Newman Lake Integrated Aquatic Vegetation Management Plan

Final
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Prepared and Funded by
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And most importantly….

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Marianne Barrentine, PE
Newman Lake Engineer

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1.0 Executive Summary

Newman Lake is a large 1200-acre lake located 20 miles northeast of Spokane, Washington, near the Washington-Idaho border. Eurasian watermilfoil was first discovered at Newman Lake in September of 2002 in a small area at the southeast end of the lake near the outlet gate. Eurasian watermilfoil is a non-native highly invasive aquatic weed listed on the state noxious weed list. Beginning in 2003 the Newman Lake Flood Control Zone District (NLFCZD) began implementing control efforts with the assistance of an Early Infestation Grant from Washington State Department of Ecology. Control efforts over the last 2 years have included frequent boat and diver surveys, diver hand pulling and herbicide treatment with granular 2,4-D (Aqua-Kleen). The methods used were determined based on staff research and community input for methods that would most effectively control Eurasian watermilfoil given the extent and conditions of the infestation at Newman Lake. These methods also best met the goals of the community to minimize the costs, the impact to recreational uses and the natural ecosystems of Newman Lake.

These efforts have been effective so far in containing Eurasian watermilfoil at Newman Lake. This Plan sets out continuing these control efforts at an estimated average annual cost of about $15,000 - $18,000 per year. This is based on a high level of control for the entire shoreline of the Lake. These efforts are required to prevent this highly invasive aquatic weed from having serious impacts on recreational uses, aquatic habitat, water quality, water supply and other nearby water bodies. However, these methods will continually be reviewed for effectiveness. Other control options discussed in the report may be selected in the future as more able to meet the management goals. This will only be done after a thorough staff review and community input.

2.0 Problem Statement

Eurasian watermilfoil (*Myriophyllum spicatum*), a non-native invasive species listed on the state noxious weed list, was first discovered at Newman Lake in Sept. 2002. It became an immediate and major concern of the Newman Lake community and therefore the concern of the NLFCZD. Eurasian watermilfoil (Milfoil) is a submersed aquatic plant that has become a problem in many of Washington's lakes and rivers. This highly invasive non-native species is fast growing and spreads rapidly by plant fragments and root systems. Because it is not native it has only limited natural enemies to control its growth. It quickly can form thick mats along shoreline areas. Potential negative impacts include:

1. **Recreational Use**: Milfoil can eventually produce dense mats that interfere with navigation and recreational activities such as boating, swimming, fishing, and water-skiing. These mats pose a safety hazard to swimmers and boaters by entanglement and foul fishing gear, motors, and oars. Although so far in Newman Lake we have only seen the milfoil growing in about 3 - 10 feet of water, it can grow at depths of up to 45 feet and reach the surface when growing in depths of up to 15 feet. For a shallow lake like Newman Lake (avg. depth 19 feet) this could be significant portion of the lake, though visibility may limit its spread here. The Lake is a well-utilized recreational lake used for year-round fishing, swimming, boating, water skiing, and more passive activities such as wildlife viewing for lake property owners and visitors. The lake also provides aesthetic values for residents and visitors. Newman Lake is stocked with trout by the Washington State Department of Fish and Wildlife (WDFW) as well as hosting a number of warm water fish stocks. It is a popular fishing and recreation destination for boaters using the public WDFW boat launch. Dense beds of milfoil would restrict most recreational activities within Newman Lake.

2. **Aquatic Habitat**: Milfoil also adversely impacts aquatic ecosystems by forming dense fast growing canopies that often shade out native vegetation. Its mono-specific stands provide poor habitat and food for waterfowl, fish, and other wildlife. Newman Lake and its watershed provide critical fish and wildlife habitat areas and host a wide variety of waterfowl fish and wildlife. Milfoil could cause a reduction in the number of waterfowl and fish that can utilize the lake. The fishery will feel impacts from a variety of milfoil effects. Milfoil does not support the same population or diversity of organisms that serve as a food source for fish, it changes the water chemistry due to milfoil decomposition, and can throw off predator/prey balances due to eliminating predator fish forage area and providing excessive refuge areas for prey. All of these will reduce the fishery over time and in turn reduce the opportunity for recreational fishing.

3. **Water Quality:** With its fast thick growth Milfoil can also significantly increase the decomposing biomass at the end of the growing season and therefore increase the internal loading of nutrients to the water and decreasing water quality. Since Newman Lake already has an excess nutrient problem, it could be especially sensitive to these impacts and this could be special concern.

4. **Water Supply**: Many property owners around Newman Lake use the lake as a water source, either for irrigation or in home uses. The proliferation of milfoil could have a negative impact for those that withdraw water from the lake, by clogging intakes and affecting water quality.

5. **Other Waterbodies:** Another concern of the district and the community is the potential for the spread of Eurasian watermilfoil to other lakes in the surrounding area. The Newman Lake outlet channel

drains to the Spokane Valley-Rathdrum Prairie aquifer and so does not drain to surface water; however, this noxious weed is easily transported to other locations on boat motors, trailers, and fishing gear and is known to establish new infestations from single plant fragments. There are other waterbodies in the area that currently are not infested with Eurasian watermilfoil; control of milfoil at Newman Lake will reduce the chances of infestation, or further the spread of milfoil to other lakes or waterbodies.

Control efforts of the last two years since discovery have limited the majority of the Eurasian watermilfoil plant growth to about 10 acres total at the north and south ends of the lake. These are non-residential areas of highly organic sediments next to wetland areas. Outside of these areas plants have been scattered. Impact to date has therefore been limited. However, without the current control efforts of surveying frequently, diver hand pulling, and herbicide treatments, spread would have been much more extensive and impacts more significant. Community concern over the spread of watermilfoil growth is a valid one.

3.0 Aquatic Vegetation Management Goals

Because of these potentially serious impacts and the strong concern of the Newman Lake Community, the NLFCZD is trying to act quickly to implement a control plan for Eurasian watermilfoil in Newman Lake. Eradication is a difficult goal however based on the experience of other lakes prompt and on-going control efforts can keep the problem manageable. Our goal for Newman Lake at this time is to:

1. Remove every Eurasian watermilfoil plant detected each year in an effort to ultimately eradicate milfoil from Newman Lake.
2. Contain Eurasian watermilfoil to the existing infested areas, reducing the overall plant numbers.
3. Maintain recreational and residential uses of the lake while minimizing impact of control efforts on these uses.
4. Protect water quality and fish and wildlife habitat using control methods that allow sustainable native plant and animal communities to thrive.
5. Minimize costs of control to the Newman Lake Homeowner and the State of Washington.

To ensure success in meeting this goal we are: involving the community in the management process, using the best available science to identify and understand likely effects of management actions prior to implementation and reviewing the effectiveness of control efforts, adjusting methods as necessary to achieve our overall goals.

4.0 Past Management Efforts and Public Involvement

Milfoil Discovery: Eurasian watermilfoil was first identified at Newman Lake during a Community Watershed tour on September 21, 2002 and surveyed by boat more closely on September 27, 2002. Numerous smaller plants were found in shallow areas (less than 3 feet of water) near the lake outlet in the southeast area of the lake. A branch of milfoil, but no growing plants, was found at Hampton Bay. The plants were young; it was estimated that they had one year of growth and perhaps were started with a few plants late in 2001. The plants were spread out to cover an area of approximately 20 acres, however if concentrated would cover an area of less than 2 acres. A map of the original infestation area is provided in fig. 4.1.

