-25-02
146.	PATRICIA K. CALHOUN	17802 E. Spring LK. Dr. SE. Renton 98058	Patricia K Calhoun	9-24-02
147.	Robert R Calhoun	17802 E. Spring LK. Dr. SE. Renton WA 98058	Robert R Calhoun	9-24-02
148.	Kathy I. Stephison	17874 W. Spring Lake Dr. SE. <sup>Renton</sup> WA 98058	Kathryn Stephison	9-25-02
149.	DARRYL B. STEPHISON	17874 W. SPRING LAKE DR 98058	Daryl Stephison	9/25/02
150.	WADE FARLEY	18215 E SPRING LK DR SE 98058	Wade Farley	9/26/02

## APPENDIX D

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Appendix D contains product labels from aquatic herbicide formulations that are included in the proposed treatment plan for aquatic noxious weeds at Spring Lake. These include the labels for two aquatic Glyphosate products (Rodeo and Aquamaster), one granular 2,4-D BEE product (Navigate), and one liquid 2,4-D DMA product (DMA\*4IVM). AquaKleen is essentially the same formulation as Navigate by a different manufacturer.

# Specimen Label



# DMA\* 4 VM

## Herbicide

\*Trademark of Dow AgroSciences LLC

Contains Dimethylamine Salt of 2,4-D†

For selective control of many broadleaf weeds in, forests, non-cropland, non-crop turf, and aquatic areas. Also for control of trees by injection.

Active Ingredient:	
2,4-Dichlorophenoxyacetic acid, dimethylamine salt †	46.3%
Inert Ingredients	53.7%
Total Ingredients	100.0%

2,4-dichlorophenoxyacetic acid †† - 38.4% - 3.8 lb/gal  
†† Isomer Specific by AOAC Method No. 978.05 (15th Edition)

† Salts are the least volatile forms of 2,4-D and do not release enough vapors from treated areas to reduce yield of adjacent susceptible crops.

EPA Reg. No. 62719-3

Keep Out of Reach of Children

# DANGER PELIGRO

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.)

### Precautionary Statements

#### Hazards to Humans and Domestic Animals

Corrosive • Causes Irreversible Eye Damage • Harmful If Swallowed, Inhaled or Absorbed Through The Skin.

Do not get in eyes, on skin, or on clothing. Avoid breathing vapor or spray mist. Wash thoroughly with soap and water after handling.

### Personal Protective Equipment (PPE)

Applicators and other handlers must wear:

- Long-sleeved shirt and long pants
- Waterproof gloves
- Shoes plus socks
- Protective eyewear
- Note: For containers of over 1 gallon, but less than 5 gallons: Mixer and loaders who do not use a mechanical system (such as probe and pump or spigot) to transfer the contents of this container must wear coveralls or chemical-resistant apron in addition to other required PPE.

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, use detergent and hot water. Keep clothing or PPE must not be reused until it has been cleaned.

### Engineering Controls Statements

For containers of 5 gallons or more: A mechanical system (such as probe and pump or spigot) must be used for transferring the contents of this container. If the contents of a non-refillable pesticide container are emptied, the probe must be rinsed before removal. If the mechanical system is used in a manner that meets the requirements listed in the Worker Protection Standard (WPS) for agricultural pesticides [40 CFR 170.240 (d) (4)], the handler PPE requirements may be reduced or modified as specified in the WPS.

When handlers use enclosed cabs or aircraft in a manner that meets the requirements listed in the Worker Protections 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 clothing 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 on skin or clothing:** Take off contaminated clothing. Rinse skin immediately with plenty of water for 15-20 minutes. 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 the poison control center or doctor. Do not give anything by mouth to an unconscious person.

**If inhaled:** Move person to fresh air. If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably by mouth-to-mouth, if possible. Call a poison control center or doctor for further treatment advice.

Have the product container or label with you when calling a poison control center or doctor, or going for treatment.

**Note to Physician:** Probable mucosal damage may contraindicate the use of gastric lavage.

### Environmental Hazards

This product is toxic to aquatic invertebrates. Drift or runoff may adversely affect aquatic invertebrates and non-target plants. For terrestrial uses, do not apply directly to water, to areas where surface water is present, or to intertidal area below the mean high water mark. Do not contaminate water when disposing of equipment washwaters.

**Mixing and Loading:** Most cases of groundwater contamination involving phenoxy herbicides such as 2,4-D have been associated with mixing/loading and disposal sites. Caution should be exercised when handling 2,4-D pesticides at such sites to prevent contamination of groundwater supplies. Use of closed systems for mixing and transferring this pesticide will reduce the probability of spills. Placement of the mixing/loading equipment on an impervious pad to contain spills will help prevent groundwater contamination.

**Notice:** Read the entire label. Use only according to label directions. Before buying or using this product, read "Warranty Disclaimer" and "Limitation of Remedies" elsewhere on this label.

In case of emergency endangering health or the environment involving this product, call 1-800-992-5994. If you wish to obtain additional product information, visit our web site at [www.dowagro.com](http://www.dowagro.com).

**Agricultural Chemical:** Do not ship or store with food, feeds, drugs or clothing.

### 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 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
- Waterproof gloves
- Shoes plus socks
- 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 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:** When this product is applied to non-cropland areas, non-crop turf, by tree injection method only in forest sites, and when applied in aquatic areas, do not allow people (other than applicator) or pets on treatment area during application. Do not enter into treated areas until sprays have dried.

### Storage and Disposal

Do not contaminate water, food, or feed by storage or disposal.

**Storage:** Keep container tightly closed when not in use. If exposed to subfreezing temperatures, the product should be warmed to at least 40°F and mixed thoroughly before using.

**Pesticide Disposal:** Pesticide wastes are toxic. Improper disposal of excess pesticide, spray mixture, or rinsate is a violation of Federal law and may contaminate groundwater. If these wastes cannot be disposed of by use according to label instructions, contact your State Pesticide or Environmental Control Agency, or the Hazardous Waste Representative at the nearest EPA Regional Office for guidance.

**Container Disposal (Metal):** Triple rinse (or equivalent). 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.

**Container Disposal (Plastic containers 5-gals or less):** Triple rinse (or equivalent). Then dispose of in a sanitary landfill, or by incineration, or, if allowed by local authorities, by burning. If burned stay out of smoke.

**General:** Consult federal, state, or local disposal authorities for appropriate procedures.

### General Information

DMA<sup>®</sup> 4 IVM herbicide is intended for selective control of many broadleaf weeds in forests, non-cropland, non-crop turf areas, and aquatic areas.

Apply DMA 4 IVM as a water or oil-water spray during warm weather when target weeds or woody plants are actively growing. Application under drought conditions will often give poor results. Use low spray pressure to minimize drift. Generally, the lower dosages recommended on this label will be satisfactory for young, succulent growth of susceptible weed species. For less susceptible species and under conditions where control is more difficult, use higher recommended rates. Deep-rooted perennial weeds such as Canada thistle and field bindweed and many woody plants usually require repeated applications for satisfactory control. Consult your State Agricultural Experiment stations or Extension Service Weed Specialists for recommendations from this label that best fit local conditions.

### General Use Precautions and Restrictions

Be sure that use of DMA 4 IVM conforms to all application regulations.

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

Excessive amounts of 2,4-D in the soil may temporarily inhibit seed germination and plant growth.

# Specimen Label



# Rodeo®

## Herbicide

For aquatic weed and brush control. For control of annual and perennial weeds and woody plants in and around aquatic and other noncrop sites; also for use in wildlife habitat areas, for perennial grass release, and grass growth suppression.

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.

Active Ingredient(s):	
glyphosate <sup>1</sup> : N-(phosphonomethyl)glycine, isopropylamine salt .....	53.8%
Inert Ingredients .....	46.2%
Total Ingredients.....	100.0%

<sup>1</sup> Contains 5.4 pounds per gallon glyphosate, isopropylamine salt (4 pounds per gallon glyphosate acid).

EPA Reg. No. 62719-324

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.)

### Precautionary Statements

#### Hazards to Humans and Domestic Animals

##### Harmful If Inhaled

Avoid breathing spray mist. Remove contaminated clothing and wash before reuse. Wash thoroughly with soap and water after handling.

### 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 Controls

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 clothing immediately if pesticide gets inside. Then wash thoroughly and put on clean clothing.

### First Aid

If inhaled: Remove individual to fresh air. If not breathing, give artificial respiration, preferably mouth-to-mouth. Get medical attention.

### Environmental Hazards

Do not contaminate water when 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 leak or spill, soak up and remove to a landfill.

### Physical or Chemical Hazards

Spray solutions of this product should be mixed, stored and applied using only stainless steel, aluminum, 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.

**Notice:** Read the entire label. Use only according to label directions. **Before buying or using this product, read "Warranty Disclaimer" and "Limitation of Remedies" elsewhere on this label.**

In case of emergency endangering health or the environment involving this product, call 1-800-992-5994. If you wish to obtain additional product information, visit our web site at [www.dowagro.com](http://www.dowagro.com).

Agricultural Chemical: Do not ship or store with food, feeds, drugs or clothing.

## 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.

**This is an end-use product. Dow AgroSciences does not intend and has not registered it for reformulation. See individual container label for repackaging limitations.**

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 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, is:

- Coveralls
- Chemical resistant gloves made of any waterproof material
- Shoes plus socks

### Storage and Disposal

Do not contaminate water, food, feed or seed by storage or disposal.

**Storage:** Store above 10°F (-12°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.

**Pesticide Disposal:** Wastes resulting from use of this product that cannot be used or chemically reprocessed should be disposed of in a landfill approved for pesticide disposal or in accordance with applicable Federal, state or local procedures.

**Container Disposal:** Emptied container retains vapor and product residue. Observe all labeled safeguards until container is cleaned, reconditioned or destroyed. Do not reuse this container. Triple rinse (or equivalent). Then puncture and dispose of in a sanitary landfill, or by incineration, or, if allowed by state and local authorities, by burning. If burned, stay out of smoke.

## General Information (How this product works)

This product herbicide is a water-soluble liquid which mixes readily with water and nonionic surfactant to be applied as a foliar spray for the control or destruction of many herbaceous and woody plants. Rodeo is intended for control of annual and perennial weeds and woody plants in and around aquatic and other noncrop sites; also for use in wildlife habitat areas, for perennial grass release, and grass growth suppression.

The active ingredient in Rodeo moves through the plant from the point of foliage contact to and into the root system. Visible effects on most annual weeds occur within 2 to 4 days, 7 days or more on most perennial weeds, and 30 days or more on most woody plants. Extremely cool or cloudy weather following treatment may slow the activity of this product and delay visual effects of control. Visible effects include gradual wilting and yellowing of the plant which advances to complete browning of above-ground growth and deterioration of underground plant parts.

Unless otherwise directed on this label, delay application until vegetation has emerged and reached the stages described for control of such vegetation under the "Weeds Controlled" section of this label.

Unemerged plants arising from unattached underground rhizomes or root stocks of perennials or brush will not be affected by the spray and will continue to grow. For this reason best control of most perennial weeds or brush is obtained when treatment is made at late growth stages approaching maturity.

Always use the higher rate of Rodeo and surfactant within the recommended range when vegetation is heavy or dense.

Do not treat weeds, brush or trees under poor growing conditions such as drought stress, disease or insect damage, as reduced control may result. Reduced control of target vegetation may also occur if foliage is heavily covered with dust at the time of treatment.

Reduced control may result when applications are made to woody plants or weeds following site disturbance or plant top growth removal from grazing, mowing, logging or mechanical brush control. For best results, delay treatment of such areas until resprouting and foliar growth has restored the target vegetation to the recommended stage of growth for optimum herbicidal exposure and control.

Rainfall or irrigation occurring within 6 hours after application may reduce effectiveness. Heavy rainfall or irrigation within 2 hours after application may wash the product off the foliage and a repeat treatment may be required.

Rodeo does not provide residual weed control. For subsequent residual weed control, follow a label-approved herbicide program. Read and carefully observe the cautionary statements and all other information appearing on the labels of all herbicides used.

**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. When not in use, keep container closed to prevent spills and contamination.

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

**ATTENTION:** Avoid drift. Extreme care must be used when applying this product to prevent injury to desirable plants and crops.

## Avoiding Injury to Non-target Plants

Spray drift produced during application is the responsibility of the applicator and care should be taken to minimize off-target movement of spray during application. A drift control agent suitable for agricultural use may be used with this product to aid in reducing spray drift. If used, follow all use recommendations and precautions on the product label.

**Do not apply where drift may be a problem due to proximity to susceptible crops or other desirable broadleaf plants.** Do not apply DMA 4 IVM directly to, or otherwise permit contact with cotton, flowers, fruit trees, grapes, ornamentals, vegetables, or other desirable plants which are susceptible to 2,4-D herbicides. Do not permit spray mist containing 2,4-D to contact susceptible plants since even very small quantities of the spray, which may not be visible, can cause severe injury during both active growth or dormant periods. Do not use in greenhouses.

**Avoid Movement of Treated Soil:** Avoid conditions under which soil from treated areas may be moved or blown to areas containing susceptible plants. Wind-blown dust containing 2,4-D may produce visible symptoms when deposited on susceptible plants, however, serious plant injury is unlikely. To minimize potential movement of 2,4-D on wind-blown dust, avoid treatment of powdery dry or light sandy soils until soil is settled by rainfall or irrigation or irrigate soon after application.

**Do not store or handle other agricultural chemicals with the same containers used for DMA 4 IVM.** Do not apply other agricultural chemicals or pesticides with equipment used to apply DMA 4 IVM unless equipment has been thoroughly cleaned to remove all traces of 2,4-D.

## Spray Drift Management (Aerial Application)

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. 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, public health uses or to applications using dry formulations.

1. The distance of the outer most 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.

In certain states, additional regulations may be applicable to aerial application of this product.

The applicator should be familiar with and take into account the information covered in the following Aerial Drift Reduction Advisory Information section.

### Aerial Spray Drift Advisory Information

**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 Wind, Temperature and Humidity, and Temperature Inversion section of this label).

### 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**-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 airstream 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 the largest droplets and the least spray drift.
- **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**-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 cross-wind, 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 2-10 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 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 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 smoke from a ground source or an aircraft smoke generator. Smoke that layers and moves laterally in a connected cloud (under low wind conditions) indicates an inversion, while smoke that moves upwards 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).

### Mixing

Mix DMA 4 IVM only with water, unless otherwise directed on this label. Add about half the water to the mixing tank, then add the DMA 4 IVM with agitation, and finally the rest of the water with continuing agitation.

**Note:** Adding oil, wetting agent, or other surfactant to the spray mixture may increase effectiveness on weeds, but also may reduce selectivity to crops resulting in crop damage.

**Tank Mixing:** When tank mixing, read and follow the label of each tank mix product used for precautionary statements, directions for use, weeds controlled, and geographic and other restrictions. Use in accordance with the most restrictive of label limitations and precautions. No label dosages should be exceeded. Do not tank mix this product with any product containing a label prohibition against tank mixing with 2,4-D.

**Tank Mix Compatibility Testing:** A jar test is recommended prior to tank mixing to ensure compatibility of this product and other pesticides. Use a clear glass quart jar with lid and mix the tank mix ingredients in their relative proportions. Invert the jar containing the mixture several times and observe the mixture for approximately 1/2 hour. If the mixture balls-up, forms flakes, sludges, jels, oily films or layers, or other precipitates, it is not compatible and the tank mix combination should not be used.

### Sprayer Clean-Out

To avoid injury to desirable plants, equipment used to apply this product should be thoroughly cleaned before re-use or applying other chemicals.

1. Rinse and flush application equipment thoroughly after use at least three times with water. Dispose of all rinse water by application to treatment area or apply to non-cropland area away from water supplies.
2. During the second rinse, add 1 qt of household ammonia for every 25 gallons of water. Circulate the solution through the entire system so that all internal surfaces are contacted (15-20 min). Let the solution stand for several hours, preferably overnight.
3. Flush the solution out of the spray tank through the boom.
4. Rinse the system twice with clean water, recirculating and draining each time.
5. Remove nozzles and screens and clean separately.
6. If equipment is to be used to apply another pesticide or agricultural chemical to a 2,4-D susceptible crop, additional steps may be required to remove all traces of 2,4-D, including cleaning of disassembled parts and replacement of hoses or other fittings that may contain absorbed 2,4-D.

### Application

Apply with calibrated air or ground equipment using sufficient spray volume to provide adequate coverage of target weeds or as otherwise directed in specific use directions. For broadcast application, use a spray volume of 3 or more gallons per acre by air and 10 or more gallons per acre for ground equipment. Where states have regulations which specify minimum spray volumes, they should be observed. In general, spray volume should be increased as crop canopy, height and weed density increase in order to obtain adequate spray coverage. Do not apply less than 3 gallons total spray volume per acre.

### Rate Ranges and Application Timing

Generally, the lower dosages given will be satisfactory for young, succulent growth of sensitive weed species. For less sensitive species and under conditions where control is more difficult, the higher dosages will be needed. Apply DMA 4 IVM during warm weather when weeds are young and actively growing.

### Spot Treatments

To prevent misapplication, spot treatments should be applied with a calibrated boom or with hand sprayers using a fixed spray volume per 1,000 sq ft as indicated below.

**Hand-Held Sprayers:** Hand-held sprayers may be used for spot applications of DMA 4 IVM. Care should be taken to apply the spray uniformly and at a rate equivalent to a broadcast application. Application rates in the table are based on the application rate for an area of 1,000 sq ft. Mix the amount of DMA 4 IVM (fl oz or ml) corresponding to the desired broadcast rate in 1 to 3 gallons of spray. To calculate the amount of DMA 4 IVM required for larger areas, multiply the table value (fl oz or ml) by the thousands of sq ft to be treated. An area of 1000 sq ft is approximately 10.5 X 10.5 yards (sides) in size.