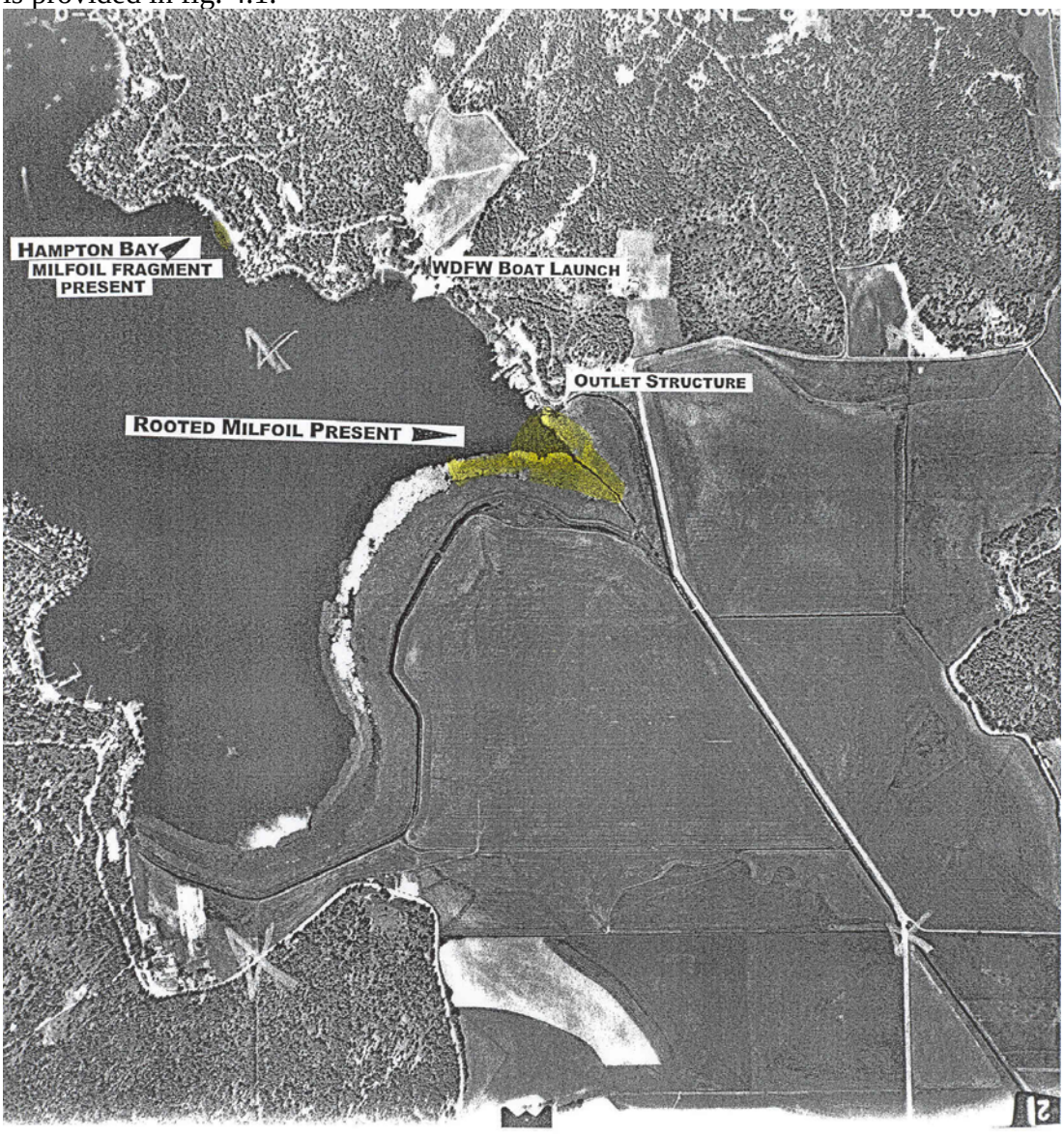

Fig. 4.1 – September 2002 Eurasian watermilfoil survey results

Initial Management Planning: Based on this survey and the support of the NLFCZD Advisory Board and Watershed Committee, the NLFCZD applied for and received an Early Infestation Grant from the

Washington State Dept. of Ecology Aquatic Weed Management Fund to initiate and support control efforts for three years. The grant was awarded on February 26, 2003. During that time the NLFCZD also began reviewing control options. NLFCZD Staff had discussions with Kathy Hamel, DOE Aquatic weed management program, along with Dr. Barry Moore, WSU Limnologist and BiJay Adams, Lake Manager, Liberty Lake Sewer and Water District who have been dealing with a similar infestation at Liberty Lake for years; the staff also reviewed control methods and information on the DOE aquatic management web site.

After discussion of these options with the NLFCZD Advisory Board and community it was decided to pursue a combination of two methods, hand-pulling and a chemical control agent, granular 2,4-D herbicide. Hand pulling would be used where plants are scattered and the herbicide were plants are too numerous to pull cost effectively. These methods seemed most appropriate for control at our lower level of infestation and met requirements of minimizing impact to recreation, native plant populations, and water quality at a low cost.

The herbicide 2,4-D is available in a granular and liquid form and must be applied by a state-licensed applicator. Washington State Department of Ecology states that 2,4-D is a relatively fast-acting herbicide that kills the entire plant (systemic herbicide). This herbicide is considered "selective" for milfoil because it generally targets the broad-leaved plants (dicots) like milfoil. Most other aquatic plants are monocots (grass-like) and are unaffected by 2,4-D. Navigate® and AquaKleen® are granular 2,4-D products registered for aquatic use and DMA*4IVM® is a liquid formulation. DOE suggests that sites suitable for treatment include lakes or ponds partially infested with Eurasian watermilfoil. Where the extent of the infestation is beyond control by hand harvesting, as in Newman Lake's case, 2,4-D is the best option. 2,4-D is not an eradication tool. Some plants survive the treatment and regrow, so these plants must be removed by other means. For that reason, 2,4-D is effective for spot treatment and can be used to reduce the amount of milfoil so that hand harvesting can remove any milfoil plants that are not killed. 2,4-D is suitable for spot treatment because it is a fast-acting herbicide that only needs a 48-hour contact time with the plant. Recent experience in Washington indicates that liquid formulation can be problematic where water use restrictions are a concern. In many applications of the liquid formulation it took ten or more days for 2,4-D residual levels to fall below the standard maximum levels of 70 ppb and 100 ppb respectively for drinking water and irrigation use. See the DOE website at http://www.ecy.wa.gov/programs/wq/plants/management/2,4D_strategies.html. This is of special concern at Newman Lake as a majority of residences use the lake water to irrigate yards and lawns. A public water supply only serves to the south west side of the lake. Ground water wells near the lake are expensive (deep) and of limited capacity. Many residences (especially seasonal) do not have any other on-site water supply besides the lake. Lake water is used for general domestic purposes as well as irrigation; bottled drinking water is usually brought in though some have small treatment systems.

2003 Management Efforts: Boat and dive surveys of the lake shoreline were done in June of 2003. Extensive infestation of Eurasian water milfoil was found around the outlet area as expected based on the Fall 2002 survey. In addition, several plants were found around the first point north of the WDFW boat launch and at Hampton Bay just ¼ mile to the northwest. Further to the southeast from the outlet gate, a small clump of Eurasian watermilfoil plants were also found. One plant was found at the north end of the lake 750 feet east of the Thompson Creek inlet. Numerous small plants were also found in the Newman Lake outlet channel. The plants at the north end and Hampton Bay were diver hand pulled. The balance of the areas including the outlet channel (15.5 acres) were treated with granular 2,4-D

(Aqua-Kleen) on July 28, 2003 and August 25, 2003. Late summer surveys estimated 95%-100% effectiveness of this treatment.

However, by late September 2003 numerous large plants had re-grown within parts of the 2,4-D treatment areas southwest of the outlet gate and north of the boat launch. Also there were two new small plants near the location of the plants that were hand-pulled at the north end of the lake. With the warm weather and milfoil plants still showing signs of vigorous growth, it was decided to retreat all of these areas (4 acres total) with granular 2,4-D in October. See Appendix C for maps and detained reports on 2003 control efforts and treatments.