**Rate Conversion Table for Spot Treatment:**

Label Broadcast Rate (pt/acre)							
1/2	2/3	3/4	1	2	3	4	8
Equivalent Amount of DMA 4 IVM per 1000 sq ft							
1/5	1/4	1/3	3/8	3/4	1	1 1/2	3
fl oz †	fl oz						
(5.5	(7.3	(8.3	(11	(22	(33	(44	(88
ml)	ml)	ml)	ml)	ml)	ml)	ml)	ml)

† Conversion factors: 1 fl oz = 29.6 (30) ml

## Weeds Controlled

### Annual or Biennial Weeds

Beggarticks †  
Bittercress, smallflowered  
bitterweed  
broomweed, common †  
burdock, common  
buttercup, smallflowered †  
carpetweed  
cinquefoil, common  
cinquefoil, rough  
cocklebur, common  
coffeeweed  
copperleaf, Virginia  
croton, Texas  
croton, woolly  
flixweed  
galinsoga  
geranium, Carolina  
hemp, wild  
horsetweed (marestail)  
jewelweed  
jimsonweed  
knotweed †  
kochia  
lambquarters, common  
lettuce, prickly †  
lettuce, wild  
lupines  
narrow, little †  
mallow, Venice †  
marshelder  
morningglory, annual  
morningglory, ivy

morningglory, woolly  
mousetail  
mustards (except blue mustard)  
parsnip, wild  
Pennycress, field  
Pepperweed †  
pigweeds (*Amaranthus* spp.) †  
poorjoe  
primrose, common  
purslane, common  
pusley, Florida  
radish, wild  
ragweed, common  
ragweed, giant  
rape, wild  
rockot, yellow  
salsify, common †  
salsify, western †  
shepherdspurse  
sicklepod  
smartweed (annual species) †  
sneezeweed, bitter  
sowthistle, annual  
sowthistle, spiny  
spanishneedles  
sunflower  
swaeldover  
tansymustard  
thistle, bull  
thistle, musk †  
thistle, Russian (tumbleweed) †  
velvetleaf  
vetches

### Perennial Weeds

Alfalfa †  
artichoke, Jerusalem †  
aster, many-flower †  
Austrian fieldcress †  
bindweed (hedge, field  
and European) †  
blue lettuce  
blueweed, Texas  
broomweed  
bulbottle †  
carrot, wild †  
catnip  
chicory  
clover, red †  
coffeeweed  
crass, hoary †  
dandelion †  
docks †  
dogbanes †  
goldenrod  
eveningprimrose, culleaf  
garlic, wild †  
hawkweed, orange †  
healal  
ironweed, western  
ivy, ground †  
Jerusalem-artichoke  
loco, bigbend  
nettles (including stinging) †  
onion, wild †  
pennywort  
plantains  
ragwort, tansy †  
sowthistle, perennial  
thistle, Canada †  
vervains †  
waterplantain  
wormwood

† These weeds are only partially controlled and may require repeat applications and/or use of higher recommended rates of this product even under ideal conditions of application.

### Specific Use Directions

### Forestry, and Non-cropland, Uses

**Agricultural Use Requirements for Forest Use (Except Tree Injection Use):** For use in forests, follow PPE and Reentry Instructions in the "Agricultural Use Requirements" section under the "Directions for Use" heading of this label.

**Agricultural Use Requirements for Forestry (Tree Injection Only) and Non-cropland Areas:** When this product is applied to non-cropland areas, non-crop turf, and by tree injection in forest sites, follow reentry requirements given in the "Non-Agricultural Use Requirements" section under the "Directions for Use" heading of this label.

## Forestry Uses

Forest site preparation, forest roadsides, brush control, established conifer release (including Christmas trees and reforestation areas)

Treatment Site Method of Application	DMA 4 IVM	Specific Use Directions
Annual Weeds	2 to 4 pt/acre	Apply when weeds are small and growing actively before the bud stage. Apply when biennial and perennial species are in the seedling to rosette stage and before flower stalks appear. For difficult to control perennial broadleaf weeds and woody species, use up to 1 gallon DMA 4 IVM and 1 to 4 qt. Garlon® 3A herbicide per acre. For conifer release, make application in early spring before budbreak of conifers when weeds are small and actively growing.
Biennial and perennial broadleaf weeds and susceptible woody plants	4 to 8 pt/acre	
Spot Treatment to control broadleaf weeds	See Instructions for "Spot Treatment"	<b>Note:</b> To control broadleaf weeds in small areas with a hand sprayer, use an application rate equivalent to the recommended broadcast rate and spray to thoroughly wet all foliage. See rate conversion table and instructions for "Spot Treatment" and use of hand-held sprayers under "Application".
Conifer Release: Species such as white pine, ponderosa pine, jack pine, red pine, black spruce, white spruce, red spruce, and balsam fir	1 1/2 to 3 qt/acre	To control competing hardwood species such as alder, aspen, birch, hazel, and willow, apply from mid to late summer when growth of conifer trees has hardened off and woody plants are still actively growing. Apply with ground or air equipment, using sufficient spray volume to ensure complete coverage. Because this treatment may cause occasional conifer injury, do not apply if such injury cannot be tolerated.
Directed Spray: Conifer plantations including pine	4 qt/100 gal	Apply when brush or weeds are actively growing by directing the spray so as to avoid contact with conifer foliage and injurious amounts of spray. Apply in oil, oil-water, or water carrier in a spray volume of 10 to 100 gallons per acre.
Basal Spray (May also be used in noncropland)	8 qt/100 gal or	Thoroughly wet the base and root collar of all stems until the spray begins to accumulate around the root collar at the ground line. Wetting stems with the mixture may also aid in control.
Surface of Cut Stumps (May also be used in noncropland)	2.6 fl oz/gal of water	Apply as soon as possible after cutting trees. Thoroughly soak the entire stump with the 2,4-D mixture including cut surface, bark and exposed roots.
Frill and Girdle (May also be used in noncropland)		Cut frills (overlapping V-shaped notches cut downward through the bark in a continuous ring around the base of the tree) using an axe or other suitable tool. Treat freshly cut frills with as much of the 2,4-D mixture as they will hold.
Tree Injection Application (May also be used noncropland)	(1 to 2 ml per injection site)	To control unwanted hardwood trees such as elm, hickory, oak, and sweetgum in forests and other non-crop areas, apply by injecting at a rate of 1 ml of undiluted DMA 4 IVM per inch of trunk diameter at breast height (DBH) as measured approximately 4 1/2 ft above the ground. Make injections as close to the root collar as possible and the injection bit must penetrate the inner bark. Applications may be made throughout the year, but for best results apply between May 15 and October 15. Maples should not be treated during the spring sap flow. For hard to control species such as ash, maple, and dogwood use 2 ml of undiluted DMA 4 IVM per injection site or double the number of 1 ml injections. <b>Note: No Worker Protection Standard worker entry restrictions or worker notification requirements apply when this product is directly injected into agricultural plants.</b>

### Precautions and Restrictions:

- Do not allow sprays to contact conifer shoot growth (current year's new growth) or injury may occur.
- Do not apply to nursery seed beds.
- For conifer release, do not use on plantations where pine or larch are among the desired species.
- For broadcast applications, do not apply more than 8.42 pt/acre of DMA 4 IVM (4.0 lb of acid equivalent) per 12 month period.

## Non-cropland Areas

Such as fencerows, hedgerows, roadsides, drainage ditches, rights-of way, utility power lines, railroads, airports, and other non-crop areas

Treatment Site Method of Application	DMA 4 IVM (pt/acre)	Specific Use Directions
Annual broadleaf weeds	2 to 4	Apply when annual weeds are small and growing actively before the bud stage. Biennial and perennial weeds should be rosette to bud stage, but not flowering at the time of application. For difficult to control perennial broadleaf weeds and woody species, tank mix up to 1 gallon DMA 4 IVM plus 1 to 4 qt. Garlon® 3A herbicide per acre. For ground application: (High volume) apply a total of 100 to 400 gal per acre; (low volume) apply a total of 10 to 100 gal per acre. For helicopter: Apply a total of 5 to 30 gal per acre spray volume.
Biennial and perennial broadleaf weeds and susceptible woody plants	4 to 8	
Spot Treatment to control broadleaf weeds	See Instructions for "Spot Treatment"	Note: To control broadleaf weeds in small areas with a hand sprayer, use an application rate equivalent to the broadcast rate recommended for this treatment site and spray to thoroughly wet all foliage. See rate conversion table and instructions for "Spot Treatment" and use of hand-held sprayers under "Application".
Tree Injection Application		See instructions for tree injection application in "Forestry Uses" section.
Southern wild rose Broadcast application	up to 4	Broadcast: Apply in a spray volume of 5 or more gallons per acre by ground equipment, or 10 or more gallons per acre by aircraft. Apply when foliage is well developed. Thorough coverage is required. Use 1 gallon of DMA 4 IVM plus 4 to 8 fluid ounces of an agricultural surfactant per 100 gallons of water. Two or more treatments may be required.
Spot treatment	1 gal/100 gal of spray	

### Precautions and Restrictions:

- Do not apply to newly seeded areas until grass is well established.
- Bentgrass, St. Augustine, clover, legumes and dichondra may be severely injured or killed by this treatment.
- Do not apply more than 8.42 pt/acre of DMA 4 IVM (4.0 lb of acid equivalent) per use season.
- Do not reapply to a treated area within 30 days of a previous application.
- If grazing of meat or dairy animals or hay harvest is desired in non-crop areas, do not apply more than 4.21 pt/acre of DMA 4 IVM (2.0 lb of acid equivalent) and do not harvest (orage for hay within 7 days of application.

## Non-crop Turf Areas

Includes cemeteries and parks, airfields, roadsides, vacant lots, and drainage ditch banks

**Use Requirements for Ornamental Turf Areas:** When this product is applied to ornamental turf areas, follow PPE and reentry instructions in the "Non-agricultural Use Requirements" section of this label.

Treatment Site (Application Timing)	DMA 4 IVM (pt/acre)	Specific Use Directions
Ornamental Turf (Postemergence) Seedling grass (five-leaf stage or later)	3/4 to 1	Apply when weeds are small and actively growing. For best results, apply when soil moisture is adequate for active weed growth. Deep-rooted perennial weeds such as bindweed and Canada thistle may require repeat applications. Do not apply to newly seeded grasses until well established (five-leaf stage or later) and then use a maximum of 1 pt/acre. Cool season grasses are tolerant of higher rates.
Well-established grasses	2 to 4	
Biennial and perennial broadleaf weeds	4	

### Precautions, Restrictions:

- Do not use on creeping grasses such as bent except as a spot treatment.
- Do not use on injury-sensitive southern grasses such as St. Augustinegrass.
- Do not use on dichondra or other herbaceous ground covers. Legumes may be damaged or killed.
- Do not reapply within 21 days of a previous application.
- Reseeding: Delay reseeding at least 30 days following application. Preferably, with spring application, reseed in the fall and with fall application, reseed in the spring.
- Do not apply more than 2 broadcast applications per year per treatment site (does not include spot treatments).

## Aquatic Uses

**Use Requirements for Aquatic Areas:** When this product is applied to aquatic areas, follow PPE and reentry instructions in the "Non-agricultural Use Requirements" section of this label.

### Control of Weeds and Brush on Banks of Irrigation Canals and Ditches

Target Plants	DMA 4 IVM (pt/acre)	Specific Use Directions
Annual Weeds	2 to 4	<p>Apply using low pressure spray (10 to 40 psi) in a spray volume of 20 to 100 gallons per acre using power operated spray equipment. Apply when wind speed is low, 5 mph or less. Apply working upstream to avoid accidental concentration of spray into water. Cross-stream spraying to opposite banks is not permitted and avoid boom spraying over water surface. When spraying shoreline weeds, allow no more than 2 foot overspray onto water surface with an average of less than 1 foot of overspray to prevent significant water contamination.</p> <p>Apply when weeds are small and growing actively before the bud stage. Apply when biennial and perennial species are in the seedling to rosette stage and before flower stalks appear. For hard-to-control weeds, a repeat application after 30 days at the same rate may be needed.</p> <p>For woody species and patches of perennial weeds, mix 1 gallon of DMA 4 IVM per 64 to 150 gallons of total spray. Wet foliage by applying about 3 to 4 gallons of spray per 1000 sq ft (10.5 X 10.5 steps).</p>
Biennial and perennial broadleaf weeds and susceptible wood plants	4	

**Restrictions and Limitations:**

- Do not apply more than 2 treatments per season or reapply within 30 days.
- Do not use on small canals (less than 10 cfs) where water will be used for drinking purposes.
- Do not apply more than 8.42 pt/acre (4.0 lb of acid equivalent) per use season.

### Aquatic Weed Control in Ponds, Lakes, Reservoirs, Marshes, Bayous, Drainage Ditches, Canals, Rivers and Streams that are Quiescent or Slow Moving, Including Programs of the Tennessee Valley Authority

**Notice to Applicators:** Before application, coordination and approval of local and state authorities may be required, either by letter or agreement or issuance of special permits for such use.

**Emergent and Floating Aquatic Weeds: Including Water hyacinth (*Eichornia crassipes*)**

**Application Rate:** 2 to 4 qt/acre.

**Specific Use Directions**

**Application Timing:** Spray weed mass only. Apply when water hyacinth plants are actively growing. Repeat application as necessary to kill regrowth and plants missed in previous operation. Use 4 qt/acre rate when plants are mature or when weed mass is dense.

**Surface Application:** Use power operated sprayers with boom or spray gun mounted on boat, tractor or truck. Thorough wetting of foliage is essential for maximum control. Use 100 to 400 gallons of spray mixture per acre. Special precautions such as use of low pressure, large nozzles and spray thickening agents should be taken to avoid spray drift to susceptible crops. Follow label directions for use of any drift control agent.

**Aerial Application:** Use drift control spray equipment or thickening agent mixed in the spray mixture. Apply 1 gallon of DMA 4 IVM per acre using standard boom systems using a minimum spray volume of 5 gallons per acre. For Microfoil® drift control spray systems, apply DMA 4 IVM in a total spray volume of 12 to 15 gallons per acre.

**Submerged Aquatic Weeds: Including Eurasian Water Milfoil (*Myriophyllum spicatum*)**

Treatment Site	Maximum Application Rate <sup>1</sup>	Specific Use Directions
Aquatic Weed Control In Ponds, Lakes, Reservoirs, Marshes, Bayous, Drainage Ditches, Canals, Rivers and Streams that are Quiescent or Slow Moving, Including Programs of the Tennessee Valley Authority	2.84 gallons (10.8 lb of acid equivalent) per acre foot	<p><b>Application Timing:</b> For best results, apply in spring or early summer when aquatic weeds appear. Check for weed growth in areas heavily infested the previous year. A second application may be needed when weeds show signs of recovery, but no later than mid-August in most areas.</p> <p><b>Subsurface Application:</b> Apply DMA 4 IVM undiluted directly to the water through a boat mounted distribution system. Shoreline areas should be treated by subsurface injection application by boat to avoid aerial drift.</p> <p><b>Surface Application:</b> Use power operated boat mounted boom sprayer. If rate is less than 5 gallons per acre, dilute to a minimum spray volume of 5 gallons per surface acre.</p> <p><b>Aerial Application:</b> Use drift control spray equipment or thickening agents mixed with sprays to reduce drift. Apply through standard boom systems in a minimum spray volume of 5 gallons per acre. For "mixing" drift control spray systems, apply DMA 4 IVM in a total spray volume of 12 to 15 gallons per acre. Apply to attain a concentration of 2 to 4 ppm (see table below).</p>

<sup>1</sup>DMA 4 IVM contains 3.8 lb of acid equivalent per gallon of product.

Amount to Apply to Attain a Concentration of 2 to 4 ppm			
Surface Area	Average Depth (ft)	2,4-D Acid Equivalent to Apply (lb/acre)	Amount of DMA 4 IVM to Apply (gal/acre)
1 acre	1	5.4 to 10.8	1.42 to 2.84
	2	10.8 to 21.6	2.84 to 5.68
	3	16.2 to 32.4	4.26 to 8.53
	4	21.6 to 43.2	5.68 to 11.37
	5	27.0 to 54.0	7.10 to 14.21

**Precautions and Restrictions for Aquatic Use:**

- Do not treat areas that are not infested with aquatic weeds.
- Do not exceed 10.8 lb of acid equivalent (2.84 gallons) per acre foot of treated water.
- Do not apply within 1500 ft of an active potable or irrigation water intake.
- **Wind Speed:** Do not apply when wind speed is at or above 10 mph when making ground or surface applications. Do not aerially apply when wind speed is greater than 5 mph. Wind speed restrictions do not apply for subsurface applications used in submerged aquatic weed control programs.
- **Dissolved Oxygen Ratio:** Fish require oxygen dissolved in water for life processes and a favorable water-oxygen ratio must be maintained. Decaying weeds use up dissolved oxygen in water. Fish kill resulting from decaying plant material can be prevented by: (1) treating the entire area when the weed mass is sparse and the rate of decomposition will not be sufficient to disturb the water-oxygen ratio; or (2) if application is delayed until there is a dense weed mass, treat no more than one-half of a lake or pond at one time. For large bodies of weed-infested water, apply product in lanes, leaving buffer strips at least 100 feet wide which can be treated in 4 to 5 weeks or when vegetation in treated lanes has decomposed. During the growing season, decomposition of treated strips will usually occur in 2 to 3 weeks.
- **Irrigation:** Unless an approved assay indicates that the 2,4-D concentration is 100 ppb (0.1 ppm) acid or less, do not use water from treated areas for: (1) irrigation other than non-crop areas or those crops or plants labeled for direct application of 2,4-D; or (2) mixing sprays for agricultural or ornamental plants.
- **Potable Water:** Unless an approved assay indicates that the 2,4-D concentration is 70 ppb (0.07 ppm) acid or less, do not use water from treated areas for potable water (drinking water).
- **Other Uses of Treated Water:** Except as stated above, there are no restrictions on use of water from treated areas for fishing, watering of livestock, or other domestic purposes.

DEW 93 02 THU 02:21 PM WILSON LEE 10 00  
FILE NO: 200010010

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### 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. Dow AgroSciences **MAKES NO OTHER EXPRESS OR IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR ANY OTHER EXPRESS OR IMPLIED WARRANTY.**

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### 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. All such risks shall be assumed by buyer.

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### Limitation of Remedies

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.

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. In no case shall Dow AgroSciences be liable for consequential or incidental damages or losses.

The terms of the Warranty Disclaimer above 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.

\*Trademark of Dow AgroSciences LLC  
Dow AgroSciences LLC • Indianapolis, IN 46268 U.S.A.

EPA-accepted 10/13/2000

Label Code: D02-141-001

Initial Printing

# NAVIGATE®

A SELECTIVE HERBICIDE FOR CONTROLLING CERTAIN UNWANTED AQUATIC PLANTS

**ACTIVE INGREDIENTS:**

Butoxyethyl ester, 2,4-Dichlorophenoxyacetic acid, .....27.6%

**INERT INGREDIENTS:** .....72.4%

**TOTAL** 100.0%

\*Isomer specific by AOAC Method, Equivalent to 2,4-Dichlorophenoxyacetic Acid 19%

EPA Reg. No. 228-378-8959

EPA Est. No. 228-IL-1

## KEEP OUT OF REACH OF CHILDREN CAUTION

For Chemical Emergency, Spill, Leak, Fire, Exposure or Accident call Chemtrec Day or Night 1-800-424-9300

**PRECAUTIONARY STATEMENTS**

HAZARDS TO HUMANS AND DOMESTIC ANIMALS

**CAUTION**

Harmful if swallowed, absorbed through skin, or inhaled. Causes eye irritation. Avoid contact with skin, eyes or clothing. Avoid breathing dust. When handling this product, wear chemical resistant gloves. Wash thoroughly with soap and water after handling. When mixing, loading, or applying this product or repairing or cleaning equipment used with this product, wear eye protection (face shield or safety glasses), chemical resistant gloves, long-sleeved shirt, long pants, socks and shoes. It is recommended that safety glasses include front, brow and temple protection. Wash hands, face and arms with soap and water as soon as possible after mixing, loading, or applying this product. Wash hands, face and hands with soap and water before eating, smoking or drinking. Wash hands and arms before using toilet. After work, remove all clothing and shower using soap and water. Do not reuse clothing worn during the previous day's mixing and loading or application of this product without cleaning first. Clothing must be kept and washed separately from other household laundry. Remove saturated clothing as soon as possible and shower.