2004 Management Efforts: In summer 2004, boat and dive surveys showed that the fall herbicide treatments were very effective. Only scattered Eurasian watermilfoil plants were found in these areas. More scattered plants were found in previously un-infested areas along the south and west shorelines of the lake. All of these plants were hand-pulled by a diver. Unfortunately much more extensive milfoil growth was found along the north shoreline east and west of the area treated in fall 2003. This entire area (5 acres) of dense growth was treated with granular 2,4-D in July 2004. This treatment proved to be 95-100% effective in late summer surveys.

Unfortunately, late summer surveys also showed that there were extensive areas of plant re-growth in the area around the outlet gate. The plants were still green and vigorously growing. With the success of last years fall treatment, we decided to proceed with an herbicide treatment for these areas. In late September 2004, the outlet gate area was treated with herbicide (granular 2,4-D) along with two small areas along the shoreline to the southwest. A total of 4.8 acres were treated. A Map of 2004 Eurasian watermilfoil population distribution and control efforts is provided as Fig. 4.2. See Appendix C for detailed reports on survey treatment and monitoring activities for 2004.

2005 Management Efforts: Milfoil growth expanded greatly in 2005. The fall of 2004 treatment did not seem to be effective in controlling the large plants near the outlet gate. There was also significant regrowth in area treated on the north shore. As a result fragments were scattered all around the lake and began starting plants in new areas. Surveys and herbicide treatments and hand-pulling continued all summer long to remove all the plants. Fig. 4.3 provides a map of survey and treatment areas. A summary of herbicide treatment areas is included in Appendix C.

History of Public Involvement and the NLFCZD: The Newman Lake Community has had a long history of passionate concern and involvement in working to improve the Newman Lake and its water quality. It is with this concern that residents have requested the assistance of the Newman Lake Flood Control Zone District to take action on a wide range of concerns over the last 40 years most recently adding invasive species control to the NLFCZD mission. From the NLFCZD Policy and Procedures Manual (October 2004):