**STATEMENT OF PRACTICAL TREATMENT**

**IF SWALLOWED:** Call a physician or Poison Control Center. Drink 1 or 2 glasses of water and induce vomiting by touching back of throat with finger. If person is unconscious, do not give anything by mouth and do not induce vomiting.

**IF ON SKIN:** Wash with plenty of soap and water. Get medical attention.

**IF INHALED:** Remove victim to fresh air. If not breathing, give artificial respiration, preferably mouth-to-mouth. Get medical attention.

**IF IN EYES:** Flush eyes with plenty of water. Call a physician if irritation persists.

**ENVIRONMENTAL HAZARDS**

This product is toxic to fish. Drift or runoff may adversely affect fish and non-target plants. Do not apply to water except as specified on this label. Do not contaminate water when disposing of equipment washwaters. Unless an approved assay indicates the 2,4-D concentration is 100 ppb (0.1 ppm) or less, or, only growing crops and non-crop areas labeled for direct treatment with 2,4-D will be affected, do not use water from treated areas for irrigating plants or mixing sprays for agricultural or ornamental plants. Unless an approved assay indicates the 2,4-D concentration is 70 ppb (0.07 ppm) or less, do not use water from treated areas for potable water (drinking water).

Clean spreader equipment thoroughly before using it for any other purposes. Vapors from this product may injure susceptible plants.

Most cases of ground water contamination involving phenoxy herbicides such as 2,4-D have been associated with mixing/loading and disposal sites. Caution should be exercised when handling 2,4-D pesticides at such sites to prevent contamination of ground water supplies. Use of closed systems for mixing or transferring this pesticide will reduce the probability of spills. Placement of the mixing/loading equipment on an impervious pad to contain spills will help prevent ground water contamination.

**STORAGE AND DISPOSAL**

**STORAGE**

Always use original container to store pesticides in a secure warehouse or building. Do not store near seeds, fertilizers, insecticides or fungicides. Do not stack more than two pallets high. Do not contaminate water, food or feed by storage or disposal. It is recommended that a SARA Title III emergency response plan be created for storage facilities. Do not transport in passenger compartment of any vehicle.

**PESTICIDE DISPOSAL**

Pesticide wastes are toxic. If container is damaged or if pesticide has leaked, clean up spilled material. Improper disposal of excess pesticide is a violation of Federal law and may contaminate ground water. If these wastes cannot be disposed of by use according to label instructions, contact your State Pesticide or Environmental Control Agency, or the Hazardous Waste representative at the nearest EPA Regional Office for guidance.

**CONTAINER DISPOSAL**

Do not reuse empty bag. Completely empty bag into application equipment. Then dispose of empty bag in a sanitary landfill or by incineration, or, if allowed by State and local authorities, by burning. If bag is burned, stay out of smoke.

MANUFACTURED FOR:

 applied biochemists

Milwaukee, WI 53022  
1-800-558-5106

www.appliedbiochemists.com

SEE ADDITIONAL PRECAUTIONS  
AND DIRECTIONS ON BACK

NAVIGATE is a trademark of Applied Biochemists  
**NET WT. 50 LBS. (22.68 KG)**

**13529**

## DIRECTIONS FOR USE

**IT IS A VIOLATION OF FEDERAL LAW TO USE THIS PRODUCT IN A MANNER INCONSISTENT WITH ITS LABELING.  
READ THIS ENTIRE LABEL BEFORE USING THIS PRODUCT**

### GENERAL PRECAUTIONS AND RESTRICTIONS

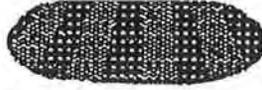
Do not use in or near a greenhouse.

### OXYGEN RATIO

Fish breathe oxygen in the water and a water-oxygen ratio must be maintained. Decaying weeds use up oxygen, but during the period when NAVIGATE® should be used, the weed mass is fairly sparse and the weed decomposition rate is slow enough so that the water-oxygen ratio is not disturbed by treating the entire area at one time.

If treatments must be applied later in the season when the weed mass is dense and repeat treatments are needed spread granules in lanes, leaving buffer strips which can then be treated when vegetation in treated lanes has disintegrated. During the growing season, weeds decompose in a 2 to 3 week period following treatment.

Buffer lanes should be 50 to 100 feet wide. Treated lanes should be as wide as the buffer strips. (See illustration below)



### WATER pH

Best results are generally obtained if the water to be treated has a pH less than 8. A pH of 8 or higher may reduce weed control. If regrowth occurs within a period of 6 to 8 weeks, a second application may be needed.

### PERMIT TO USE CHEMICALS IN WATER

In many states, permits are required to control weeds by chemical means in public water. If permits are required, they may be obtained from the Chief, Fish Division, State Department of Conservation or the State Department of Public Health.

### GENERAL INFORMATION

NAVIGATE® is formulated on special heat treated attaclay granules that resist rapid decomposition in water, sink quickly to lake or pond bottoms and release the weed killing chemical in the critical root zone area. This product is designed to selectively control the weeds listed on the label. While certain other weeds may be suppressed, control may be incomplete. Reduced control may occur in lakes where water replacement comes from bottom springs.

### WHEN TO APPLY

For best results, spread NAVIGATE® in the spring and early summer, during the time weeds start to grow. If desired, this timing can be checked by sampling the lake bottom in areas heavily infested with weeds the year before. If treatments are delayed until weeds form a dense mat or reach the surface, two treatments may be necessary. Make the second treatment when weeds show signs of recovery. Treatments made after September may be less effective depending upon water temperatures and weed growth. Occasionally, a second application will be necessary if heavy regrowth occurs or weeds reinfest from untreated areas.

### HOW TO APPLY

**FOR LARGE AREAS:** Use a fertilizer spreader or mechanical seeder such as the Gerber or Gandy or other equipment capable of uniformly applying this product. Before spreading any chemical, calibrate your method of application to be sure of spreading the proper amount. When using boats and power equipment, you must determine the proper combination of (1) boat speed (2) rate of delivery from the spreader, and (3) width of swath covered by the granules.

**FOR SMALL AREAS:** (Around Docks or Isolated Patches of Weeds): Use a portable spreader such as the Cyclone seeder or other equipment capable of uniformly applying this product. Estimate or measure out the area you want to treat. Weight out the amount of material needed and spread this uniformly over the area. More uniform coverage is obtained by dividing the required amount in two and covering the area twice, applying the second half at right angles to the first.

Use the following formula to calibrate your spreader's delivery in pounds of NAVIGATE PER MINUTE:

$$\frac{\text{Miles per hour} \times \text{spreader width} \times \text{pounds per acre}}{495} = \text{pounds per minute}$$

Example: To apply 100 pounds of NAVIGATE per acre using a spreader that covers a 20 foot swath from a boat traveling at 4 miles per hour, set the spreader to deliver 16 pounds of NAVIGATE granules per minute.

$$\frac{4 \text{ mph} \times 20 \text{ feet} \times 100 \text{ Lbs./A}}{495} = 16 \text{ Lbs./Min.}$$

### AMOUNTS TO USE

Rates of application vary with resistance of weed species to the chemical, density of weed mass at time of treatment, stage of growth, water depth, and rate of water flow through the treated area. Use the higher rate for dense weeds, when water is more than 8 feet deep and where there is a large volume turnover.

	NAVIGATE POUNDS PER ACRE	NAVIGATE POUNDS PER 2000 SQ. FT.
<b>SUSCEPTIBLE WEEDS</b>		
Water Milfoil (Myriophyllum spp.)	100 TO 200	5
Water stargrass (Heteranthera dubia)		
<b>SLIGHTLY TO MODERATELY RESISTANT WEEDS</b>		
Bladderwort (Utricularia spp.)	150 to 200	7-1/2 to 10
White water Lily (Nymphaea spp.)		
Yellow water lily (Nuphar spp.)		
Or spatterdock*		
Water shield (Brasenia spp.)		
Water chestnut (Trapa natans)		
Coontail* (Ceratophyllum Demersum)		
*Repeat treatments may be needed		

### LIMITED WARRANTY AND DISCLAIMER

The manufacturer warrants that this material conforms to its chemical description and is reasonably fit for the purposes stated on the label when used in accordance with directions under normal conditions of use and Buyer assumes all risk of any use contrary to such directions. SELLER MAKES NO OTHER WARRANTY EXPRESSED OR IMPLIED AS TO FITNESS OR MERCHANTABILITY, AND NO AGENT OF SELLER IS AUTHORIZED TO DO SO EXCEPT IN WRITING WITH SPECIFIC REFERENCE TO THIS WARRANTY. In no event shall the Seller's liability for any breach of warranty exceed the purchase price of the material as to which a claim is made.

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 plant or crop injury occurring from the use of this product is greatest when winds are gusty or in excess of 5 miles per hour or when other conditions, including lesser wind velocities, will allow spray drift to occur. When spraying, avoid combinations of pressure and nozzle type that will result in splatter or fine particles (mist) which are likely to drift. **Avoid applying at excessive speed or pressure.**

### **Mixing and Application Instructions**

**Clean sprayer and parts immediately after using this product by thoroughly flushing with water and dispose of rinsate according to labeled use or disposal instructions.**

**Apply these spray solutions in properly maintained and calibrated equipment capable of delivering desired volumes. Hand-gun applications should be properly directed to avoid spraying desirable plants. Note: reduced results may occur if water containing soil is used, such as water from ponds and unlined ditches.**

#### **Mixing**

Rodeo mixes readily with water. Mix spray solutions of this product as follows:

1. Fill the mixing or spray tank with the required amount of water while adding the required amount of this product (see "Directions for Use" and "Weeds Controlled" sections of this label).
2. Near the end of the filling process, add the required surfactant and mix well. Remove hose from tank immediately after filling to avoid siphoning back into the water source.

**Note:** If tank mixing with Garlon® 3A herbicide, ensure that Garlon 3A is well mixed with at least 75 percent of the total spray volume before adding Rodeo to the spray tank to avoid incompatibility.

During mixing and application, foaming of the spray solution may occur. To prevent or minimize foam, avoid the use of mechanical agitators, place the filling hose below the surface of the spray solution (only during filling), terminate by-pass and return lines at the bottom of the tank, and, if needed, use an approved anti-foam or defoaming agent.

Keep by-pass line on or near bottom of tank to minimize foaming. Screen size in nozzle or line strainers should be no finer than 50 mesh. Carefully select correct nozzle to avoid spraying a fine mist. For best results with conventional ground application equipment, use flat fan nozzles. Check for even distribution of spray droplets.

**IMPORTANT:** When using this product, unless otherwise specified, mix 2 or more quarts of a nonionic surfactant per 100 gallons of spray solution. Use a nonionic surfactant labeled for use with herbicides. The surfactant must contain 50 percent or more active ingredient.

Always read and follow the manufacturer's surfactant label recommendations for best results.

These surfactants should not be used in excess of 1 quart per acre when making broadcast applications.

Carefully observe all cautionary statements and other information appearing in the surfactant label.

**Colorants or marking dyes** approved for use with herbicides may be added to spray mixtures of this product. Colorants or dyes used in spray solutions of this product may reduce performance, especially at lower rates or dilutions. Use colorants or dyes according to the manufacturer's label recommendations.

### **Application Equipment and Techniques**

**ATTENTION: AVOID DRIFT. EXTREME CARE MUST BE EXERCISED 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 crops, plants, or other areas on which the treatment was not intended. The likelihood of plant or crop injury occurring from the use of this product is greatest when winds are gusty or in excess of 5 miles per hour or when other conditions, including lesser wind velocities, will allow spray drift to occur. When spraying, avoid combinations of pressure and nozzle type that will result in splatter or fine particles (mist) which are likely to drift. **AVOID APPLYING AT EXCESSIVE SPEED OR PRESSURE.**

**Note:** Use of this product in a manner not consistent with this label may result in injury to persons, animals, or crops, or other unintended consequences. When not in use, keep container closed to prevent spills and contamination.

#### **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. 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, public health uses or to applications using dry formulations.

1. The distance of the outer most 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.

The applicator should be familiar with and take into account the information covered in the following **Aerial Drift Reduction Advisory Information:**

**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 Wind, Temperature and Humidity, and Temperature Inversion section of this label).

**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-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 airstream 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  $\frac{3}{4}$  of the wingspan or rotor length may further reduce drift without reducing swath width.

Application-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 cross-wind, 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 2-10 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 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 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 connected cloud (under low wind conditions) indicates an inversion, while smoke that moves upwards 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).

## Aerial Equipment

For aerial application of this product in California, refer to Federal supplemental label for Rodeo herbicide entitled "For Aerial Application in California Only". In California, aerial application may be made in aquatic sites and noncrop areas, including aquatic sites present in noncrop areas that are part of the intended treatment.

**For control of weed or brush species listed in this label using aerial application equipment:** For aerial broadcast application, unless otherwise specified, apply the rates of Rodeo and surfactant recommended for broadcast application in a spray volume of 3 to 20 gallons of water per acre. See the "Weeds Controlled" section of this label for labeled annual and herbaceous weeds and woody plants and broadcast rate recommendations. Aerial applications of this product may only be made as specifically recommended in this label.

**AVOID DRIFT. Do not apply during inversion conditions, when winds are gusty or under any other condition which will allow drift. Drift may cause damage to any vegetation contacted to which treatment is not intended. To prevent injury to adjacent desirable vegetation, appropriate buffer zones must be maintained.**

Coarse sprays are less likely to drift; therefore, do not use nozzles or nozzle configurations which dispense spray as fine spray droplets. Do not angle nozzles forward into the airstream and do not increase spray volume by increasing nozzle pressure.

Drift control additives may be used. When a drift control additive is used, read and carefully observe the cautionary statements and all other information appearing in the additive label. The use of a drift control agent for conifer and herbaceous release applications may result in conifer injury and is not recommended.

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

Thoroughly wash aircraft, especially landing gear, after each day of spraying to remove residues of this product accumulated during spraying or from spills. **Prolonged exposure of this product to uncoated steel surfaces may result in corrosion and possible failure of the part. Landing gear are most susceptible.** The maintenance of an organic coating (paint) which meets aerospace specification MIL-C-38413 may prevent corrosion.

## Ground Broadcast Equipment

**For control of weed or brush species listed in this label using conventional boom equipment:** For ground broadcast application, unless otherwise specified, apply the rates of Rodeo and surfactant recommended for broadcast application in a spray volume of 3 to 30 gallons of water per acre. See the "Weeds Controlled" section of this label for labeled annual and herbaceous weeds and woody plants and broadcast rate recommendations. As density of vegetation increases, spray volume should be increased within the recommended range to ensure complete coverage. Carefully select correct nozzle to avoid spraying a fine mist. For best results with ground application equipment, use flat fan nozzles. Check for even distribution of spray droplets.

## Hand-Held and High-Volume Equipment (Use Coarse Sprays Only)

**For control of weeds listed in this label using knapsack sprayers or high-volume spraying equipment utilizing handguns or other suitable nozzle arrangements:**

**High volume sprays:** Prepare a 3/4 to 2 percent solution of this product in water, add a nonionic surfactant and apply to foliage of vegetation to be controlled. For specific rates of application and instructions for control of various annual and perennial weeds, see the "Weeds Controlled" section in this label.

Applications should be made on a spray-to-wet basis. Spray coverage should be uniform and complete. Do not spray to point of runoff.

**Low volume directed sprays:** Rodeo may be used as a 5 to 8 percent solution in low-volume directed sprays for spot treatment of trees and brush. This treatment method is most effective in areas where there is a low density of undesirable trees or brush. 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. Ensure that at least 50 percent of the leaves are contacted by the spray solution. For flat fan and cone nozzles and with hand-directed mist blowers, mist the application over the foliage of the targeted vegetation. Small, open-branched trees need only be treated from one side. If the foliage is thick or there are multiple root sprouts, applications must be made from several sides to ensure adequate spray coverage.

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

### Spray Solution

Desired Volume	Amount of Rodeo						
	3/4%	1%	1 1/4%	1 1/2%	2%	5%	8%
1 gal	1 fl oz	1 1/3 fl oz	1 2/3 fl oz	2 fl oz	2 2/3 fl oz	6 1/2 fl oz	10 1/4 fl oz
25 gal	1 1/2 pt	1 qt	1 1/4 qt	1 1/2 qt	2 qt	5 qt	2 gal
100 gal	3 qt	1 gal	1 1/4 gal	1 1/2 gal	2 gal	5 gal	8 gal

2 tablespoons = 1 fluid ounce

For use in knapsack sprayers, it is suggested that the recommended amount of this product be mixed with water in a larger container. Fill the knapsack sprayer with the mixed solution and add the correct amount of surfactant.

## Wiper Applications

For wick or wiper applications, mix 1 gallon of this product with 2 gallons of clean water to make a 33 percent solution. Addition of a nonionic surfactant at a rate of 10 percent by volume of total herbicide solution is recommended.

Wiper applications can be used to control or suppress annual and perennial weeds listed on this label. In heavy weed stands, a double application in opposite directions may improve results. See the "Weed Controlled" section in this label for recommended timing, growth stage and other instructions for achieving optimum results

## Aquatic and Other Noncrop Sites

Apply Rodeo as directed and under conditions described to control or partially control weeds and woody plants listed in the "Weeds Controlled" section in industrial, recreational and public areas or other similar aquatic or terrestrial sites on this label.

## Aquatic Sites

Rodeo may be applied to emerged weeds in all bodies of fresh and brackish water which may be flowing, nonflowing 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, and similar sites.

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

- Rodeo 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 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 1/2 mile upstream of an active potable water intake in flowing water (i.e., river, stream, etc.) or within 1/2 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 1/2 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 re-treat 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 1/2 pints per acre must not be exceeded in any single broadcast application that is being made over water.
- 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.

### Other Noncrop Sites

Rodeo may be used to control the listed weeds in the following terrestrial noncrop sites and/or in aquatic sites within these areas:

Habitat Restoration & Management Areas  
 Highways & Roadsides  
 Industrial Plant Sites  
 Petroleum Tank Farms  
 Pipeline, Power, Telephone & Utility Rights-of-Way  
 Pumping Installations  
 Railroads  
 Similar Sites

### Cut Stump Application

Woody vegetation may be controlled by treating freshly cut stumps of trees and resprouts with this product. Apply this product using suitable equipment to ensure coverage of the entire cambium. Cut vegetation close to the soil surface. Apply a 50 to 100 percent solution of this product to freshly cut surface immediately after cutting. Delay in applying this product may result in reduced performance. For best results, trees should be cut during periods of active growth and full leaf expansion.

When used according to directions for cut stump application, this product will control, partially control or suppress most woody brush and tree species, some of which are listed below:

Common Name	Scientific Name
Alder	<i>Alnus spp.</i>
Coyote brush †	<i>Baccharis consanguinea</i>
Dogwood †	<i>Cornus spp.</i>
Eucalyptus	<i>Eucalyptus spp.</i>
Hickory †	<i>Carya spp.</i>
Madrone	<i>Arbutus menziesii</i>
Maple †	<i>Acer spp.</i>
Oak	<i>Quercus spp.</i>
Poplar †	<i>Populus spp.</i>
Reed, giant	<i>Arundo donax</i>
Salt cedar	<i>Tamarix spp.</i>
Sweet gum †	<i>Liquidambar styraciflua</i>
Sycamore †	<i>Platanus occidentalis</i>
Tan oak	<i>Lithocarpus densiflorus</i>
Willow	<i>Salix spp.</i>

† Rodeo is not approved for this use on these species in the state of California.

## Wildlife Habitat Restoration and Management Areas

Rodeo is recommended for the restoration and/or maintenance of native habitat and in wildlife management areas.

**Habitat Restoration and Maintenance:** When applied as directed, exotic and other undesirable vegetation may be controlled in habitat management areas. Applications may be made to allow recovery of native plant species, to open up water to attract waterfowl, and for similar broad-spectrum vegetation control requirements in habitat management areas. Spot treatments may be made to selectively remove unwanted plants for habitat enhancement. For spot treatments, care should be exercised to keep spray off of desirable plants.

**Wildlife Food Plots:** Rodeo may be used as a site preparation treatment prior to planting wildlife food plots. Apply as directed to control vegetation in the plot area. Any wildlife food species may be planted after applying this product, or native species may be allowed to reinfest the area. If tillage is needed to prepare a seedbed, wait 7 days after applying this product before tilling to allow for maximum effectiveness.

### Injection and Frill Applications

Woody vegetation may be controlled by injection or frill application of this product. Apply this product using suitable equipment which must penetrate into living tissue. Apply the equivalent of 1 ml of this product per 2 to 3 inches of trunk diameter. This is best achieved by applying 25 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 dilute material to a continuous frill or more closely spaced cuttings. Avoid application techniques that allow runoff to occur from frill or cut areas in species that exude sap freely after frills or cutting. In species such as these, make frill or cut at an oblique angle so as to produce a cupping effect and use undiluted material. For best results, applications should be made during periods of active growth and full leaf expansion.

This treatment will control the following woody species:

Common Name	Scientific Name
Oak	<i>Quercus spp.</i>
Poplar	<i>Populus spp.</i>
Sweet gum	<i>Liquidambar styraciflua</i>
Sycamore	<i>Platanus occidentalis</i>

This treatment will suppress the following woody species:

Common Name	Scientific Name
Black gum †	<i>Nyssa sylvatica</i>
Dogwood	<i>Cornus spp.</i>
Hickory	<i>Carya spp.</i>
Maple, red	<i>Acer rubrum</i>

† Rodeo is not approved for this use on this species in the state of California.

### Release of Bermudagrass or Bahiagrass on Noncrop Sites

#### Release Of Dormant Bermudagrass and Bahiagrass

When applied as directed, this product will provide control or suppression of many winter annual weeds and tall fescue for effective release of dormant bermudagrass or bahiagrass. Make applications to dormant bermudagrass or bahiagrass.

For best results on winter annuals, treat when weeds 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 in or beyond the 4 to 6-leaf stage.

#### Weeds Controlled

Rate recommendations for control or suppression of winter annuals and tall fescue are listed below.

Apply the recommended rates of this product in 10 to 25 gallons of water per acre plus 2 quarts nonionic surfactant per 100 gallons of total spray volume.

#### Weeds Controlled or Suppressed †

Note: C = Controlled; S = Suppressed

Weed Species	Rate of Rodeo (Fluid Ounces Per Acre)					
	6	9	12	18	24	48
Barley, little <i>Hordeum pusillum</i>	S	C	C	C	C	C
Bedstraw, catchweed <i>Galium aparine</i>	S	C	C	C	C	C
Bluegrass, annual <i>Poa annua</i>	S	C	C	C	C	C
Chervil <i>Chaerophyllum tainturieri</i>	S	C	C	C	C	C
Chickweed, common <i>Stellaria media</i>	S	C	C	C	C	
Clover, crimson <i>Trifolium incarnatum</i>	•	S	S	C	C	C
Clover, large hop <i>Trifolium campestre</i>	•	S	S	C	C	C
Speedwell, corn <i>Veronica arvensis</i>	S	C	C	C	C	C
Fescue, tall <i>Festuca arundinacea</i>	•	•	•	•	S	S
Geranium, Carolina <i>Geranium carolinianum</i>	•	•	S	S	C	C
Henbit <i>Lamium amplexicaule</i>	•	S	C	C	C	C
Ryegrass, Italian <i>Lolium multiflorum</i>	•	•	S	C	C	C
Vetch, common <i>Vicia sativa</i>	•	•	S	C	C	C

† These rates apply only to sites where an established competitive turf is present.

#### Release of Actively Growing Bermudagrass

NOTE: Use only on sites where bahiagrass or bermudagrass are desired for ground cover and some temporary injury or yellowing of the grasses can be tolerated.

When applied as directed, this product will aid in the release of bermudagrass by providing control of annual species listed in the "Weeds Controlled" section in this label, and suppression or partial control of certain perennial weeds.

For control or suppression of those annual species listed in this label, use 3/4 to 2 1/4 pints of this product as a broadcast spray in 10 to 25 gallons of spray solution per acre, plus 2 quarts of a nonionic surfactant per 100 gallons of total spray volume. Use the lower rate when treating annual weeds below 6 inches in height (or length of runner in annual vines). Use the higher rate as size of plants increases or as they approach flower or seedhead formation.

Use the higher rate for partial control or longer-term suppression of the following perennial species. Use lower rates for shorter-term suppression of growth.

Bahiagrass	Johnsongrass <sup>†</sup>
Dallisgrass	Trumpet creeper <sup>**</sup>
Fescue (tall)	Vaseygrass

<sup>†</sup> Johnsongrass is controlled at the higher rate.

<sup>\*\*</sup> Suppression at the higher rate only.

Use only on well-established bermudagrass. Bermudagrass injury may result from the treatment but regrowth will occur under moist conditions. Repeat applications in the same season are not recommended, since severe injury may result.

### Bahiagrass Seedhead and Vegetative Suppression

When applied as directed in the "Noncrop Sites" section in this label, this product will provide significant inhibition of seedhead emergence and will suppress vegetative growth for a period of approximately 45 days with single applications and approximately 120 days with sequential applications.

Apply this product 1 to 2 weeks after full green-up of bahiagrass or after the bahiagrass has been mowed to a uniform height of 3 to 4 inches. Applications must be made prior to seedhead emergence. Apply 5 fluid ounces per acre of this product, plus 2 quarts of an approved nonionic surfactant per 100 gallons of total spray volume in 10 to 25 gallons of water per acre.

Sequential applications of this product plus nonionic surfactant may be made at approximately 45-day intervals to extend the period of seedhead and vegetative growth suppression. For continued vegetative growth suppression, sequential applications must be made prior to seedhead emergence.

Apply no more than 2 sequential applications per year. As a first sequential application, apply 3 fluid ounces of this product per acre plus nonionic surfactant. A second sequential application of 2 to 3 fluid ounces per acre plus nonionic surfactant may be made approximately 45 days after the last application.

### Annual Grass Growth Suppression

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 ounces of this product in 10 to 40 gallons of spray solution per acre. Mix 2 quarts of a nonionic surfactant per 100 gallons of spray solution. Applications should be made when annual grasses are actively growing and before the seedheads are in the boot stage of development. Treatments made after seedhead emergence may cause injury to the desired grasses.

### Weeds Controlled

#### 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," "General Information" and "Mixing

and Application Instructions" for labeled uses and specific application instructions.

**Broadcast Application Rates:** Use 1 1/2 pints of this product per acre plus 2 or more quarts of a nonionic surfactant per 100 gallons of spray solution if weeds are less than 6 inches tall. If weeds are greater than 6 inches tall, use 2 1/2 pints of this product per acre plus 2 or more quarts of an approved nonionic surfactant per 100 gallons of spray solution.

**Hand-Held, High-Volume Application Rates:** Use a 3/4 percent solution of this product in water plus 2 or more quarts of a nonionic surfactant per 100 gallons of spray solution and apply to foliage of vegetation to be controlled.

**When applied as directed, Rodeo plus nonionic surfactant will control the following annual weeds:**

Common Name	Scientific Name
Balsamapple <sup>†</sup>	<i>Momordica charantia</i>
Barley	<i>Hordeum vulgare</i>
Barnyardgrass	<i>Echinochloa crus-galli</i>
Bassia, fivehook	<i>Bassia hyssopifolia</i>
Bluegrass, annual	<i>Poa annua</i>
Bluegrass, bulbous	<i>Poa bulbosa</i>
Brome	<i>Bromus spp.</i>
Buttercup	<i>Ranunculus spp.</i>
Cheat	<i>Bromus secalinus</i>
Chickweed, mouseear	<i>Cerastium vulgatum</i>
Cocklebur	<i>Xanthium strumarium</i>
Corn, volunteer	<i>Zea mays</i>
Crabgrass	<i>Digitaria spp.</i>
Dwarf dandelion	<i>Krigia cespitosa</i>
Falseflax, smallseed	<i>Camelina microcarpa</i>
Fiddleneck	<i>Amsinckia spp.</i>
Flaxleaf fleabane	<i>Conyza bonariensis</i>
Fleabane	<i>Erigeron spp.</i>
Foxtail	<i>Setaria spp.</i>
Foxtail, Carolina	<i>Alopecurus carolinianus</i>
Groundsel, common	<i>Senecio vulgaris</i>
Horseweed/Marestail	<i>Conyza canadensis</i>
Kochia	<i>Kochia scoparia</i>
Lambsquarters, common	<i>Chenopodium album</i>
Lettuce, prickly	<i>Lactuca serriola</i>
Morningglory	<i>Ipomoea spp.</i>
Mustard, blue	<i>Chorispora tenella</i>
Mustard, tansy	<i>Descurainia pinnata</i>
Mustard, tumble	<i>Sisymbrium altissimum</i>
Mustard, wild	<i>Sinapis arvensis</i>
Oats, wild	<i>Avena fatua</i>
Panicum	<i>Panicum spp.</i>
Pennycress, field	<i>Thlaspi arvense</i>
Pigweed, redroot	<i>Amaranthus retroflexus</i>
Pigweed, smooth	<i>Amaranthus hybridus</i>
Ragweed, common	<i>Ambrosia artemisiifolia</i>
Ragweed, giant	<i>Ambrosia trifida</i>
Rocket, London	<i>Sisymbrium irio</i>
Rye	<i>Secale cereale</i>
Ryegrass, Italian <sup>**</sup>	<i>Lolium multiflorum</i>
Sandbur, field	<i>Cenchrus spp.</i>
Shattercane	<i>Sorghum bicolor</i>
Shepherd's-purse	<i>Capsella bursa-pastoris</i>
Signalgrass, broadleaf	<i>Brachiaria platyphylla</i>
Smartweed, Pennsylvania	<i>Polygonum pennsylvanicum</i>
Sowthistle, annual	<i>Sonchus oleraceus</i>

panishneedles <sup>††</sup>  
 Stinkgrass  
 Sunflower  
 Thistle, Russian  
 Spurry, umbrella  
 Velvetleaf  
 Wheat  
 Witchgrass

*Bidens bipinnata*  
*Eragrostis cilianensis*  
*Helianthus annuus*  
*Salsola kali*  
*Holosteum umbellatum*  
*Abutilon theophrasti*  
*Triticum aestivum*  
*Panicum capillare*

<sup>†</sup>Apply with hand-held equipment only.  
<sup>††</sup>Apply 3 pints of this product per acre.

Annual weeds will generally continue to germinate from seed throughout the growing season. Repeat treatments will be necessary to control later germinating weeds.

### Perennial Weeds

Apply Rodeo to control most vigorously growing perennial weeds. Unless otherwise directed, apply when target plants are actively growing and most have reached early head or early bud stage of growth. Unless otherwise directed, allow at least 7 days after application before disturbing vegetation.

**NOTE:** If weeds have been mowed or tilled, do not treat until regrowth has reached the recommended stages. Fall treatments must be applied before a killing frost.

Repeat treatments may be necessary to control weeds regenerating from underground parts or seed.

**Specific Weed Control Recommendations:** For perennial weeds, apply the recommended rate plus 2 or more quarts of a nonionic surfactant per 100 gallons of spray solution. See the "General Information", "Directions for Use" and "Mixing and Application" sections in this label for specific uses and application instructions.

**When applied as directed, Rodeo plus nonionic surfactant will control the following perennial weeds:** (Numbers in parentheses "(-)" following common name of a listed weed species refer to "Specific Perennial Weed Control Recommendations" for that weed which follow the species listing.)

Common Name	Scientific Name
Alfalfa (31)	<i>Medicago sativa</i>
Alligatorweed <sup>†</sup> (1)	<i>Alternanthera philoxeroides</i>
Anise/Fennel (31)	<i>Foeniculum vulgare</i>
Artichoke, Jerusalem (31)	<i>Helianthus tuberosus</i>
Bahiagrass (31)	<i>Paspalum notatum</i>
Bermudagrass (2)	<i>Cynodon dactylon</i>
Bindweed, field (3)	<i>Convolvulus arvensis</i>
Bluegrass, Kentucky (12)	<i>Poa pratensis</i>
Blueweed, Texas (3)	<i>Helianthus ciliaris</i>
Brackenfern (4)	<i>Pteridium spp.</i>
Bromegrass, smooth (12)	<i>Bromus inermis</i>
Canarygrass, reed (12)	<i>Phalaris arundinacea</i>
Cattail (5)	<i>Typha spp.</i>

Clover, red (31)  
 Clover, white (31)  
 Cogongrass (6)  
 Cordgrass (7)  
 Cutgrass, giant <sup>†</sup> (8)  
 Dallisgrass (31)  
 Dandelion (31)  
 Dock, curly (31)  
 Dogbane, hemp (9)  
 Fescue (31)  
 Fescue, tall (10)  
 Guineagrass (11)  
 Hemlock, poison (31)  
 Horsenettle (31)  
 Horseradish (9)  
 Ice Plant (22)  
 Johnsongrass (12)  
 Kikuyugrass (21)  
 Smartweed (3)  
 Lantana (13)  
 Lespedeza, common (31)  
 Lespedeza, sericea (31)  
 Loosestrife, purple (14)  
 Lotus, American (15)  
 Maidencane (16)  
 Milkweed (17)  
 Muhly, wirestem (21)  
 Mullein, common (31)  
 Napiergrass (31)  
 Nightshade, silverleaf (3)  
 Nutsedge, purple (18)  
 Nutsedge, yellow (18)  
 Orchardgrass (12)  
 Pampasgrass (19)  
 Paragrass (16)  
 Phragmites<sup>††</sup> (20)  
 Quackgrass (21)  
 Reed, giant (22)  
 Ryegrass, perennial (12)  
 Smartweed, swamp (31)  
 Spatterdock (23)  
 Starthistle, yellow (31)  
 Sweet potato, wild <sup>†</sup> (24)  
 Thistle, artichoke (25)  
 Thistle, Canada (25)  
 Timothy (12)  
 Torpedograss <sup>†</sup> (26)  
 Tules, common (27)  
 Vaseygrass (31)  
 Velvetgrass (31)  
 Waterhyacinth (28)  
 Waterlettuce (29)  
 Waterprimrose (30)  
 Wheatgrass, western (12)

*Trifolium pratense*  
*Trifolium repens*  
*Imperata cylindrica*  
*Spartina spp.*  
*Zizaniopsis miliacea*  
*Paspalum dilatatum*  
*Taraxacum officinale*  
*Rumex crispus*  
*Apocynum cannabinum*  
*Festuca spp.*  
*Festuca arundinacea*  
*Panicum maximum*  
*Conium maculatum*  
*Solanum carolinense*  
*Ammoracia rusticana*  
*Mesembryanthemum crystallinum*  
*Sorghum halepense*  
*Pennisetum clandestinum*  
*Centaurea repens*  
*Lantana camara*  
*Lespedeza striata*  
*Lespedeza cuneata*  
*Lythrum salicaria*  
*Nelumbo lutea*  
*Panicum hematomon*  
*Asclepias spp.*  
*Muhlenbergia frondosa*  
*Vernonia thapsus*  
*Pennisetum purpureum*  
*Solanum elaeagnifolium*  
*Cyperus rotundus*  
*Cyperus esculentus*  
*Dactylis glomerata*  
*Cortaderia jubata*  
*Brachiaria mutica*  
*Phragmites spp.*  
*Agropyron repens*  
*Arundo donax*  
*Lolium perenne*  
*Polygonum coccineum*  
*Nuphar luteum*  
*Centaurea solstitialis*  
*Ipomoea pandurata*  
*Cynara cardunculus*  
*Cirsium arvense*  
*Phleum pratense*  
*Panicum repens*  
*Scirpus acutus*  
*Paspalum urvillei*  
*Holcus spp.*  
*Eichornia crassipes*  
*Pistia stratiotes*  
*Ludwigia spp.*  
*Agropyron smithii*

<sup>†</sup>Partial control.

<sup>††</sup>Partial control in southeastern states. See "Specific Weed Control Recommendations" below.