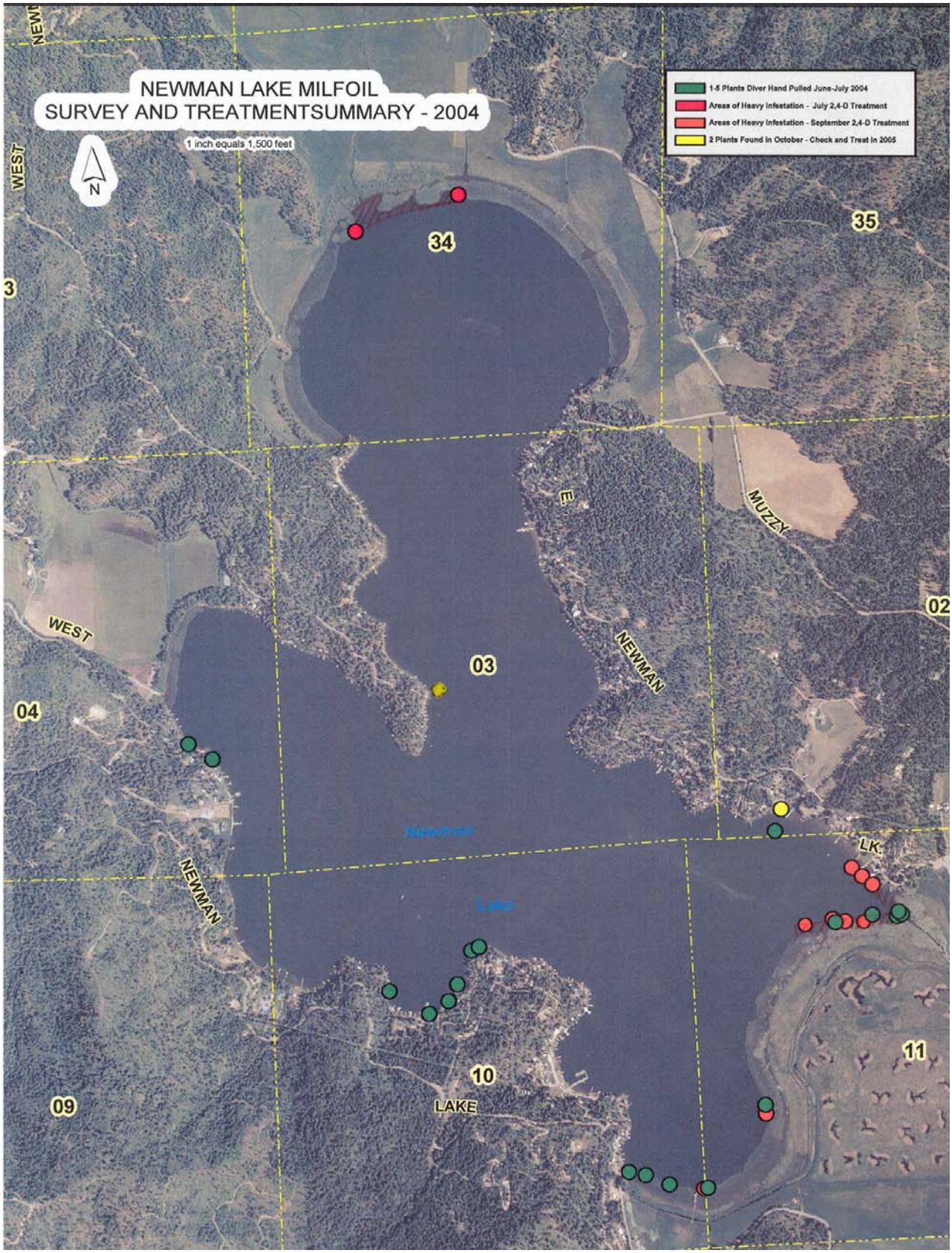

Fig. 4.2: 2004 Newman Lake Milfoil Distribution and Control

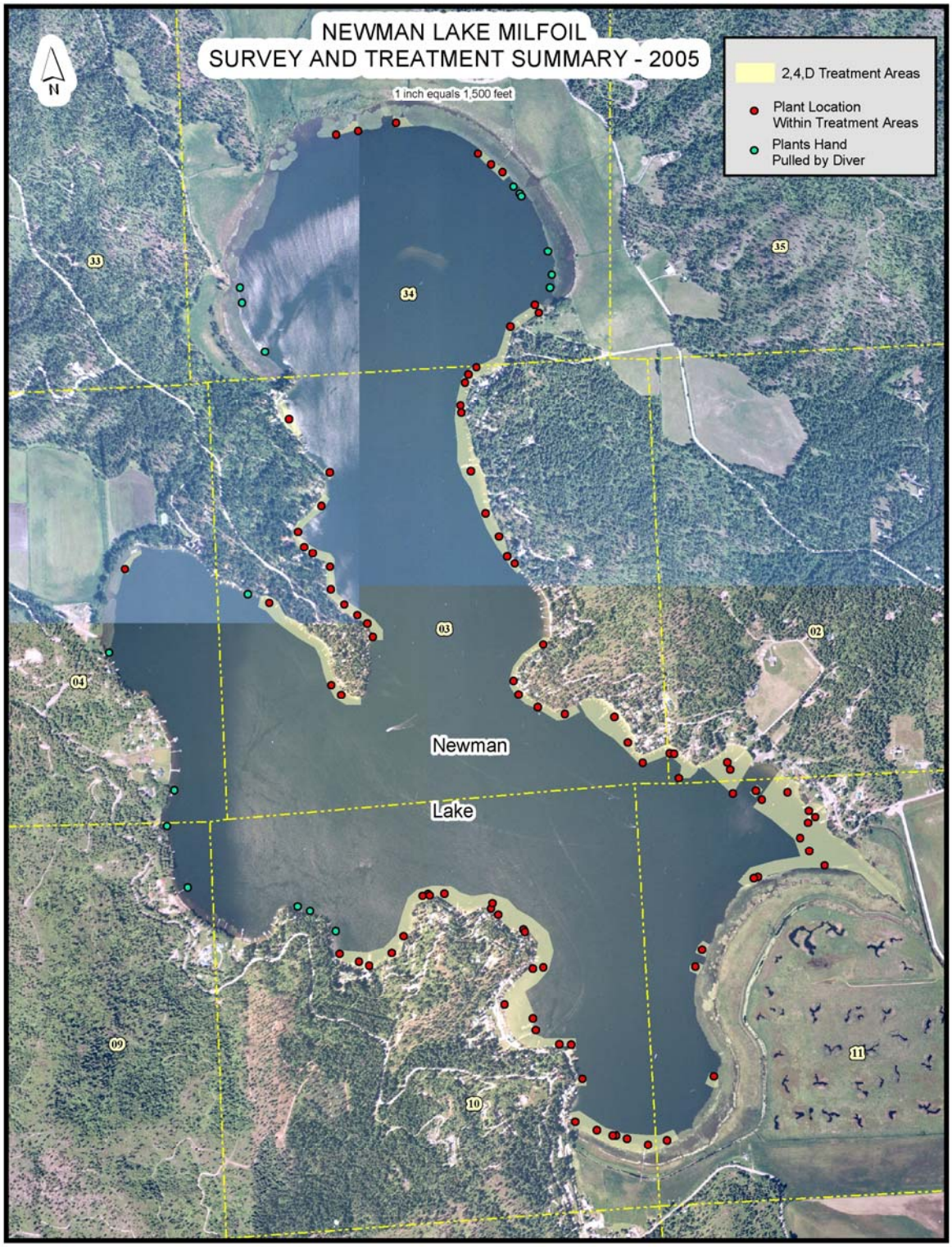

Fig. 4.3: 2005 Newman Lake Milfoil Distribution and Control

"D. MISSION AND GOALS

Citizen concerns and interests have driven the mission of the District since its formation in 1968. It now covers a broad range of watershed issues from flood control, to water quality improvement, to Watershed management.

Mission Statement:

To maintain and operate Newman Lake flood control facilities and manage the lake level to serve the needs of homeowners, farmers, recreationists and others.

To provide leadership and a focus for community efforts to improve the water quality of Newman Lake.

To work with landowners and public and private agencies to minimize impact of watershed activities on lake water quality.

To monitor Lake water quality and operate and maintain the lake aeration and alum injection systems to maximize their benefit.

To control invasive species while minimizing disruption to use of the Lake by homeowners and recreational users"

The Newman Lake Flood Control Zone District was formed in 1968 when Newman Lake area property owners asked Spokane County for assistance in managing the lake level and flooding problems around Newman Lake. The existing flood and water control facilities at Newman Lake had deteriorated and were not functioning properly.

Newman Lake area citizens began to raise water quality concerns in the late 1970's and early 1980's. Serious algae blooms were having an impact on the beauty and recreational use of the lake. To allow the District to assist in efforts to study and alleviate water quality problems, citizens initiated a campaign to revise state law to allow flood control zone districts to fund water quality improvements. This was accomplished in 1983.

In 1985, again driven by community concern, the District applied for and received a grant from the Washington State Department of Ecology (DOE) to study the Lake's water quality problems. This began Phase I of the Lake Restoration Program. This study identified the problem as overloading of nutrients, most particularly phosphorus from watershed runoff and recycling of in-lake sediments. This was feeding excessive algae growth and creating a high biological oxygen demand that was causing extremely low oxygen levels in the lower level of the lake, damaging fish habitat. Proposed solutions included: an alum treatment to bind up phosphorus in the water column and cap sediments to reduce nutrient recycling; a hypolimnetic aeration system to increase oxygen in lower lake levels and thereby reduce nutrient recycling and improve fish habitat; and reduce sediment/nutrient loading input from the watershed with a watershed management plan, public education, and a septic system survey.

These recommendations were implemented as Phase II of the Lake restoration with grant funding from DOE in 1989. The goal of this grant was reduction of nutrient levels in the lake now and into the future. The District provided 25% of the matching funds with a lake restoration benefit assessment that it began collecting in 1989. Total cost of the Phase II restoration program was about one million dollars. The

surface alum treatment (about 520 dry tons alum) was done in 1989 at total cost of $265,000. The Hypolimnetic Aeration system, constructed at a cost of $539,000, began operation in 1992. In addition, the Spokane Regional Health District conducted a survey of lake front septic systems and public involvement was encouraged through the establishment of the Newman Lake Watershed Committee (NLWSC), a watershed management plan was prepared, a "Lake Book" was published to provide information to homeowners, and a water quality monitoring program was initiated.

The NLFCZD (under RCW 86.15, Flood Control Zone Districts) is supervised by the Spokane County Board of County Commissioners (BCC) and the Spokane County Engineer administers the District. An eight-member citizen Advisory Board is made up of 5 voting members and 3 alternates and is critical to the operation of the District. The Board of County Commissioners added the three alternate positions in 1996 to broaden Advisory Board viewpoint base and increase the opportunity for residents to become involved in the operation of the District. The District works to keep as diverse perspectives and opinions on Advisory Board as possible. One member is the current president of the Newman Lake Property Owners Association (NLPOA). The other four represent as much as possible, agricultural, forestry, lakefront homeowner, and seasonal resident interests. Alternate positions represent similar diversity.

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This Advisory Board is very involved in the in determining the plans, operating goals and budget for the District with frequent emails and four meetings per year. The District also holds and an annual summer general meeting and sends out two newsletters per year with the NLPOA to inform and get input from the general Newman Lake community. The District also works closely with the Newman Lake Watershed Committee (NLWSC, a sub-committee of the NLPOA) on watershed management and other issues affecting Lake water quality. The NLWSC is made up of over 40 concerned watershed property owners with a wide spectrum of interests. They are working to build a coalition of community involvement, support, and direction needed to accomplish the broad scope of effort necessary to comprehensively approach watershed management. As an indication of this commitment, there are over 30 community volunteers participating in the stream monitoring in the Newman Lake watershed, a program begun with the support of a DOE water quality grant in 2003.

It is also important to note that the activities of the NLFCZD are funded by benefit assessments on lake and near lake front property owners. So the home and property owners immediately around the lake are paying directly for NLFCZD efforts to control lake level, improve water quality and control invasive species. In 2005 the annual NLFCZD assessment was $188,080. Seven hundred and seventy (770) of the 1767 parcels in the District paid an average assessment of $245 with the average waterfront home owner paying about $500 per year to support District activities.

Public Involvement in Milfoil Control: With the discovery of Eurasian milfoil at Newman Lake, the NLFCZD has involved the community in management decisions and responded to the numerous concerns of the community. Information on Eurasian milfoil and management options have been presented at NLFCZD Advisory Board meetings and annual general meetings and sent out in newsletters. See meeting and information summary table, table 4.1 below. We proposed a draft preliminary milfoil management plan at a public meeting at Newman Lake on April 23rd 2003. See Appendix I for a copy. The Newman Lake Flood Control Zone District wanted to evaluate all control options and means of management for suppression and future control of milfoil within Newman Lake and make sure the goals and concerns of the community were included in the final plan. This Newman

Lake Aquatic Vegetation Management Plan report with its management goals and plans are the result of this interaction over the last 2½ years. Another indication of widespread support for these Aquatic weed management efforts can be seen in the results of our watershed wide "Survey of Newman Lake Property Owners About Lake Water Quality Issues" of June 2003. Results published in October 2003 show 66% of respondents indicated Milfoil control should be a high priority in water quality improvement efforts of the NLFCZD.