### Specific Perennial Weed Control Recommendations:

- Alligatorweed:** Apply 6 pints of this product per acre as a broadcast spray or as a 1 1/4 percent solution with hand-held equipment to provide partial control of alligatorweed. Apply when most of the target plants are in bloom. Repeat applications will be required to maintain such control.
- Bermudagrass:** Apply 7 1/2 pints of this product per acre as a broadcast spray or as a 1 1/2 percent solution with hand-held equipment. Apply when target plants are actively growing and when seedheads appear.
- Bindweed, field / Silverleaf Nightshade / Texas Blueweed:** Apply 6 to 7 1/2 pints of this product per acre as a broadcast spray west of the Mississippi River and 4 1/2 to 6 pints of this product per acre east of the Mississippi River. With hand-held equipment, use a 1 1/2 percent solution. Apply when target plants are actively growing and are at or beyond full bloom. For silverleaf nightshade, best results can be obtained when application is made after berries are formed. Do not treat when weeds are under drought stress. New leaf development indicates active growth. For best results apply in late summer or fall.
- Brackenfern:** Apply 4 1/2 to 6 pints of this product per acre as a broadcast spray or as a 3/4 to 1 percent solution with hand-held equipment. Apply to fully expanded fronds which are at least 18 inches long.
- Cattail:** Apply 4 1/2 to 6 pints of this product per acre as a broadcast spray or as a 3/4 percent solution with hand-held equipment. 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.
- Cogongrass:** Apply 4 1/2 to 7 1/2 pints of this product per acre as a broadcast spray. Apply when cogongrass is at least 18 inches tall and actively growing in late summer or fall. Allow 7 or more days after application before tillage or mowing. 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:** Apply 4 1/2 to 7 1/2 pints of this product per acre as a broadcast spray or as a 1 to 2 percent solution with hand-held equipment. Schedule applications in order to allow 6 hours before treated plants are covered by tidewater. The presence of debris and silt on the cordgrass plants will reduce performance. It may be necessary to wash targeted plants prior to application to improve uptake of this product into the plant.
- Cutgrass, giant:** Apply 6 pints of this product per acre as a broadcast spray or as a 1 percent solution with hand-held equipment to provide partial control of giant cutgrass. 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.
- Dogbane, hemp / Knapweed / Horseradish:** Apply 6 pints of this product per acre as a broadcast spray or as a 1 1/2 percent solution with hand-held equipment. Apply when target plants are actively growing and most have reached the late bud-to-flower stage of growth. For best results, apply in late summer or fall.
- Fescue, tall:** Apply 4 1/2 pints of this product per acre as a broadcast spray or as a 1 percent solution with hand-held equipment. Apply when target plants are actively growing and most have reached the boot-to-head stage of growth. When applied prior to the boot stage, less desirable control may be obtained.
- Guineagrass:** Apply 4 1/2 pints of this product per acre as a broadcast spray or as a 3/4 percent solution with hand-held equipment. Apply when target plants are actively growing and when most have reached at least the 7-leaf stage of growth.
- Johnsongrass / Bluegrass, Kentucky / Bromegrass, smooth / Canarygrass, reed / Orchardgrass / Ryegrass, perennial / Timothy / Wheatgrass, western:** Apply 3 to 4 1/2 pints of this product per acre as a broadcast spray or as a 3/4 percent solution with hand-held equipment. Apply when target plants are actively growing and most 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.
- Lantana:** Apply this product as a 3/4 to 1 percent solution with hand-held equipment. Apply to actively growing lantana at or beyond the bloom stage of growth. Use the higher application rate for plants that have reached the woody stage of growth.
- Loosestrife, purple:** Apply 4 pints of this product per acre as a broadcast spray or as a 1 to 1 1/2 percent solution using hand-held equipment. Treat when plants are actively growing 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:** Apply 4 pints of this product per acre as a broadcast spray or as a 3/4 percent solution with hand-held equipment. Treat when plants are actively growing 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 / Paragrass:** Apply 6 pints of this product per acre as a broadcast spray or as a 3/4 percent solution with hand-held equipment. 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:** Apply 4 1/2 pints of this product per acre as a broadcast spray or as a 1 1/2 percent solution with hand-held equipment. Apply when target plants are actively growing and most have reached the late bud-to-flower stage of growth.
- Nutsedge, purple, yellow:** Apply 4 1/2 pints of this product per acre as a broadcast spray, or as a 3/4 percent solution with hand-held equipment 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.
- Pampasgrass:** Apply a 1 1/2 percent solution of this product with hand-held equipment when plants are actively growing.
- Phragmites:** For partial control of phragmites in Florida and the counties of other states bordering the Gulf of Mexico, apply 7 1/2 pints per acre as a broadcast spray or apply a 1 1/2 percent solution with hand-held equipment. In other areas of the U.S., apply 4 to 6 pints per acre as a broadcast spray or apply a 3/4 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 / Kikuyugrass / Muhly, wirestem:** Apply 3 to 4 1/2 pints of this product per acre as a broadcast spray or as a 3/4 percent solution with hand-held equipment when most quackgrass or wirestem muhly is at least 8 inches in height (3 to 4-leaf stage of growth) and actively growing. Allow 3 or more days after application before tillage.
- Reed, giant / ice plant:** For control of giant reed and ice plant, apply a 1 1/2 percent solution of this product with hand-held equipment when plants are actively growing. For giant reed, best results are obtained when applications are made in late summer to fall.

3. **Spatterdock:** Apply 6 pints of this product per acre as a broadcast spray or as a 3/4 percent solution with hand-held equipment. Apply when most plants are in full bloom. For best results, apply during the summer or fall months.
24. **Sweet potato, wild:** Apply this product as a 1 1/2 percent solution using hand-held equipment. Apply to actively growing weeds that are at or beyond the bloom stage of growth. Repeat applications will be required. Allow the plant to reach the recommended stage of growth before retreatment.
25. **Thistle, Canada / artichoke:** Apply 3 to 4 1/2 pints of this product per acre as a broadcast spray or as a 1 1/2 percent solution with hand-held equipment for Canada thistle. To control artichoke thistle, apply a 2 percent solution as a spray-to-wet application. Apply when target plants are actively growing and are at or beyond the bud stage of growth.
26. **Torpedograss:** Apply 6 to 7 1/2 pints of this product per acre as a broadcast spray or as a 3/4 to 1 1/2 percent solution with hand-held equipment to provide partial control of torpedograss. Use the lower rates under terrestrial conditions, and the higher rates under permanently submerged or a floating mat condition. Repeat treatments will be required to maintain such control.
27. **Tules, common:** Apply this product as a 1 1/2 percent solution with hand-held equipment. Apply to actively growing 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.
28. **Waterhyacinth:** Apply 5 to 6 pints of this product per acre as a broadcast spray or apply a 3/4 to 1 percent solution with hand-held equipment. Apply when target plants are actively growing and 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 rates when more rapid visual effects are desired.
9. **Waterlettuce:** For control, apply a 3/4 to 1 percent solution of this product with hand-held equipment to actively growing plants. Use higher rates where infestations are heavy. Best results are obtained from mid-summer through winter applications. Spring applications may require retreatment.
30. **Waterprimrose:** Apply this product as a 3/4 percent solution using hand-held equipment. Apply to plants that are actively growing at or beyond the bloom stage of growth, but before fall color changes occur. Thorough coverage is necessary for best control.
31. **Other perennial weeds listed above:** Apply 4 1/2 to 7 1/2 pints of Rodeo per acre as a broadcast spray or apply as a 3/4 to 1 1/2 percent solution with hand-held equipment.

## Woody Brush and Trees

**NOTE:** If brush has been mowed or tilled or trees have been cut, do not treat until regrowth has reached the recommended stage of growth.

### Application Rates and Timing

When applied as a 5 to 8 percent solution as a directed application as described in the "Hand-Held and High-Volume Equipment" section, this product will control or partially control all wood brush and tree species listed in this section of this label. Use the higher rate of application for dense stands and larger woody brush and trees.

**Specific Brush or Tree Control Recommendations:** Numbers in parentheses "(-)" following the common name of a listed brush or tree species refer to "Specific Brush or Tree Control Recommendations" which follow the species listing. See this section for specific application rates and timing for listed species.

For woody brush and trees, apply the recommended rate plus 2 or more quarts of a nonionic surfactant per 100 gallons of spray solution when plants are actively growing and, unless otherwise directed, after full-leaf expansion. 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.

In arid areas, best results are obtained when application is made in the spring or early summer when brush species are at high moisture content and are flowering. Ensure thorough coverage when using hand-held equipment. 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 following a frost.

See the "Directions for Use" and "Mixing and Application Instructions" sections in this label for labeled use and specific application instructions. **When applied as directed, Rodeo plus nonionic surfactant will control the following woody brush plants and trees:** (Numbers in parentheses "(-)" following common name of a listed brush or tree species refer to "Specific Brush or Tree Control Recommendations" for that species which follow the species listing.)

Common Name	Scientific Name
Alder (1)	<i>Alnus spp.</i>
Ash <sup>†</sup> (20)	<i>Fraxinus spp.</i>
Aspen, quaking (2)	<i>Populus tremuloides</i>
Bearclover, Bearmat (20)	<i>Chamaebatia foliolosa</i>
Birch (3)	<i>Betula spp.</i>
Blackberry (1)	<i>Rubus spp.</i>
Broom, French (4)	<i>Cytisus monspessulanus</i>
Broom, Scotch (4)	<i>Cytisus scoparius</i>
Buckwheat, California <sup>†</sup> (5)	<i>Eriogonum fasciculatum</i>
Cascara <sup>†</sup> (20)	<i>Rhamnus purshiana</i>
Catsclaw <sup>†</sup> (6)	<i>Acacia greggi</i>
Ceanothus (20)	<i>Ceanothus spp.</i>
Chamise (17)	<i>Adenostoma fasciculatum</i>
Cherry, bitter (7)	<i>Prunus emarginata</i>
Cherry, black (7)	<i>Prunus serotina</i>
Cherry, pin (7)	<i>Prunus pennsylvanica</i>
Coyote brush (8)	<i>Baccharis consanguinea</i>
Creepers, Virginia <sup>†</sup> (20)	<i>Parthenocissus quinquefolia</i>
Dewberry (1)	<i>Rubus trivialis</i>
Dogwood (9)	<i>Cornus spp.</i>
Elderberry (3)	<i>Sambucus spp.</i>
Elm <sup>†</sup> (20)	<i>Ulmus spp.</i>
Eucalyptus, bluegum (10)	<i>Eucalyptus globulus</i>
Hasardia <sup>†</sup> (5)	<i>Haplopappus squamosus</i>
Hawthorn (2)	<i>Crataegus spp.</i>
Hazel (3)	<i>Corylus spp.</i>
Hickory (9)	<i>Carya spp.</i>
Holly, Florida (11)	<i>Schinus terebinthifolius</i>
(Brazilian peppertree)	
Honeysuckle (1)	<i>Lonicera spp.</i>
Hornbeam, American (20)	<i>Carpinus caroliniana</i>
Kudzu (12)	<i>Pueraria lobata</i>
Locust, black <sup>†</sup> (20)	<i>Robinia pseudoacacia</i>
Manzanita (20)	<i>Arctostaphylos spp.</i>

Maple, red <sup>†</sup> (13)	<i>Acer rubrum</i>
Maple, sugar (14)	<i>Acer saccharum</i>
Maple, vine <sup>†</sup> (20)	<i>Acer circinatum</i>
Monkey flower <sup>†</sup> (5)	<i>Mimulus guttatus</i>
Oak, black <sup>†</sup> (20)	<i>Quercus velutina</i>
Oak, northern pin (14)	<i>Quercus palustris</i>
Oak, post (1)	<i>Quercus stellata</i>
Oak, red (14)	<i>Quercus rubra</i>
Oak, southern red (7)	<i>Quercus falcata</i>
Oak, white <sup>†</sup> (20)	<i>Quercus alba</i>
Persimmon <sup>†</sup> (20)	<i>Diospyros spp.</i>
Poison-ivy (15)	<i>Rhus radicans</i>
Poison-oak (15)	<i>Rhus toxicodendron</i>
Poplar, yellow <sup>†</sup> (20)	<i>Liriodendron tulipifera</i>
Prunus (7)	<i>Prunus spp.</i>
Raspberry (1)	<i>Rubus spp.</i>
Redbud, eastern (20)	<i>Cercis canadensis</i>
Rose, multiflora (16)	<i>Rosa multiflora</i>
Russian-olive (20)	<i>Elaeagnus angustifolia</i>
Sage: black (17), white	<i>Salvia spp.</i>
Sagebrush, California (17)	<i>Artemisia californica</i>
Salmonberry (3)	<i>Rubus spectabilis</i>
Salt cedar <sup>†</sup> (9)	<i>Tamarix spp.</i>
Saltbush, sea myrtle (18)	<i>Baccharis halimifolia</i>
Sassafras (20)	<i>Sassafras aibidum</i>
Sourwood <sup>†</sup> (20)	<i>Oxydendrum arboreum</i>
Sumac, poison <sup>†</sup> (20)	<i>Rhus vernix</i>
Sumac, smooth <sup>†</sup> (20)	<i>Rhus glabra</i>
Sumac, winged <sup>†</sup> (20)	<i>Rhus copallina</i>
Sweetgum (7)	<i>Liquidambar styraciflua</i>
Swordfern <sup>†</sup> (20)	<i>Polystichum munitum</i>
Tallowtree, Chinese (17)	<i>Sapium sebiferum</i>
Thimbleberry (3)	<i>Rubus parviflorus</i>
Tobacco, tree <sup>†</sup> (5)	<i>Nicotiana glauca</i>
Trumpet creeper (2)	<i>Campsis radicans</i>
Waxmyrtle, southern <sup>†</sup> (11)	<i>Myrica cerifera</i>
Willow (19)	<i>Salix spp.</i>

<sup>†</sup> Partial control (See below for control or partial control instructions.)

#### Specific Brush or Tree Control Recommendations:

- Alder / Blackberry / Dewberry / Honeysuckle / Oak, Post / Raspberry:** For control, apply 4 1/2 to 6 pints per acre as a broadcast spray or as a 3/4 to 1 1/4 percent solution with hand-held equipment.
- Aspen, Quaking / Hawthorn / Trumpet creeper:** For control, apply 3 to 4 1/4 pints of this product per acre as a broadcast spray or as a 3/4 to 1 1/4 percent solution with hand-held equipment.
- Birch / Elderberry / Hazel / Salmonberry / Thimbleberry:** For control, apply 3 pints per acre of this product as a broadcast spray or as a 3/4 percent solution with hand-held equipment.
- Broom, French / Broom, Scotch:** For control, apply a 1 1/4 to 1 1/2 percent solution with hand-held equipment.
- Buckwheat, California / Hasardia / Monkey flower / Tobacco, tree:** For partial control of these species, apply a 3/4 to 1 1/2 percent solution of this product as a foliar spray with hand-held equipment. Thorough coverage of foliage is necessary for best results.
- Catsclaw:** For partial control, apply a 1 1/4 to 1 1/2 percent solution with hand-held equipment when at least 50 percent of the new leaves are fully developed.

- Cherry, bitter / Cherry, black / Cherry, pin / Oak, southern red / Sweetgum / Prunus:** For control, apply 3 to 7 1/2 pints of this product per acre as a broadcast spray or as a 1 to 1 1/2 percent solution with hand-held equipment.
- Coyote brush:** For control, apply a 1 1/4 to 1 1/2 percent solution with hand-held equipment when at least 50 percent of the new leaves are fully developed.
- Dogwood / Hickory / Salt cedar:** For partial control, apply a 1 to 2 percent solution of this product with hand-held equipment or 6 to 7 1/2 pints per acre as a broadcast spray.
- Eucalyptus, bluegum:** For control of eucalyptus resprouts, apply a 1 1/2 percent solution of this product with hand-held equipment when resprouts are 6 to 12-feet tall. Ensure complete coverage. Apply when plants are actively growing. Avoid application to drought-stressed plants.
- Holly, Florida / Waxmyrtle, southern:** For partial control, apply this product as a 1 1/2 percent solution with hand-held equipment.
- Kudzu:** For control, apply 6 pints of this product per acre as a broadcast spray or as a 1 1/2 percent solution with hand-held equipment. Repeat applications will be required to maintain control.
- Maple, red:** For control, apply as a 3/4 to 1 1/4 percent solution with hand-held equipment when leaves are fully developed. For partial control, apply 2 to 7 1/2 pints of this product per acre as a broadcast spray.
- Maple, sugar / Oak: northern pin / Oak, red:** For control, apply as a 3/4 to 1 1/4 percent solution with hand-held equipment when at least 50 percent of the new leaves are fully developed.
- Poison-ivy / Poison-oak:** For control, apply 6 to 7 1/2 pints of this product per acre as a broadcast spray or as a 1 1/2 percent solution with hand-held equipment. Repeat applications may be required to maintain control. Fall treatments must be applied before leaves lose green color.
- Rose, multiflora:** For control, apply 3 pints of this product per acre as a broadcast spray or as a 3/4 percent solution with hand-held equipment. Treatments should be made prior to leaf deterioration by leaf-feeding insects.
- Sage, black / Sagebrush, California / Chamise / Tallowtree, Chinese:** For control of these species, apply a 3/4 percent solution of this product as a foliar spray with hand-held equipment. Thorough coverage of foliage is necessary for best results.
- Saltbush, sea myrtle:** For control, apply this product as a 1 percent solution with hand-held equipment.
- Willow:** For control, apply 4 1/2 pints of this product per acre as a broadcast spray or as a 3/4 percent solution with hand-held equipment.
- Other woody brush and trees listed above:** For partial control, apply 3 to 7 1/2 pints of this product per acre as a broadcast spray or as a 3/4 to 1 1/2 percent solution with hand-held equipment.

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### Warranty Disclaimer

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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. Dow AgroSciences MAKES NO OTHER EXPRESS OR IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR ANY OTHER EXPRESS OR IMPLIED WARRANTY.

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### Inherent Risks of Use

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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 and for which risks shall be assumed by buyer.

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### Limitation of Remedies

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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.

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. In no case shall Dow AgroSciences be liable for consequential or incidental damages or losses.

The terms of the Warranty Disclaimer above 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.

\*Trademark of Dow AgroSciences LLC  
**Dow AgroSciences LLC • Indianapolis, IN 46268 U.S.A.**

Label Code: D02-148-002  
Replaces Label: D02-148-001

### Revisions:

1. Update of specific uses allowed in the state of California.

This sample label is current as of 10/27/99. The product descriptions and recommendations provided in this sample label are for background information only. Always refer to the label on the product before using Monsanto or any other agricultural product.

21195Y1-1/CG



## Complete Directions for Use in Aquatic and Other Noncrop Sites.

EPA Reg. No. 524-343

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 IS LIKELY TO RESULT.

AquaMaster is a trademark of Monsanto Company.

2000-1

Read the entire label before using this product.

Use only according to label instructions.

It is a violation of Federal law to use this product in any manner inconsistent with its labeling.

Not all products recommended 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 OR REPACKAGING. SEE INDIVIDUAL CONTAINER LABEL FOR REPACKAGING LIMITATIONS.

## 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 litre 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 litre or 4 pounds per U.S. gallon of the acid, glyphosate.

## 2.0 IMPORTANT PHONE NUMBERS

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

2. 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!

Remove contaminated clothing and wash clothing before reuse.

Wash thoroughly with soap and water after handling.

### 3.2 Environmental Hazards

Do not contaminate water when 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, aluminum, 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. For any requirements specific to your State or Tribe, consult the agency responsible for pesticide regulations.

## 4.0 STORAGE AND DISPOSAL

Do not contaminate water, foodstuffs, feed or seed by storage or disposal.

**STORAGE:** STORE ABOVE 10°F (-12°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.

**DISPOSAL:** Wastes resulting from the use of this product that cannot be used or chemically reprocessed should be disposed of in a landfill approved for pesticide disposal or in accordance with applicable Federal, state, or local procedures.

Emptied container retains vapor and product residue. Observe all labeled safeguards until container is cleaned, reconditioned, or destroyed.

**FOR REFILLABLE PORTABLE CONTAINERS:** Do not reuse this container except for refill in accordance with a valid Monsanto Repackaging or Toll Repackaging Agreement. If not refilled or returned to the authorized repackaging facility, triple rinse container, then puncture and dispose of in a sanitary landfill, or by incineration, or, if allowed by state and local authorities, by burning. If burned, stay out of smoke.

**FOR METAL CONTAINERS (non-aerosol):** Triple rinse (or equivalent). 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.

**FOR BULK CONTAINERS:** Triple rinse emptied bulk container. Then offer for recycling or reconditioning, or dispose of in a manner approved by state and local authorities.

FOR PLASTIC 1-WAY CONTAINERS AND BOTTLES: Do not reuse container. Triple rinse container, then puncture and dispose of in a sanitary landfill, or by incineration, or, if allowed by state and local authorities, by burning. If burned, stay out of smoke.

FOR DRUMS: Do not reuse container. Return container per the Monsanto container return program. If not returned, triple rinse container, then puncture and dispose of in a sanitary landfill, or by incineration, or, if allowed by state and local authorities, by burning. If burned, stay out of smoke.

## 5.0 GENERAL INFORMATION

This product, a water-soluble liquid, mixes readily with water and nonionic surfactant to be applied as a foliar spray for the control or destruction of many herbaceous and woody plants.

This product moves through the plant from the point of foliage contact to and into the root system. Visible effects on most annual weeds occur within 2 to 4 days but on most perennial brush species may not occur for 7 days or more. Extremely cool or cloudy weather following treatment may slow the activity of this product and delay visual effects of control. 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.

Unless otherwise directed on this label, delay application until vegetation has emerged and reached the stages described for control of such vegetation under the "WEEDS CONTROLLED" section of this label.

Unemerged plants arising from unattached underground rhizomes or root stocks of perennials or brush will not be affected by the spray and will continue to grow. For this reason best control of most perennial weeds or brush is obtained when treatment is made at late growth stages approaching maturity.

Always use the higher rate of this product per acre within the recommended range when vegetation is heavy or dense.

Do not treat weeds or brush under poor growing conditions such as drought stress, disease or insect damage, as reduced control may result. Reduced results may also occur when treating weeds or brush heavily covered with dust.

Reduced control may result when applications are made to any weed or brush species that have been mowed, grazed or cut, and have not been allowed to regrow to the recommended stage for treatment.

Rainfall or irrigation occurring within 6 hours after application may reduce effectiveness. Heavy rainfall or irrigation within 2 hours after application may wash the product off the foliage and a repeat treatment may be required.

When this product comes in contact with soil (on the soil surface or as suspended soil or sediment in water) it is bound to soil particles. Under recommended use situations, once this product is bound to soil particles, it is not available for plant uptake and will not harm off-site vegetation where roots grow into the treatment area or if the soil is transported off-site. Under recommended use conditions, the strong affinity of this product to soil particles prevents this product from leaching out of the soil profile and entering ground water. The affinity between this product and soil particles remains until this product is degraded, which is primarily a biological degradation process carried out under both aerobic and anaerobic conditions by soil microflora.

This product does not provide residual weed control. For subsequent residual weed control, follow a label-approved herbicide program. Read and carefully observe the cautionary statements and all other information appearing on the labels of all herbicides used.

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

### ATTENTION

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 plant or crop injury occurring from the use of this product is greatest when winds are gusty or in excess of 5 miles per hour or when other conditions, including lesser wind velocities, will allow spray drift to occur. When spraying, avoid combinations of pressure and nozzle type that will result in splatter or fine particles (mist) which 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. When not in use, keep container closed to prevent spills and contamination.

## 6.0 MIXING

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

**NOTE:** REDUCED RESULTS MAY OCCUR IF WATER CONTAINING SOIL IS USED, SUCH AS VISIBLY MUDDY WATER OR WATER FROM PONDS AND DITCHES THAT IS NOT CLEAR.

### 6.1 Mixing with Water and Surfactant

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 water. Add the recommended amount of this product and the required surfactant near the end of the filling process and mix well. Use caution to avoid siphoning back into the carrier source. Use approved anti-back-siphoning devices where required by state or local regulations. 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.

Maintain good agitation at all times until the contents of the tank are sprayed. If the spray mixture is allowed to settle, thorough agitation may be 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.

When using this product, mix 2 or more quarts of a nonionic surfactant per 100 gallons of spray solution. Use a nonionic surfactant labeled for use with herbicides. The surfactant must contain 50 percent or more active ingredient.

These surfactants should not be used in excess of 1 quart per acre when making broadcast applications.

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

### 6.2 Mixing for Hand-Held Sprayers

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	3/4%	1%	1 1/4%	1 1/2%	5%	8%
1 Gal	1 oz.	1 1/3 oz.	1 2/3 oz.	2 oz.	6 oz.	10 1/4 oz.
25 Gal	1 1/2 pt.	1 qt.	1 1/4 qt.	1 1/2 qt.	5 qt.	2 gal.
100 Gal	3 qt.	1 gal.	1 1/4 gal.	1 1/2 gal.	5 gal.	8 gal.

2 tablespoons = 1 fluid ounce

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

### 6.3 Colorants or Dyes

Agriculturally-approved colorants or marking dyes may be added to this product. Colorants or dyes used in spray solutions of this product may reduce performance, especially at

lower rates or dilution. Use colorants or dyes according to the manufacturer's recommendations.

## 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 determine the potential for spray drift. The applicator and the grower are responsible for considering all these factors when making decisions.

### 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 INVERSION" 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 protection. 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 airstream, 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 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 the exposure of the droplets to evaporation and wind.

### Swath Adjustment

When applications are made with a crosswind, the swath will be displaced downward. 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 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 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 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

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).

## 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, REFER TO THE FEDERAL SUPPLEMENTAL LABEL FOR AERIAL APPLICATIONS IN THAT STATE FOR SPECIFIC INSTRUCTIONS, RESTRICTIONS AND REQUIREMENTS.

AVOID DRIFT—DO NOT APPLY DURING LOW-LEVEL INVERSION CONDITIONS, WHEN WINDS ARE GUSTY OR UNDER ANY OTHER CONDITION WHICH FAVORS DRIFT. DRIFT IS LIKELY TO CAUSE DAMAGE TO ANY VEGETATION CONTACTED TO WHICH TREATMENT IS NOT INTENDED. TO PREVENT INJURY TO ADJACENT DESIRABLE VEGETATION, APPROPRIATE BUFFER ZONES MUST BE MAINTAINED.

Use the recommended rates of this product and surfactant in 3 to 20 gallons of water per acre as a broadcast spray, unless otherwise specified.

Coarse sprays are less likely to drift; therefore, do not use nozzles or nozzle configurations which dispense spray as fine spray droplets. Do not angle nozzles forward into the airstream and do not increase spray volume by increasing nozzle pressure.

Drift control additives may be used. When a drift control 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.

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 are most susceptible.

## 7.2 Ground Broadcast Equipment

Use the recommended rates of this product in 3 to 40 gallons of water per acre as a broadcast spray unless otherwise specified. See the "WEEDS CONTROLLED" section of this label for specific rates. As density of weeds increases, spray volume should be increased within the recommended 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 for even distribution of spray droplets.

## 7.3 Hand-Held and High-Volume Equipment

Use Coarse Sprays Only

For control of weeds listed in this label using backpack or knapsack sprayers or high-volume spraying equipment utilizing handguns or other suitable nozzle arrangements—Prepare a 3/4 to 2 percent solution of this product in water, add a nonionic surfactant and apply to foliage of vegetation to be controlled. For specific rates of application and instructions for control of various annual and perennial weeds, see the "WEEDS CONTROLLED" section in this label.

Applications should be made on a spray-to-wet basis. Spray coverage should be uniform and complete. Do not spray to point of runoff.

This product may be used as a 5 to 8 percent solution for low-volume directed sprays for spot treatment of trees and brush. It is most effective in areas where there is a low density of undesirable trees or brush. 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. Ensure that at least 50 percent of the leaves are contacted by the spray solution. For flat fan and cone nozzles and with hand-directed mist blowers, mist the application over the foliage of the targeted vegetation. Small, open-branched trees need only be treated from one side. If the foliage is thick or there are multiple root sprouts, applications must be made from several sides to ensure adequate spray coverage.

## 7.4 Selective Equipment (Wiper Applications)

A wiper or sponge applicator applies the herbicide solution onto weeds by rubbing the weed with an absorbent material containing the herbicide solution.

Wiper applications can be used to control or suppress annual and perennial weeds listed on this label. In heavy weed stands, a double application in opposite directions may improve results. See the "WEEDS CONTROLLED" section in this label for recommended timing, growth stage and other instructions for achieving optimum results.

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

For wick or wiper applications, mix 2 1/2 gallons of this product plus 1 quart of a nonionic surfactant with 7 1/4 gallons of clean water to prepare a 25 percent solution.

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

## 8.0 SITE AND USE RECOMMENDATIONS

Detailed instructions follow alphabetically, by site.

Unless otherwise specified, applications may be made to control any weeds listed in the annual, perennial and woody brush tables. Refer also to the "SELECTIVE EQUIPMENT" section.

## 8.1 Aquatic and Other Noncrop Sites

When applied as directed and under the conditions described in the "WEEDS CONTROLLED" section in this label, this product will control or partially control the labeled weeds growing in the following industrial, recreational and public areas or other similar aquatic and terrestrial sites.

### Aquatic Sites

This product may be applied to emerged weeds in all bodies of fresh and brackish water which may be flowing, nonflowing 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, and similar sites.

If aquatic sites are present in the noncrop 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 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 1/2 mile up-stream of an active potable water intake in flowing water (i.e., river, stream, etc.) or within 1/2 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 1/2 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 re-treat 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 1/2 pints per acre must not be exceeded in any single broadcast application that is being made over water.

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.

**Other Noncrop-Type Sites**—This product may be used to control the listed weeds in terrestrial noncrop sites and/or in aquatic sites within these areas:

Airports  
Golf Courses  
Habitat Restoration & Management Areas  
Highways  
Industrial Plant Sites  
Lumberyards  
Natural Areas  
Parking Areas  
Parks  
Petroleum Tank Farms  
Pipeline, Power, Telephone & Utility Rights-of-Way  
Pumping Installations  
Railroads  
Roadsides  
Schools  
Storage Areas  
Similar Industrial and Non-crop Sites

## 8.2 Cut Stump Application

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, some of which are listed below. 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.

When used according to directions for cut stump application, this product will CONTROL, PARTIALLY CONTROL or SUPPRESS most woody brush and tree species, some of which are listed below:

<b>Alder</b> <i>Alnus spp.</i>	<b>Poplar*</b> <i>Populus spp.</i>
<b>Coyote brush*</b> <i>Baccharis consanguinea</i>	<b>Reed, giant</b> <i>Arundo donax</i>
<b>Dogwood*</b> <i>Cornus spp.</i>	<b>Salt cedar</b> <i>Tamarix spp.</i>
<b>Eucalyptus</b> <i>Eucalyptus spp.</i>	<b>Sweet gum*</b> <i>Liquidambar styraciflua</i>
<b>Hickory*</b> <i>Carya spp.</i>	<b>Sycamore</b> <i>Platanus occidentalis</i>
<b>Madrone</b> <i>Arbutus menziesii</i>	<b>Tan oak</b> <i>Lithocarpus densiflorus</i>
<b>Maple*</b> <i>Acer spp.</i>	<b>Willow</b> <i>Salix spp.</i>
<b>Oak</b> <i>Quercus spp.</i>	

\*This product is not approved for this use on these species in the State of California.

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. INJURY RESULTING FROM ROOT GRAFTING IS LIKELY TO OCCUR IN ADJACENT WOODY BRUSH OR TREES.

## 8.3 Habitat Restoration and Management

This product is recommended for the restoration and/or maintenance of native habitat and in wildlife management areas.

### Habitat Restoration and Management

This product may be used to control exotic, alien and other undesirable vegetation in habitat management and natural areas, including riparian and estuarine areas, 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

This product may be used as a site preparation treatment prior to planting wildlife food plots. Any wildlife food species, including natives, 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.

## 8.4 Injection and Frill Applications

Woody vegetation may be controlled by injection or frill application of this product. Apply this product using suitable equipment which must penetrate into living tissue. Apply the equivalent of 1 ml of this product per 2 to 3 inches of trunk diameter. This is best achieved by applying 25 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 dilute material to a continuous frill or more closely spaced cuttings. Avoid application techniques that allow runoff to occur from frill or cut areas in species that exude sap freely after frills or cutting. In species such as these, make frill or cut at an oblique angle so

as to produce a cupping effect and use undiluted material. For best results, applications should be made during periods of active growth and full leaf expansion.

This treatment WILL CONTROL the following woody species:

<b>Oak</b> <i>Quercus spp.</i>	<b>Sweet gum</b> <i>Liquidambar styraciflua</i>
<b>Poplar</b> <i>Populus spp.</i>	<b>Sycamore</b> <i>Platanus occidentalis</i>

This treatment WILL SUPPRESS the following woody species:

<b>Black gum*</b> <i>Nyssa sylvatica</i>	<b>Hickory</b> <i>Carya spp.</i>
<b>Dogwood</b> <i>Cornus spp.</i>	<b>Maple, red</b> <i>Acer rubrum</i>

DO NOT MAKE INJECTION OR FRILL APPLICATIONS WHEN THE ROOTS OF DESIRABLE WOODY BRUSH OR TREES MAY BE GRAFTED TO THE ROOTS OF THE TREATED TREES. INJURY RESULTING FROM ROOT GRAFTING IS LIKELY TO OCCUR IN ADJACENT WOODY BRUSH OR TREES.

\*This product is not approved for this use on this species in the State of California.

## 8.5 Roadsides

### RELEASE OF DORMANT BERMUDAGRASS AND BAHIAGRASS

When applied as directed, this product will provide control or suppression of many winter annual weeds and tall fescue for effective release of dormant bermudagrass or bahiagrass. Make applications to dormant bermudagrass or bahiagrass.

For best results on winter annuals, treat when weeds 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 in or beyond the 4- to 6-leaf stage.

### WEEDS CONTROLLED

Rate recommendations for control or suppression of winter annuals and tall fescue are listed below.

Apply the recommended rates of this product in 10 to 25 gallons of water per acre plus 2 quarts nonionic surfactant per 100 gallons of total spray volume.

### WEEDS CONTROLLED OR SUPPRESSED\*

NOTE: C = Control  
S = Suppression

WEED SPECIES	AQUAMASTER FLUID OZ/ACRE					
	6	9	12	18	24	48
<b>Barley, little</b> <i>Hordeum pusillum</i>	S	C	C	C	C	C
<b>Bedstraw, catchweed</b> <i>Galium aparine</i>	S	C	C	C	C	C
<b>Bluegrass, annual</b> <i>Poa annua</i>	S	C	C	C	C	C
<b>Chervil</b> <i>Chaerophyllum tainturieri</i>	S	C	C	C	C	C
<b>Chickweed, common</b> <i>Stellaria media</i>	S	C	C	C	C	C
<b>Clover, crimson</b> <i>Trifolium incarnatum</i>	•	S	S	C	C	C
<b>Clover, large hop</b> <i>Trifolium campestre</i>	•	S	S	C	C	C
<b>Speedwell, com</b> <i>Veronica arvensis</i>	S	C	C	C	C	C
<b>Fescue, tall</b> <i>Festuca arundinacea</i>	•	•	•	•	S	S
<b>Geranium, Carolina</b> <i>Geranium carolinianum</i>	•	•	S	S	C	C
<b>Henbit</b> <i>Lamium amplexicaule</i>	•	S	C	C	C	C
<b>Ryegrass, Italian</b> <i>Lolium multiflorum</i>	•	•	S	C	C	C
<b>Vetch, common</b> <i>Vicia sativa</i>	•	•	S	C	C	C

\*These rates apply only to sites where an established competitive turf is present.

## RELEASE OF ACTIVELY GROWING BERMUDAGRASS

**NOTE:** USE ONLY ON SITES WHERE BAHAGRASS OR BERMUDAGRASS ARE DESIRED FOR GROUND COVER AND SOME TEMPORARY INJURY OR YELLOWING OF THE GRASSES CAN BE TOLERATED.

When applied as directed, this product will aid in the release of bermudagrass by providing control of annual species listed in the "WEEDS CONTROLLED" section in this label, and suppression or partial control of certain perennial weeds.

For control or suppression of those annual species listed in this label, use 3/4 to 2 1/4 pints of this product as a broadcast spray in 10 to 25 gallons of spray solution per acre, plus 2 quarts of a nonionic surfactant per 100 gallons of total spray volume. Use the lower rate when treating annual weeds below 6 inches in height (or length of runner in annual vines). Use the higher rate as size of plants increases or as they approach flower or seedhead formation.

Use the higher rate for partial control or longer-term suppression of the following perennial species. Use lower rates for shorter-term suppression of growth.

Bahigrass	Johnsongrass**
Dallisgrass	Trumpet creeper*
Fescue (tall)	Vaseygrass

\*Suppression at the higher rate only

\*\*Johnsongrass is controlled at the higher rate.

Use only on well-established bermudagrass. Bermudagrass injury may result from the treatment but regrowth will occur under moist conditions. Repeat applications in the same season are not recommended, since severe injury may result.

## BAHIAGRASS SEEDHEAD AND VEGETATIVE SUPPRESSION

When applied as directed in the "NONCROP SITES" section in this label, this product will provide significant inhibition of seedhead emergence and will suppress vegetative growth for a period of approximately 45 days with single applications and approximately 120 days with sequential applications.