Date	Meeting/Information Type	# of People	Notes
10/17/2002	NLFCZD Advisory Board Mtg.	10	Discuss milfoil survey and control options
1/9/2003	NLFCZD Advisory Board Mtg.	12	Discuss milfoil control options and grant application
3/27/2003	NLFCZD Advisory Board Mtg.	12	Discuss milfoil control options and grant application
4/5/2003	Newman Lake Newsletter	1400	Milfoil info, control options and meeting announcement
4/23/2003	NLWSC/Milfoil Public Meeting	about 10	Discussion preliminary management plan
5/29/2003	NLFCZD Advisory Board Mtg.	6	milfoil control update
6/21/2003	NLPOA/NLFCZD Annual Meeting	30+	Milfoil info, control options
10/23/2003	NLFCZD Advisory Board Mtg.	about 10	Milfoil management update
11/3/2003	Newman Lake Newsletter	1400	Milfoil info and management update
3/11/2004	NLFCZD Advisory Board Mtg.	about 10	Add Invasive species control to NLFCZD goals /Survey results discussed
5/20/2004	NLFCZD Advisory Board Mtg.	9	Milfoil Management Plans and budget
5/30/2004	Newman Lake Newsletter	1400	Milfoil info and management update
6/19/2004	NLPOA/NLFCZD Annual Meeting	30+	Milfoil info and management update
10/28/2004	NLFCZD Advisory Board Mtg.	9	Milfoil management update
3/4/2005	Newman Lake Newsletter	1400	Milfoil management update
3/10/2005	NLFCZD Advisory Board Mtg.	10	Milfoil management update

Table 4.1 : Public Meeting and Information – Newman Lake Milfoil Management 2003-2005

Public Education is an important element in the control of aquatic invasive species. Signs have been developed by DOE to bring attention to the Eurasian watermilfoil infestation in lakes and to show anglers and other lake users how to avoid transporting aquatic plants from one lake to another. These signs have been installed at the Washington State Department of Fish and Wildlife boat launch at Newman Lake and the two private resorts on the lake that also have boat launches. Educational flyers have been distributed to residents and concerned citizens at public meetings. The Newman Lake Newsletter, mailed to all Newman Lake residents (see Appendix J for sample article) has also been used to inform residents of the infestation and best management practices that can be applied to limit the spread and future degree of infestation. In addition, Lake Books (put together by the Newman Watershed Plan Committee and DOE) are distributed to every Lake property owner. These books have been developed to help property owners understand how our actions affect the water quality of our lakes (Department of Ecology, 1992).

5.0 Lake and Watershed Characteristics

Location/Description: Newman Lake is located near the Idaho border in Northeast Washington, lying approximately 20 miles northeast of the City of Spokane in Spokane County (See location/watershed map, fig. 5.1). The watershed is located within Water Resource Inventory Area (WRIA) #57, Middle Spokane. Newman Lake has a surface area of 1200 acres with about 9 miles of shoreline and is the largest natural lake in Spokane County. The Lake is relatively shallow however with a mean depth of 19 feet and a maximum depth of 30 feet. (See bathymetry map, fig. 5.2)

Hydrology: The Newman Lake watershed is about 18,500 mostly forested acres with peak elevation of 5160 feet down to the lake at 2125 feet. Mean annual precipitation ranges from about 24 in. by the lake to 35 inches at the highest elevations. Runoff into the lake is heavily dependent on winter snow pack. Of the 9 major lake inlets only one, Thompson Creek, which enters the lake at the far north end, is perennial. Newman Lake has no natural outlet; historically, during high water the lake flooded the floodplain area south of the lake. The 3-mile long manmade outlet channel now carries lake runoff from the outlet gate structure at the southeast end of the lake to the Newman Lake sump, an area of exposed Spokane Valley aquifer gravels where it infiltrates into the ground and recharges the Spokane Valley-Rathdrum Prairie Aquifer. See Fig.'s 5.1, 5.3 and 5.4 for locations of inlets, outlet channel and sump.

History: The Lake has historically been used for forestry and agricultural uses with summer cabins located around the lake perimeter on the east, west and southwest. In the late 1800's an area water control system was constructed and maintained by a group of farmers at the south end of the lake. The system consisted of a 4-mile outlet channel to Moab, and a gravel sump to infiltrate excess lake water to the Spokane Rathdrum aquifer (the lake had no natural outlet). This opened up land for farming and created a channel to float timber to the rail line in Moab for marketing. The outlet was turned over to an irrigation interest in 1903 for water uses in the Spokane Valley. An outlet structure and dike were constructed on the south end of the lake. The development of the Spokane Valley Water Project negated the need for continued use of Newman Lake water and the irrigation district was soon looking to turn the outlet facilities over to another entity for maintenance and operation. The Newman Lake Flood Control Zone District was formed in 1968 when the property owners asked for assistance with the maintenance of the deteriorating facilities. Since that time the facilities have been upgraded and maintained routinely.

Water Quality: Newman Lake undergoes fairly strong summer stratification with greatly reduced dissolved oxygen in the hypolimnion lower layer. This condition reduces fisheries habitat and encourages the release of a large quantity of phosphorus from the sediment, resulting in nuisance algal blooms in the mid-late summer. Physiochemical and productivity data indicate that Newman Lake is in a mesotrophic state of enrichment.

Water quality became a concern in the watershed when severe algae blooms clouded the lake and resulted in fish kills in the late 1970's and 1980's. The citizens initiated a campaign to change Washington State Law to include water quality components into the Flood Control Zone District activities. This was accomplished in 1983. In 1985 the NLFCZD obtained a grant from DOE for Phase 1 of a Lake Restoration Program. This identified water quality concerns in the watershed and proposed recommendations for improvement. The improvements included an aerator system, alum treatment, a watershed management plan, public education, and a septic system survey. A DOE grant, with 25% matching funds helped implement these recommendations in Phase 2 of the Lake restoration effort. Also