Apply this product 1 to 2 weeks after full green-up of bahiagrass or after the bahiagrass has been mowed to a uniform height of 3 to 4 inches. Applications must be made prior to seedhead emergence. Apply 5 fluid ounces per acre of this product, plus 2 quarts of an approved nonionic surfactant per 100 gallons of total spray volume in 10 to 25 gallons of water per acre.

Sequential applications of this product plus nonionic surfactant may be made at approximately 45-day intervals to extend the period of seedhead and vegetative growth suppression. For continued vegetative growth suppression, sequential applications must be made prior to seedhead emergence.

Apply no more than 2 sequential applications per year. As a first sequential application, apply 3 fluid ounces of this product per acre plus nonionic surfactant. A second sequential application of 2 to 3 fluid ounces per acre plus nonionic surfactant may be made approximately 45 days after the last application.

## ANNUAL GRASS GROWTH SUPPRESSION

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 ounces of this product in 10 to 40 gallons of spray solution per acre. Mix 2 quarts of a nonionic surfactant per 100 gallons of spray solution. Applications should be made when annual grasses are actively growing and before the seedheads are in the boot stage of development. Treatments made after seedhead emergence may cause injury to the desired grasses.

## 9.0 WEEDS CONTROLLED

### 9.1 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", "GENERAL INFORMATION" and "MIXING AND APPLICATION INSTRUCTIONS" for labeled uses and specific application instructions.

**Broadcast Application**—Use 1 1/2 pints of this product per acre plus 2 or more quarts of a nonionic surfactant per 100 gallons of spray solution if weeds are less than 6 inches tall. If weeds are greater than 6 inches tall, use 2 1/2 pints of this product per acre plus 2 or more quarts of an approved nonionic surfactant per 100 gallons of spray solution.

**Hand-Held, High-Volume Application**—Use a 3/4 to 1 1/2 percent solution of this product in water plus 2 or more quarts of a nonionic surfactant per 100 gallons of spray solution and apply to foliage of vegetation to be controlled. Use the higher rate for tough-to-control species or for weeds over 24 inches tall.

When applied as directed under the conditions described in this label, this product plus nonionic surfactant WILL CONTROL the following ANNUAL WEEDS:

<b>Balsamapple**</b> <i>Momordica charantia</i>	<b>Mustard, tansy</b> <i>Descurainia pinnata</i>
<b>Barley</b> <i>Hordeum vulgare</i>	<b>Mustard, tumble</b> <i>Sisymbrium altissimum</i>
<b>Barnyardgrass</b> <i>Echinochloa crus-galli</i>	<b>Mustard, wild</b> <i>Sinapis arvensis</i>
<b>Bassia, fivehook</b> <i>Bassia hyssopifolia</i>	<b>Oats, wild</b> <i>Avena fatua</i>
<b>Bluegrass, annual</b> <i>Poa annua</i>	<b>Panicum</b> <i>Panicum spp.</i>
<b>Bluegrass, bulbous</b> <i>Poa bulbosa</i>	<b>Pennycress, field</b> <i>Thlaspi arvense</i>
<b>Brome</b> <i>Bromus spp.</i>	<b>Pigweed, redroot</b> <i>Amaranthus retroflexus</i>
<b>Buttercup</b> <i>Ranunculus spp.</i>	<b>Pigweed, smooth</b> <i>Amaranthus hybridus</i>
<b>Cheat</b> <i>Bromus secalinus</i>	<b>Puncturevine</b> <i>Tribulus terrestris</i>
<b>Cheeseweed</b> <i>Malva parviflora</i>	<b>Ragweed, common</b> <i>Ambrosia artemisiifolia</i>
<b>Chickweed, mouseear</b> <i>Cerastium vulgatum</i>	<b>Ragweed, giant</b> <i>Ambrosia trifida</i>
<b>Cocklebur</b> <i>Xanthium strumarium</i>	<b>Rocket, London</b> <i>Sisymbrium irio</i>
<b>Corn, volunteer</b> <i>Zea mays</i>	<b>Rye</b> <i>Secale cereale</i>
<b>Crabgrass</b> <i>Digitaria spp.</i>	<b>Ryegrass, Italian*</b> <i>Lolium multiflorum</i>
<b>Dwarf dandelion</b> <i>Krigia cespitosa</i>	<b>Sandbur, field</b> <i>Cenchrus spp.</i>
<b>Falseflax, smallseed</b> <i>Camelina microcarpa</i>	<b>Shattercane</b> <i>Sorghum bicolor</i>
<b>Fiddleneck</b> <i>Amsinckia spp.</i>	<b>Shepherd's-purse</b> <i>Capsella bursa-pastoris</i>
<b>Flaxleaf fleabane</b> <i>Conyza bonariensis</i>	<b>Signalgrass, broadleaf</b> <i>Brachiaria platyphylla</i>
<b>Fleabane</b> <i>Erigeron spp.</i>	<b>Smartweed, Pennsylvania</b> <i>Polygonum pennsylvanicum</i>
<b>Foxtail</b> <i>Setaria spp.</i>	<b>Sowthistle, annual</b> <i>Sonchus oleraceus</i>
<b>Foxtail, Carolina</b> <i>Alopecurus carolinianus</i>	<b>Spanishneedles*</b> <i>Bidens bipinnata</i>
<b>Groundsel, common</b> <i>Senecio vulgaris</i>	<b>Stinkgrass</b> <i>Eragrostis ciliaris</i>
<b>Horseweed/Marestail</b> <i>Conyza canadensis</i>	<b>Sunflower</b> <i>Helianthus annuus</i>
<b>Kochia</b> <i>Kochia scoparia</i>	<b>Thistle, Russian</b> <i>Salsola kali</i>
<b>Lambsquarters, common</b> <i>Chenopodium album</i>	<b>Spurry, umbrella</b> <i>Holosteum umbellatum</i>
<b>Lettuce, prickly</b> <i>Lactuca serriola</i>	<b>Velvetleaf</b> <i>Abutilon theophrasti</i>
<b>Morningglory</b> <i>Ipomoea spp.</i>	<b>Wheat</b> <i>Triticum aestivum</i>
<b>Mustard, blue</b> <i>Chorispora tenella</i>	<b>Witchgrass</b> <i>Panicum capillare</i>

\*Apply 3 pints of this product per acre

\*\*Apply with hand-held equipment only.

Annual weeds will generally continue to germinate from seed throughout the growing season. Repeat treatments will be necessary to control later germinating weeds.

## 9.2 Perennial Weeds

Apply a 3/4 to 1 1/2 percent solution of this product to control or destroy most vigorously growing perennial weeds. Add 2 or more quarts of a nonionic surfactant per 100 gallons of spray solution to the rates of this product given in this list. See the "GENERAL INFORMATION," "DIRECTIONS FOR USE" and "MIXING AND APPLICATION" sections in this label for specific uses and application instructions.

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 5 to 8 percent solution of this product.

Unless otherwise directed, allow at least 7 days after application before disturbing vegetation. If weeds have been mowed or tilled, do not treat until regrowth has reached the recommended stages. Fall treatments must be applied before a killing frost.

Repeat treatments may be necessary to control weeds regenerating from underground parts or seed.

When applied as appropriate under the conditions described, this product plus surfactant WILL CONTROL the following PERENNIAL WEEDS:

<b>Alfalfa</b> <i>Medicago sativa</i>	<b>Fescue, tall</b> <i>Festuca arundinacea</i>
<b>Alligatorweed*</b> <i>Alternanthera philoxeroides</i>	<b>Guineagrass</b> <i>Panicum maximum</i>
<b>Anise/Fennel</b> <i>Foeniculum vulgare</i>	<b>Hemlock, poison</b> <i>Conium maculatum</i>
<b>Artichoke, Jerusalem</b> <i>Helianthus tuberosus</i>	<b>Horsenettle</b> <i>Solanum carolinense</i>
<b>Bahiagrass</b> <i>Paspalum notatum</i>	<b>Horseradish</b> <i>Armoracia rusticana</i>
<b>Beachgrass, European</b> <i>Ammophila arenaria</i>	<b>Ice Plant</b> <i>Carpobrotus edulis</i>
<b>Bermudagrass</b> <i>Cynodon dactylon</i>	<b>Ivy, German, cape</b> <i>Senecio mikanoides</i> <i>Delairea odorata</i>
<b>Bindweed, field</b> <i>Convolvulus arvensis</i>	<b>Johnsongrass</b> <i>Sorghum halepense</i>
<b>Bluegrass, Kentucky</b> <i>Poa pratensis</i>	<b>Kikuyugrass</b> <i>Pennisetum clandestinum</i>
<b>Blueweed, Texas</b> <i>Helianthus ciliaris</i>	<b>Knapweed, Russian</b> <i>Centaurea repens</i>
<b>Brackenfern</b> <i>Pteridium spp.</i>	<b>Lantana</b> <i>Lantana camara</i>
<b>Bromegrass, smooth</b> <i>Bromus inermis</i>	<b>Lespedeza: common, serices</b> <i>Lespedeza striata</i> <i>Lespedeza cuneata</i>
<b>Canarygrass, reed</b> <i>Phalaris arundinacea</i>	<b>Loosestrife, purple</b> <i>Lythrum salicaria</i>
<b>Cattail</b> <i>Typha spp.</i>	<b>Lotus, American</b> <i>Nelumbo lutea</i>
<b>Clover, red</b> <i>Trifolium pratense</i>	<b>Maidencane</b> <i>Panicum hematomon</i>
<b>Clover, white</b> <i>Trifolium repens</i>	<b>Milkweed</b> <i>Asclepias spp.</i>
<b>Cogongrass</b> <i>Imperata cylindrica</i>	<b>Muhly, wirestem</b> <i>Muhlenbergia frondosa</i>
<b>Cordgrass</b> <i>Spartina spp.</i>	<b>Mullein, common</b> <i>Verbascum thapsus</i>
<b>Cutgrass, giant*</b> <i>Zizaniopsis miliacea</i>	<b>Napiergrass</b> <i>Pennisetum purpureum</i>
<b>Dallisgrass</b> <i>Paspalum dilatatum</i>	<b>Nightshade, silverleaf</b> <i>Solanum elaeagnifolium</i>
<b>Dandelion</b> <i>Taraxacum officinale</i>	<b>Nutsedge: purple</b> <i>Cyperus rotundus</i> <b>yellow</b> <i>Cyperus esculentus</i>
<b>Dock, curly</b> <i>Rumex crispus</i>	<b>Orchardgrass</b> <i>Dactylis glomerata</i>
<b>Dogbane, hemp</b> <i>Apocynum cannabinum</i>	
<b>Fescue</b> <i>Festuca spp.</i>	

<b>Pampasgrass</b> <i>Cortaderia jubata</i>	<b>Thistle, artichoke</b> <i>Cynara cardunculus</i>
<b>Paragrass</b> <i>Brachiaria mutica</i>	<b>Thistle, Canada</b> <i>Cirsium arvense</i>
<b>Pepperweed, perennial</b> <i>Lepidium latifolium</i>	<b>Timothy</b> <i>Phleum pratense</i>
<b>Phragmites**</b> <i>Phragmites spp.</i>	<b>Torpedograss*</b> <i>Panicum repens</i>
<b>Quackgrass</b> <i>Agropyron repens</i>	<b>Tules, common</b> <i>Scirpus acutus</i>
<b>Reed, giant</b> <i>Arundo donax</i>	<b>Vaseygrass</b> <i>Paspalum urvillei</i>
<b>Ryegrass, perennial</b> <i>Lolium perenne</i>	<b>Velvetgrass</b> <i>Holcus spp.</i>
<b>Smartweed, swamp</b> <i>Polygonum coccineum</i>	<b>Waterhyacinth</b> <i>Eichornia crassipes</i>
<b>Spatterdock</b> <i>Nuphar luteum</i>	<b>Waterlettuce</b> <i>Pistia stratiotes</i>
<b>Starthistle, yellow</b> <i>Centaurea solstitialis</i>	<b>Waterprimrose</b> <i>Ludwigia spp.</i>
<b>Sweet potato, wild*</b> <i>Ipomoea pandurata</i>	<b>Wheatgrass, western</b> <i>Agropyron smithii</i>

\* Partial control.

\*\* Partial control in southeastern states. See specific recommendations below.

**Alligatorweed**—Apply 6 pints of this product per acre as a broadcast spray or as a 1 1/4 percent solution with hand-held equipment to provide partial control of alligatorweed. Apply when most of the target plants are in bloom. Repeat applications will be required to maintain such control.

**Bermudagrass**—Apply 7 1/2 pints of this product per acre as a broadcast spray or as a 1 1/2 percent solution with hand-held equipment. Apply when target plants are actively growing and when seed heads appear.

**Bindweed, field / Silverleaf Nightshade / Texas Blueweed**—Apply 6 to 7 1/2 pints of this product per acre as a broadcast spray west of the Mississippi River and 4 1/2 to 6 pints of this product per acre east of the Mississippi River. With hand-held equipment, use a 1 1/2 percent solution. Apply when target plants are actively growing and are at or beyond full bloom. For silverleaf nightshade, best results can be obtained when application is made after berries are formed. Do not treat when weeds are under drought stress. New leaf development indicates active growth. For best results apply in late summer or fall.

**Brackenfern**—Apply 4 1/2 to 6 pints of this product per acre as a broadcast spray or as a 3/4 to 1 percent solution with hand-held equipment. Apply to fully expanded fronds which are at least 18 inches long.

**Cattail**—Apply 4 1/2 to 6 pints of this product per acre as a broadcast spray or as a 3/4 percent solution with hand-held equipment. 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.

**Cogongrass**—Apply 4 1/2 to 7 1/2 pints of this product per acre as a broadcast spray. Apply when cogongrass is at least 18 inches tall and actively growing in late summer or fall. Allow 7 or more days after application before tillage or mowing. 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**—Apply 4 1/2 to 7 1/2 pints of this product per acre as a broadcast spray or as a 1 to 2 percent solution with hand-held equipment. Schedule applications in order to allow 6 hours before treated plants are covered by tidewater. The presence of debris and silt on the cordgrass plants will reduce performance. It may be necessary to wash targeted plants prior to application to improve uptake of this product into the plant.

**Cutgrass, giant**—Apply 6 pints of this product per acre as a broadcast spray or as a 1 percent solution with hand-held equipment to provide partial control of giant cutgrass. 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.

**Dogbane, hemp / Knapweed / Horseradish**—Apply 6 pints of this product per acre as a broadcast spray or as a 1 1/2 percent solution with hand-held equipment. Apply when target plants are actively growing and most have reached the late bud-to-flower stage of growth. For best results, apply in late summer or fall.

**Fescue, tall**—Apply 4 1/2 pints of this product per acre as a broadcast spray or as a 1 percent solution with hand-held equipment. Apply when target plants are actively growing and most have reached the boot-to-head stage of growth. When applied prior to the boot stage, less desirable control may be obtained.

**Guineagrass**—Apply 4 1/2 pints of this product per acre as a broadcast spray or as a 3/4 percent solution with hand-held equipment. Apply when target plants are actively growing and when most have reached at least the 7-leaf stage of growth.

**Johnsongrass / Bluegrass, Kentucky / Bromegrass, smooth / Canarygrass, reed / Orchardgrass / Ryegrass, perennial / Timothy / Wheatgrass, western**—Apply 3 to 4 1/2 pints of this product per acre as a broadcast spray or as a 3/4 percent solution with hand-held equipment. Apply when target plants are actively growing and most 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.

**Lantana**—Apply this product as a 3/4 to 1 percent solution with hand-held equipment. Apply to actively growing lantana at or beyond the bloom stage of growth. Use the higher application rate for plants that have reached the woody stage of growth.

**Loosestrife, purple**—Apply 4 pints of this product per acre as a broadcast spray or as a 1 to 1 1/2 percent solution using hand-held equipment. Treat when plants are actively growing 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**—Apply 4 pints of this product per acre as a broadcast spray or as a 3/4 percent solution with hand-held equipment. Treat when plants are actively growing at or beyond the bloom stage of growth. Best results are achieved when application is made during summer or fall months. Fall treatment may be necessary to control regrowth from underground parts and seeds.

**Maidencane / Paragrass**—Apply 6 pints of this product per acre as a broadcast spray or as a 3/4 percent solution with hand-held equipment. 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**—Apply 4 1/2 pints of this product per acre as a broadcast spray or as a 1 1/2 percent solution with hand-held equipment. Apply when target plants are actively growing and most have reached the late bud-to-flower stage of growth.

**Nutsedge, purple, yellow**—Apply 4 1/2 pints of this product per acre as a broadcast spray, or as a 3/4 percent solution with hand-held equipment 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.

**Pampasgrass**—Apply a 1 1/2 percent solution of this product with hand-held equipment when plants are actively growing.

**Phragmites**—For partial control of phragmites in Florida and the counties of other states bordering the Gulf of Mexico, apply 7 1/2 pints per acre as a broadcast spray or apply a 1 1/2 percent solution with hand-held equipment. In other areas of the U.S., apply 4 to 6 pints per acre as a broadcast spray or apply a 3/4 percent solution with hand-held equipment for partial control. For best results, treat during late summer of 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 / Kikuyugrass / Muhly, wirestem**—Apply 3 to 4 1/2 pints of this product per acre as a broadcast spray or as

a 3/4 percent solution with hand-held equipment when most quackgrass or wirestem muhly is at least 8 inches in height (3- to 4-leaf stage of growth) and actively growing. Allow 3 or more days after application before tillage.

**Reed, giant / Ice Plant**—For control of giant reed and ice plant, apply a 1 1/2 percent solution of this product with hand-held equipment when plants are actively growing. For giant reed, best results are obtained when applications are made in late summer to fall.

**Spatterdock**—Apply 6 pints of this product per acre as a broadcast spray or as a 3/4 percent solution with hand-held equipment. Apply when most plants are in full bloom. For best results, apply during the summer or fall months.

**Sweet potato, wild**—Apply this product as a 1 1/2 percent solution using hand-held equipment. Apply to actively growing weeds that are at or beyond the bloom stage of growth. Repeat applications will be required. Allow the plant to reach the recommended stage of growth before retreatment.

**Thistle: Canada, artichoke**—Apply 3 to 4 1/2 pints of this product per acre as a broadcast spray or as a 1 1/2 percent solution with hand-held equipment for Canada thistle. To control artichoke thistle, apply a 2 percent solution as a spray-to-wet application. Apply when target plants are actively growing and are at or beyond the bud stage of growth.

**Torpedograss**—Apply 6 to 7 1/2 pints of this product per acre as a broadcast spray or as a 3/4 to 1 1/2 percent solution with hand-held equipment to provide partial control of torpedograss. Use the lower rates under terrestrial conditions, and the higher rates under partially submerged or a floating mat condition. Repeat treatments will be required to maintain such control.

**Tules, common**—Apply this product as a 1 1/2 percent solution with hand-held equipment. Apply to actively growing 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.