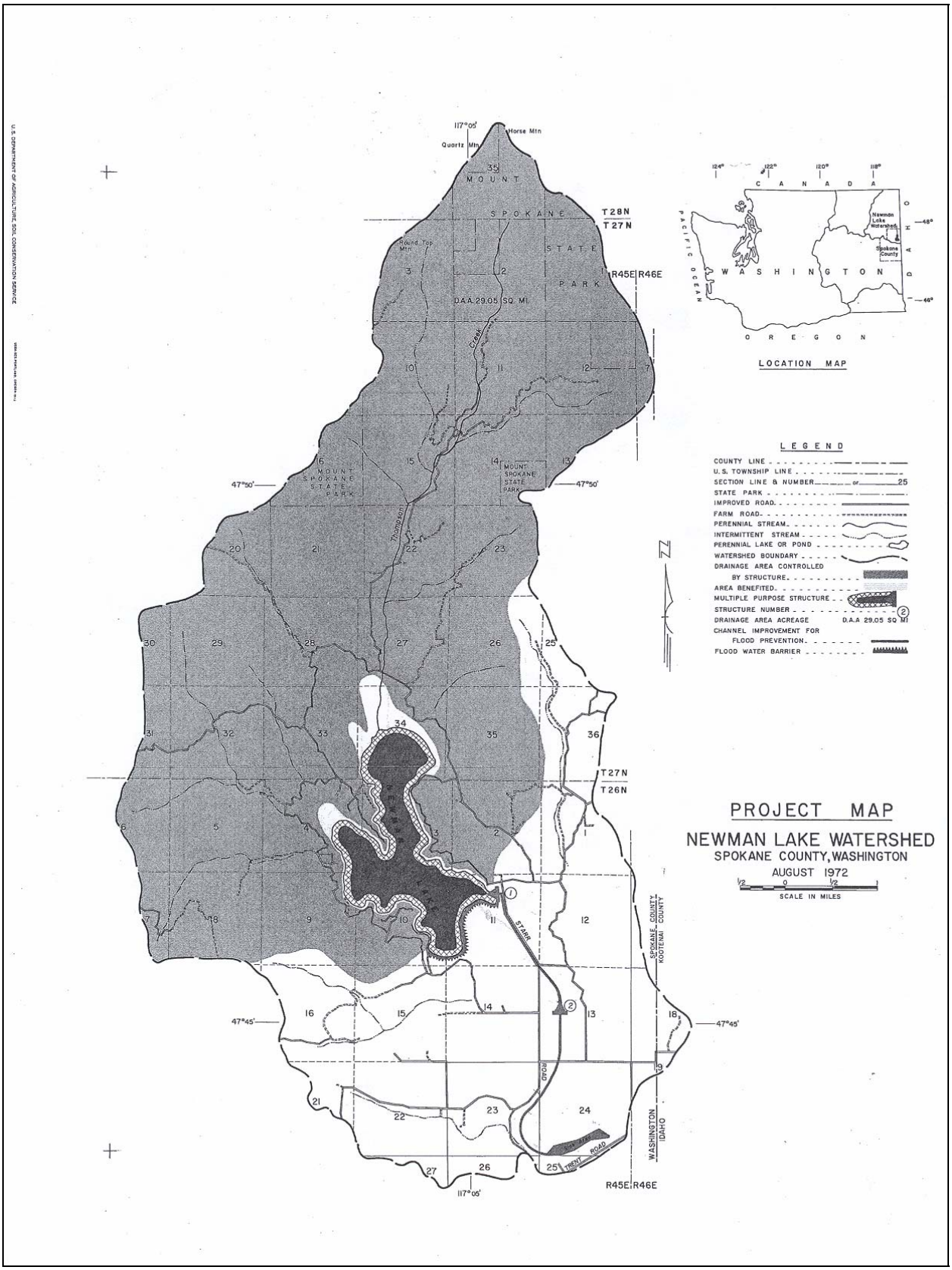
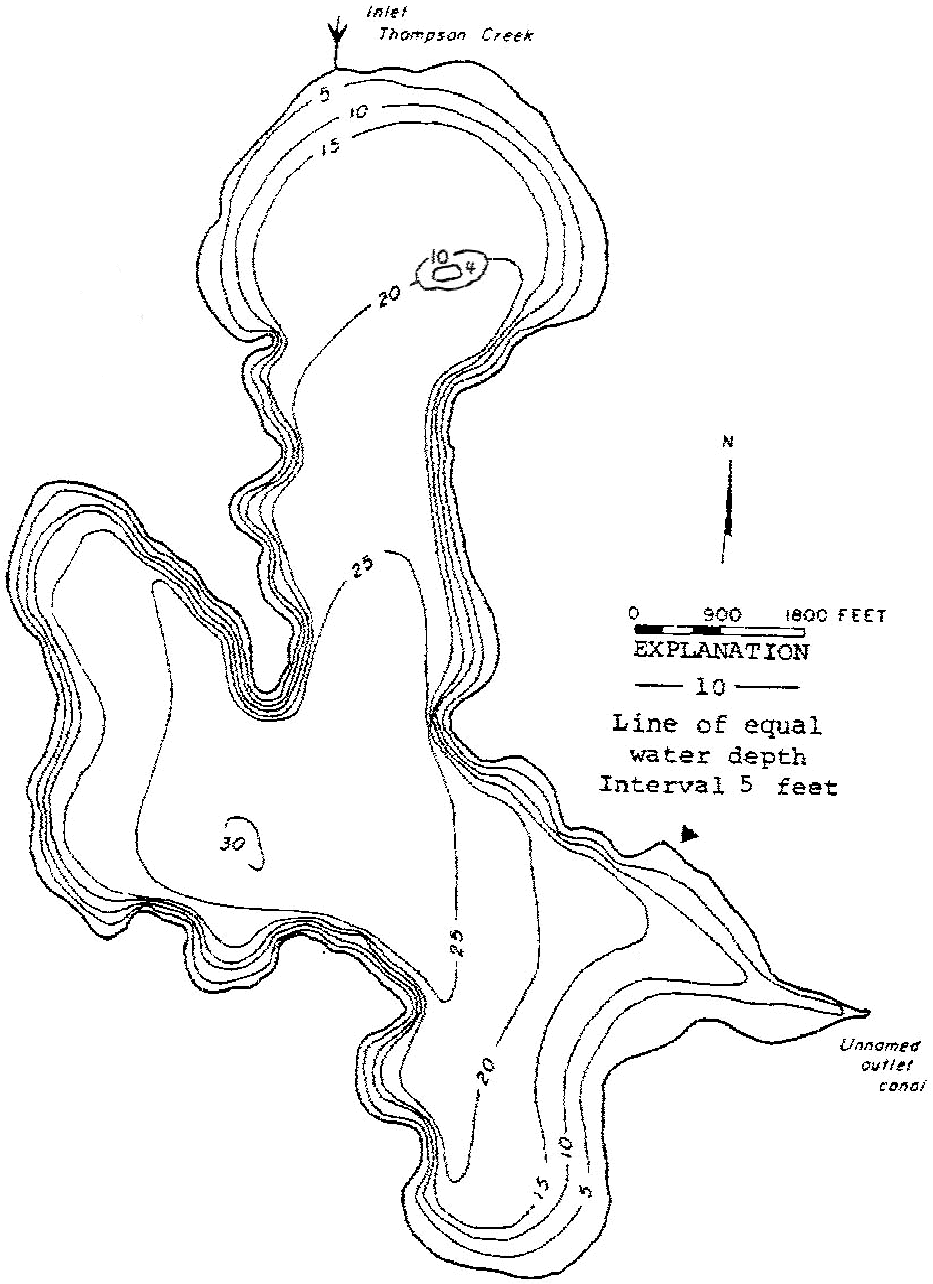


Fig. 5.1 – Newman Lake Watershed Map



Newman Lake, Spokane County. From Washington Department of Game, February 18, 1951.
Updated July 2001

Fig. 5.2: Newman Lake Bathymetry - from WDFW web site

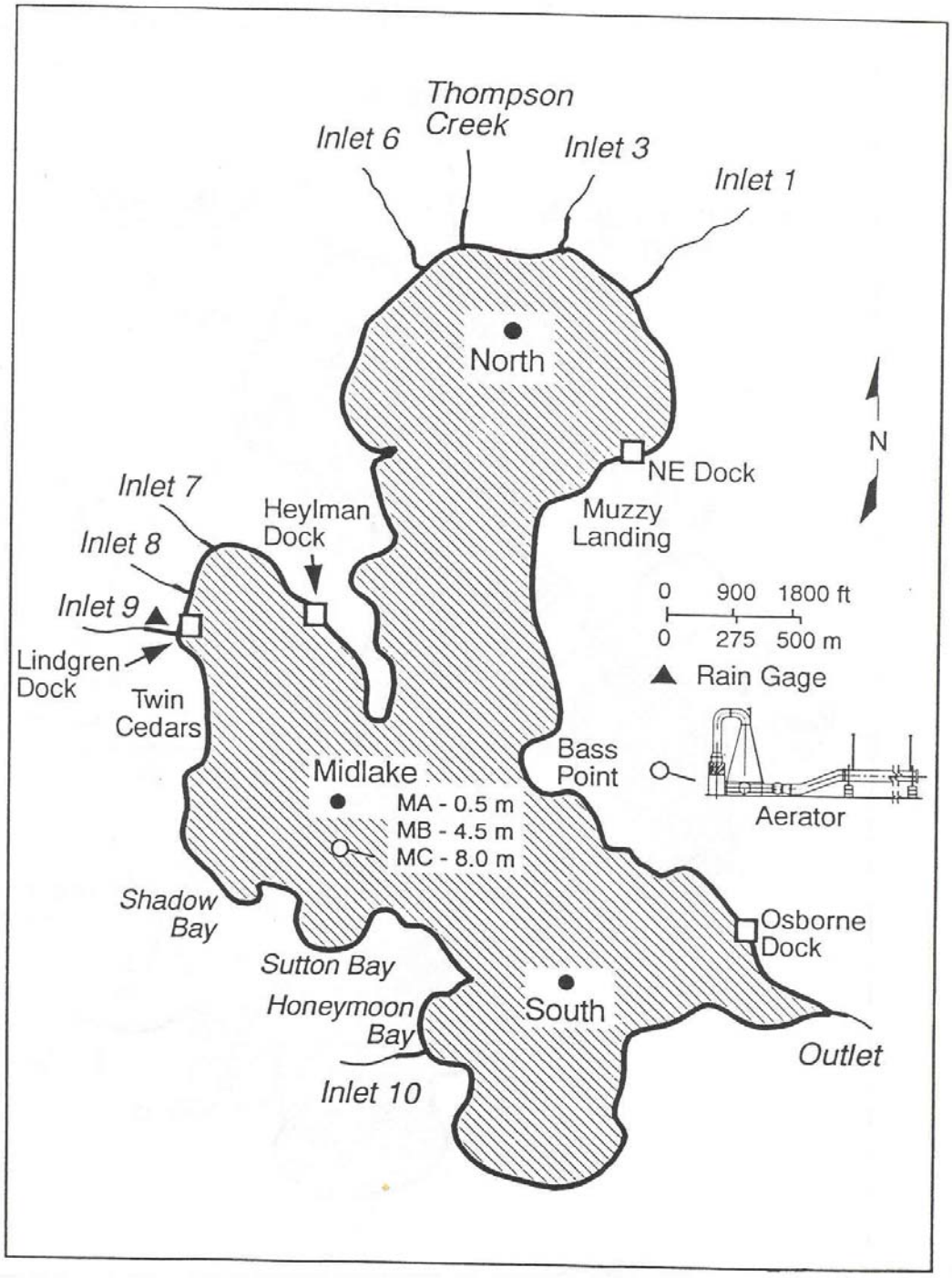


Figure 2. In lake and inlet sampling stations at Newman Lake, Washington.

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Fig. 5.3 – Newman Lake sampling locations and inlets, from Newman Lake Restoration Phase II Report, WSU WRC, 1997

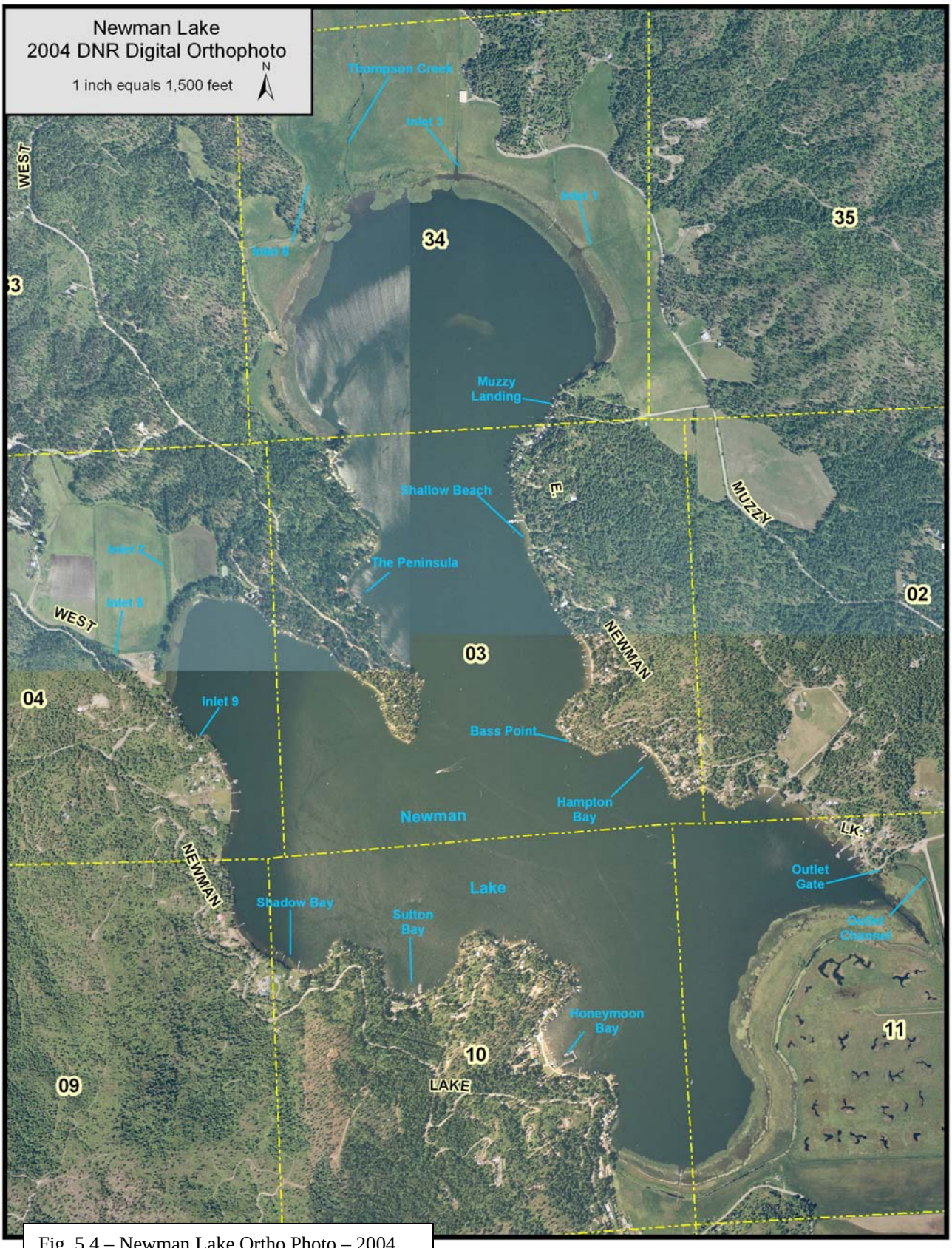

Fig. 5.4 – Newman Lake Ortho Photo – 2004

in 1997 the NLFCZD added a micro-floc alum injection system (funded entirely by Newman Lake property owners) when the effects of the 1989 whole lake alum treatment began to wane. Lake quality has significantly improved since the completion of Phase 2, with improved dissolved oxygen levels and reduced algae blooms. However, Newman Lake is still listed on the State 303d list of impaired water body due to high levels of Total Phosphorus. A TMDL study is currently underway. Lake water quality data for 2004 is tabulated in Appendix B. Location of sampling sites is provided in Fig. 5.3.

Land Use: The area around Newman Lake is mostly rural and forested. The watershed is about 29 sq. miles (18,500 acres) of mostly forest land (86.3%) on the southern slopes of Mount Spokane. The remaining land use area is split between agricultural (5.4%) consisting of small farms with mostly hay, grains and grasses production and some grazing, located on the north and northeast shore of the lake, and residential (1.6%) located mostly in a narrow strips adjacent to the lakeshore on the east, west and southwest shorelines. The balance of the area (6.6%) is open water including the Lake itself. The Spokane County Comprehensive Plan designates all the areas within the Newman Lake watershed as rural conservation or resource forestland. See Fig. 5.5.