**Waterhyacinth**—Apply 5 to 6 pints of this product per acre as a broadcast spray or apply a 3/4 to 1 percent solution with hand-held equipment. Apply when target plants are actively growing and 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 rates when more rapid visual effects are desired.

**Waterlettuce**—For control, apply a 3/4 to 1 percent solution of this product with hand-held equipment to actively growing plants. Use higher rates where infestations are heavy. Best results are obtained from mid-summer through winter applications. Spring applications may require retreatment.

**Waterprimrose**—Apply this product as a 3/4 percent solution using hand-held equipment. Apply to plants that are actively growing at or beyond the bloom stage of growth, but before fall color changes occur. Thorough coverage is necessary for best control.

**Other perennials listed on this label**—Apply 4 1/2 to 7 1/2 pints of this product per acre as a broadcast spray or as a 3/4 to 1 1/2 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.

## 9.3 Woody Brush and Trees

Apply a 1 to 2 percent solution of this product to control or partially control the woody brush and tree species listed below. Add 2 or more quarts of a nonionic surfactant per 100 gallons of spray solution to the rates of this product given in this list. See the "GENERAL INFORMATION", "DIRECTIONS FOR USE" and "MIXING AND APPLICATION" sections in this label for specific uses and application instructions.

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 5 to 8 percent solution of this product.

When applied as recommended under the conditions described, this product plus surfactant CONTROLS or PARTIALLY CONTROLS the following woody brush plants and trees:

<b>Alder</b> <i>Alnus spp.</i>	<b>Hornbeam, American</b> <i>Carpinus caroliniana</i>	<b>Sourwood*</b> <i>Oxydendrum arboreum</i>	<b>Tallowtree, Chinese</b> <i>Sapium sebiferum</i>
<b>Ash*</b> <i>Fraxinus spp.</i>	<b>Huckleberry</b> <i>Vaccinium spp.</i>	<b>Sumac:</b> <b>Laurel*</b> <i>Rhus toxicodendron</i>	<b>Thimbleberry</b> <i>Rubus paviflorus</i>
<b>Aspen, quaking</b> <i>Populus tremuloides</i>	<b>Kudzu</b> <i>Pueraria lobata</i>	<b>Poison*</b> <i>Rhus vernix</i>	<b>Tobacco, tree*</b> <i>Nicotiana glauca</i>
<b>Bearclover, Bearmat</b> <i>Chamaebatia foliolosa</i>	<b>Locust, black*</b> <i>Robinia pseudoacacia</i>	<b>Smooth*</b> <i>Rhus glabra</i>	<b>Toyon*</b> <i>Herteromeles arbutifolia</i>
<b>Birch</b> <i>Betula spp.</i>	<b>Magnolia, sweetbay</b> <i>Magnolia virginiana</i>	<b>Sugarbush*</b> <i>Rhus ovata</i>	<b>Trumpetcreeper</b> <i>Campsis radicans</i>
<b>Blackberry</b> <i>Rubus spp.</i>	<b>Manzanita</b> <i>Arctostaphylos spp.</i>	<b>Winged*</b> <i>Rhus copallina</i>	<b>Waxmyrtle, southern*</b> <i>Myrica cerifera</i>
<b>Broom:</b> <b>French</b> <i>Cytisus monspessulanus</i>	<b>Maple:</b> <b>Red**</b> <i>Acer rubrum</i>	<b>Sweet gum</b> <i>Liquidambar styraciflua</i>	<b>Willow</b> <i>Salix spp.</i>
<b>Scotch</b> <i>Cytisus scoparius</i>	<b>Sugar</b> <i>Acer saccharum</i>	<b>Swordfern*</b> <i>Polystichum munitum</i>	<b>Yerbasenta, California</b> <i>Eriodictyon californicum</i>
<b>Buckwheat, California*</b> <i>Eriogonum fasciculatum</i>	<b>Vine*</b> <i>Acer circinatum</i>		
<b>Cascara*</b> <i>Rhamnus purshiana</i>	<b>Monkey Flower*</b> <i>Mimulus guttatus</i>		
<b>Castor bean</b> <i>Ricinus communis</i>	<b>Oak:</b> <b>Black*</b> <i>Quercus velutina</i>		
<b>Catsclaw*</b> <i>Acacia greggi</i>	<b>Northern pine</b> <i>Quercus palustris</i>		
<b>Ceanothus</b> <i>Ceanothus spp.</i>	<b>Post</b> <i>Quercus stellata</i>		
<b>Chamise</b> <i>Adenostoma fasciculatum</i>	<b>Red</b> <i>Quercus rubra</i>		
<b>Cherry:</b> <b>Bitter</b> <i>Prunus emarginata</i>	<b>Southern red</b> <i>Quercus falcata</i>		
<b>Black</b> <i>Prunus serotina</i>	<b>White*</b> <i>Quercus alba</i>		
<b>Pin</b> <i>Prunus pensylvanica</i>	<b>Orange, Osage</b> <i>Maclura pomifera</i>		
<b>Cottonwood, eastern</b> <i>Populus deltoides</i>	<b>Peppertree, Brazilian— (Florida Holly)</b> <i>Schinus terebinthifolius</i>		
<b>Coyote brush</b> <i>Baccharis consanguinea</i>	<b>Persimmon*</b> <i>Diospyros spp.</i>		
<b>Creeper, Virginia*</b> <i>Parthenocissus quinquefolia</i>	<b>Poison Ivy</b> <i>Rhus radicans</i>		
<b>Cypress, swamp, bald</b> <i>Taxodium distichum</i>	<b>Poison Oak</b> <i>Rhus toxicodendron</i>		
<b>Deerweed</b> <i>Lotus scoparius</i>	<b>Poplar, yellow*</b> <i>Liriodendron tulipifera</i>		
<b>Dewberry</b> <i>Rubus trivialis</i>	<b>Prunus</b> <i>Prunus spp.</i>		
<b>Dogwood</b> <i>Cornus spp.</i>	<b>Raspberry</b> <i>Rubus spp.</i>		
<b>Elderberry</b> <i>Sambucus spp.</i>	<b>Redbud, eastern</b> <i>Cercis canadensis</i>		
<b>Elm*</b> <i>Ulmus spp.</i>	<b>Redcedar, eastern</b> <i>Juniperus virginiana</i>		
<b>Eucalyptus, bluegum</b> <i>Eucalyptus globulus</i>	<b>Rose, multiflora</b> <i>Rosa multiflora</i>		
<b>Gallberry</b> <i>Ilex glabra</i>	<b>Russian-olive</b> <i>Elaeagnus angustifolia</i>		
<b>Hackberry, western</b> <i>Celtis occidentalis</i>	<b>Sage: black, white</b> <i>Salvia spp.</i>		
<b>Hasardia*</b> <i>Haplopappus squamosus</i>	<b>Sagebrush, California</b> <i>Artemisia californica</i>		
<b>Hawthorn</b> <i>Crataegus spp.</i>	<b>Salmonberry</b> <i>Rubus spectabilis</i>		
<b>Hazel</b> <i>Corylus spp.</i>	<b>Saltcedar, tamarisk*</b> <i>Tamarix spp.</i>		
<b>Hickory</b> <i>Carya spp.</i>	<b>Saltbush, Sea myrtle</b> <i>Baccharis halimifolia</i>		
<b>Honeysuckle</b> <i>Lonicera spp.</i>	<b>Sassafras</b> <i>Sassafras albidum</i>		

\*Partial control

\*\*See below for control or partial control instruction.

**NOTE:** If brush has been mowed or tilled or trees have been cut, do not treat until regrowth has reached the recommended stage of growth.

Apply the recommended rate of this product plus 2 or more quarts of a nonionic surfactant per 100 gallons of spray solution when plants are actively growing and, unless otherwise directed, after full-leaf expansion. 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.

In arid areas, best results are obtained when application is made in the spring or early summer when brush species are at high moisture content and are flowering. Ensure thorough coverage when using hand-held equipment. 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.

See the "DIRECTIONS FOR USE" and "MIXING AND APPLICATION INSTRUCTIONS" sections in this label for labeled use and specific application instructions.

Applied as a 5 to 8 percent solution as a directed application as described in the "HAND-HELD AND HIGH-VOLUME EQUIPMENT" section, this product will control or partially control all species listed in this section of this label. Use the higher rate of application for dense stands and larger woody brush and trees.

Apply the product as follows to control or partially control the following woody brush and trees.

**Alder / Blackberry / Dewberry / Honeysuckle / Oak, Post / Raspberry**—For control, apply 4 1/2 to 6 pints per acre as a broadcast spray or as a 3/4 to 1 1/4 percent solution with hand-held equipment.

**Aspen, Quaking / Hawthorn / Trumpetcreeper**—For control, apply 3 to 4 1/4 pints of this product per acre as a broadcast spray or as a 3/4 to 1 1/4 percent solution with hand-held equipment.

**Birch / Elderberry / Hazel / Salmonberry / Thimbleberry**—For control, apply 3 pints per acre of this product as a broadcast spray or as a 3/4 percent solution with hand-held equipment.

**Broom: French, Scotch**—For control, apply a 1 1/4 to 1 1/2 percent solution with hand-held equipment.

**Buckwheat, California / Hasardia / Monkey Flower / Tobacco, Tree**—For partial control of these species, apply a 3/4 to 1 1/2 percent solution of this product as a foliar spray with hand-held equipment. Thorough coverage of foliage is necessary for best results.

**Castorbean**—For control, apply a 1 1/2 percent solution of this product with hand-held equipment.

**Catsclaw**—For partial control, apply a 1 1/4 to 1 1/2 percent solution with hand-held equipment when at least 50 percent of the new leaves are fully developed.

**Cherry: Bitter, Black, Pin / Oak, Southern Red / Sweet Gum / Prunus**—For control, apply 3 to 7 1/2 pints of this product per acre as a broadcast spray or as a 1 to 1 1/2 percent solution with hand-held equipment.

**Coyote brush**—For control, apply a 1 1/4 to 1 1/2 percent solution with hand-held equipment when at least 50 percent of the new leaves are fully developed.

**Dogwood / Hickory / Salt cedar**—For partial control, apply a 1 to 2 percent solution of this product with hand-held equipment or 6 to 7 1/2 pints per acre as a broadcast spray.

**Eucalyptus, bluegum**—For control of eucalyptus resprouts, apply a 1 1/2 percent solution of this product with hand-held equipment when resprouts are 6- to 12-foot tall. Ensure complete coverage. Apply when plants are actively growing. Avoid application to drought-stressed plants.

**Kudzu**—For control, apply 6 pints of this product per acre as a broadcast spray or as a 1 1/2 percent solution with hand-held equipment. Repeat applications will be required to maintain control.

**Maple, Red**—For control, apply as a 3/4 to 1 1/4 percent solution with hand-held equipment when leaves are fully developed. For partial control, apply 2 to 7 1/2 pints of this product per acre as a broadcast spray.

**Maple, Sugar / Oak: Northern Pin, Red**—For control, apply as a 3/4 to 1 1/4 percent solution with hand-held equipment when at least 50 percent of the new leaves are fully developed.

**Peppertree, Brazilian (Holly, Florida) / Waxmyrtle, southern**—For partial control, apply this product as a 1 1/2 percent solution with hand-held equipment.

**Poison Ivy / Poison Oak**—For control, apply 6 to 7 1/2 pints of this product per acre as a broadcast spray or as a 1 1/2 percent solution with hand-held equipment. Repeat applications may be required to maintain control. Fall treatments must be applied before leaves lose green color.

**Rose, multiflora**—For control, apply 3 pints of this product per acre as a broadcast spray or as a 3/4 percent solution with hand-held equipment. Treatments should be made prior to leaf deterioration by leaf-feeding insects.

**Sage, black / Sagebrush, California / Chamise / Tallowtree, Chinese**—For control of these species, apply a 3/4 percent solution of this product as a foliar spray with hand-held equipment. Thorough coverage of foliage is necessary for best results.

**Saltbush, Sea myrtle**—For control, apply this product as a 1 percent solution with hand-held equipment.

**Willow**—For control, apply 4 1/2 pints of this product per acre as a broadcast spray or as a 3/4 percent solution with hand-held equipment.

**Other woody brush and trees listed in this label**—For partial control, apply 3 to 7 1/2 pints of this product per acre as a broadcast spray or as a 3/4 to 1 1/2 percent solution with hand-held equipment.

## 10.0 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.

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 of 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. 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 at once unopened.

EPA Reg. No. 524-343

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In case of an emergency involving this product,  
or for medical assistance,  
Call Collect, day or night, (314) 694-4000.

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ST. LOUIS, MISSOURI, 63167 U.S.A.

## Appendix E: Spring (Otter) Lake Water Rights

CONTROL NUMBER	TYPE/ STAT	BUSINESS/PERSON NAME	DATE	WRIA	County	ACRE FT/YR	ACRES - IRR	PURPOSES	SOURCE	Address (if known)
ANECDOTAL		BELL, ROBERT		8	KING					18607 E. Spring Lake DR SE
S1-084600CL	CL[S]	BRUMBAUGH, NEIL		8	KING			DG	SPRING	18118 West Spring Lake Drive SE
S1-21846CWRIS	CE	ELEY ROLLAND & JOAN,	6/10/1974	8	KING	1	1	IR	SPRING LAKE	
ANECDOTAL		FLEMING		8	KING					18032 West Spring Lake Drive SE
S1-21688CWRIS	CE	GREEN IRENE C,	5/21/1974	8	KING	2	1	IR	OTTER LAKE	
G1-088728CL	CL[S]	GREEN, IRENE C.		8	KING			DG	?	
G1-004137CL	CL[L]	GREEN, SAMUEL W.	0/0/1964	8	KING			DG ST	?	18401 West Spring Lake Drive SE
S1-155199CL	CL[S]	GROSS, VIRGIL O		8	KING			IR	SPRING LAKE	
G1-088430CL	CL[S]	HART, LEONARD A.		8	KING			DG IR	?	
G1-029465CL	CL[L]	HEINDEL, EARL W.	0/0/1962	8	KING			DG	?	
G1-029455CL	CL[L]	HISER, OPAL	0/0/1963	8	KING			DG	?	
S1-140180CL	CL[S]	HOLLISTER, DALE F		8	KING			DG IR	SPRING LAKE	
S1-135730CL	CL[L]	HOLMQUIST, ALICE A	0/0/1963	8	KING			IR	SPRING LAKE	
G1-107161CL	CL[S]	KYRISS, HARVEY C		8	KING			DG IR	?	18410 East Spring Lake Drive SE
S1-21724CWRIS	CE	LAYSON W L & M J,	5/29/1974	8	KING	3	1	IR	SPRING LAKE	
S1-078169CL	CL[S]	LAYSON, WILLIAM L.		8	KING			DG	SPRING LAKE	
G1-077911CL	CL[S]	LAYSON, WILLIAM L.		8	KING			DG	?	
G1-127300CL	CL[S]	LEE, WAYNE B		8	KING			DG IR	?	
S1-160086CL	CL[S]	MC CARTER, ROBERT G		8	KING			DG IR	LAKE	18232 West Spring Lake Dr SE
S1-132708CL	CL[S]	MOORE, VEOLA		8	KING				SPRING LAKE	
S1-22336CWRIS	CE	ODSTRCIL J V & E T,	6/12/1974	8	KING	3	1	IR DS	OTTER LAKE	
S1-22336CWRIS		ODSTRCIL J V & E T,	6/12/1974	8	KING		1		SPRING LAKE	
S1-091529CL	CL[S]	ODSTRICIL, TERRY V		8	KING			DG IR	SPRING LAKE	18329 E. Spring Lake Drive SE
S1-25188AWRIS	AP/REJ	OLSEN ALFRED,	3/2/1988	8	KING		0	IR	SPRING LAKE	
S1-20729CWRIS	CE	OSTHUS HENRY H,	6/29/1973	8	KING	1	0	DS	SPRING LAKE	18214 W. Spring Lake Dr SE
G1-031893CL	CL[S]	OSTHUS, HENRY H.		8	KING			DG	?	
S1-22020CWRIS	CE	PORTER R LEO,	7/29/1974	8	KING	2	1	IR	SPRING LAKE	
S1-26920CWRIS	CE	RICKENBACKER J & M,	1/27/1993	8	KING	0.6	0	IR DS	SPRING LAKE	
S1-135157CL	CL[S]	SAATHOFF, DOUGLAS D		8	KING			IR	SPRING LAKE	17904 W. Spring Lake Drive SE
S1-26732	AP/REJ	SCHNEIDER, BRIAN	9/4/1992	8	KING		0	IR DS	SPRING LAKE	17946 West Spring Lake Drive SE
S1-21675CWRIS	CE	SECORD BARBARA A,	5/21/1974	8	KING	2	1	IR	OTTER LAKE	18113 East Spring Lake Drive SE
G1-093093CL	CL[S]	SECORD, BARBARA A		8	KING			DG	?	
G1-018883CL	CL[L]	SLAUSON, HOWARD L.	0/0/1954	8	KING			DG	?	17836 W. Spring Lake Drive SE

## Appendix E: Spring (Otter) Lake Water Rights

CONTROL NUMBER	TYPE/ STAT	BUSINESS/PERSON NAME	DATE	WRIA	County	ACRE FT/YR	ACRES - IRR	PURPOSES	SOURCE	Address (if known)
G1-077662CL	CL[S]	SMITH, ROBERT C.		8	KING			DG	?	
S1-102635CL	CL[S]	SPRING, DOLORES L		8	KING			IR	SPRING LAKE	
G1-102379CL	CL[S]	SPRING, DOLORES L		8	KING			DG	?	
CONTROL NUMBER	TYPE/ STAT	BUSINESS/PERSON NAME	DATE	WRIA	County	ACRE FT/YR	ACRES - IRR	PURPOSES	SOURCE	Address (if known)
G1-144564CL	CL[S]	STIGEN, MILDRED V		8	KING			DG	?	
S1-22939CWRIS	CE	VERGER PEGGY LEE,	8/25/1977	8	KING	0.5	0	IR	OTTER LAKE	18715 E. Spring Lake Drive SE
G1-043828CL	CL[S]	WIMBUSH, STEPHEN J.		8	KING			DG	?	
G1-004070CL	CL[L]	WITTERS, FLORENCE MA	0/0/1958	8	KING			DG	?	
S1-20877CWRIS	CE	ZYLSTRA LAURENCE B,	9/4/1973	8	KING	0.5		IR	OTTER LAKE	
S1-20877CWRIS		ZYLSTRA LAURENCE B,	9/4/1973	8	KING				SPRING LAKE	
S1-036495CL	CL[L]	ZYLSTRA, LAURENCE B.	0/0/1960	8	KING			DG	SPRING LAKE	