Population: The Newman Lake watershed had 571 residences in 2004, mostly clustered along the Lake shoreline. This equates to an estimated watershed population of 1,428, year-round and seasonal combined. The growth rate of residences in the watershed over the last 14 years is about 8.2%, a fairly moderate pace. Based on the results of the recent Land Use Survey, seasonal residences are about 61 % of this total. This has changed very little in the last 15 years, despite the fact that many older cabins are being replaced with larger modern homes.

Beneficial and Recreational Uses:
The lake supports a number of recreational activities. There is a public boat launch owned by the WDFW on the southeast shore of the lake. WDFW stocks the lake with trout routinely (6-8 inch rainbow trout, *oncorhynchus mykiss* and triploid) and tiger muskie (*esox lucius x E. masquinongy*). The lake also supports a warm water fishery which includes largemouth bass (*micropterus salmoides*), smallmouth bass (*micropterus dolomieu*), black crappie (*pomoxis nigromaculatus*), bluegill (*lepomis macrochirus*), pumpkin seed (*lepomis gibbosus*), yellow perch (*perca flarescens*), yellow bullhead (amerurus natalis), brown bullhead (*amerurus nebulosus*), and tiger muskie (WDFW, "Warmwater Fish of Washington", at http://wdfw.wa.gov/fish/warmwater/species.htm). The fishery is a popular one for residents and visitors. Although no current numbers are available, the Newman Lake restoration feasibility study, WRC, Funk et al, April 1988, indicates that about 8,500 man-days are spent by fisherman at Newman Lake annually. A summary of stocking history is provided in tables 5.5 and 5.6.

Newman Lake is also very popular for boaters, swimmers and water-skiers. In addition to the WDFW boat launch, there are two private resorts on the lake with boat launches and other facilities including swimming beaches, a store, camping, cabins, and boat rental. Cherokee Landing Resort is located just north of the outlet and the Sutton Bay Resort is on the west side of the lake at Sutton Bay. The only other public access to the lake is the McKenzie Conservation Area recently acquired by Spokane County Parks and Recreation under the Conservation Futures Program. Public access to the 421 acres of upland woodlands, wetlands and 3000' of shoreline is limited to passive and non-motorized recreation. See Fig. 5.6, Newman Lake Beneficial Uses Map.

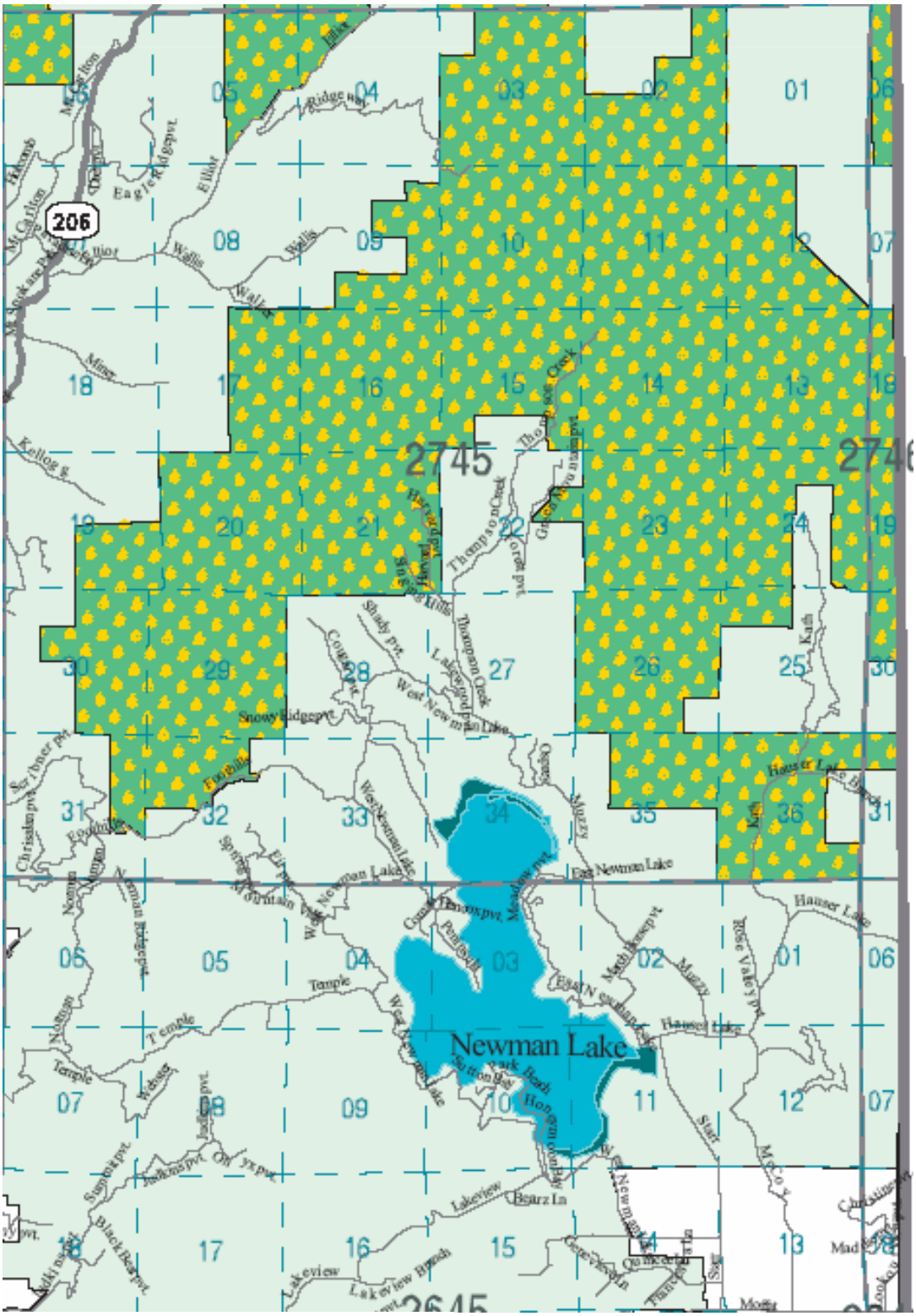

Fig. 5.4: Spokane County Comprehensive Plan – Newman Lake Watershed

Newman Lake Fish Stocking History 1999-2005
Washington State Department of Fish and Wildlife

Year	Rainbow Trout Catchable (8-12")	Triploid Rainbow Trout 14" or larger	Rainbow Trout Fry Fry (2-5")	Total	Date
2005	15,000	0	0	15,000	Mar., Apr.
2004	10,000	0	0	10,000	Mar., Apr.
2003	12,000	0	40,040	52,040	Mar., Apr. (fry-spr/fall)
2002	10,000	0	0	10,000	Mar., Apr.
2001	10,000	3,000	0	13,000	Mar., Apr.
2000	10,000	3,750	0	13,750	Mar., Apr.
1999	10,000	0	0	10,000	Mar., Apr.

summary of information from WDFW web site at http://wdfw.wa.gov/fish/plants/index.htm

Table 5.1 – Newman Lake Trout Stocking History

Tiger muskellunge stocked in Newman Lake, Spokane County, Washington since 1992.

Year	Number	Size (inches)
1992	679	7-9
1994	2,250	12
1994	200	14
1995	955	8-9
1997	1,000	13
1998	500	13-14
1999	400	13-14
2000	400	12-16
2000	94	18
2002	500	12-14
2004	350	14
2005	700	13

from Report No. FPT 04-02, "2000 Warmwater Fisheries Survey of Newman Lake, Spokane County, Washington", March 2004, by Randall S. Osborne, Heather Woller, and Marc Divens, Warmwater Enhancement Program, Washington Department of Fish and Wildlife, 600 Capitol Way North, Olympia, Washington 98501-1091, and Randall S. Osborne, correspondence July 28, 2005

Table 5.2 – Newman Lake Tiger Muskie Stocking History, 1992-2005

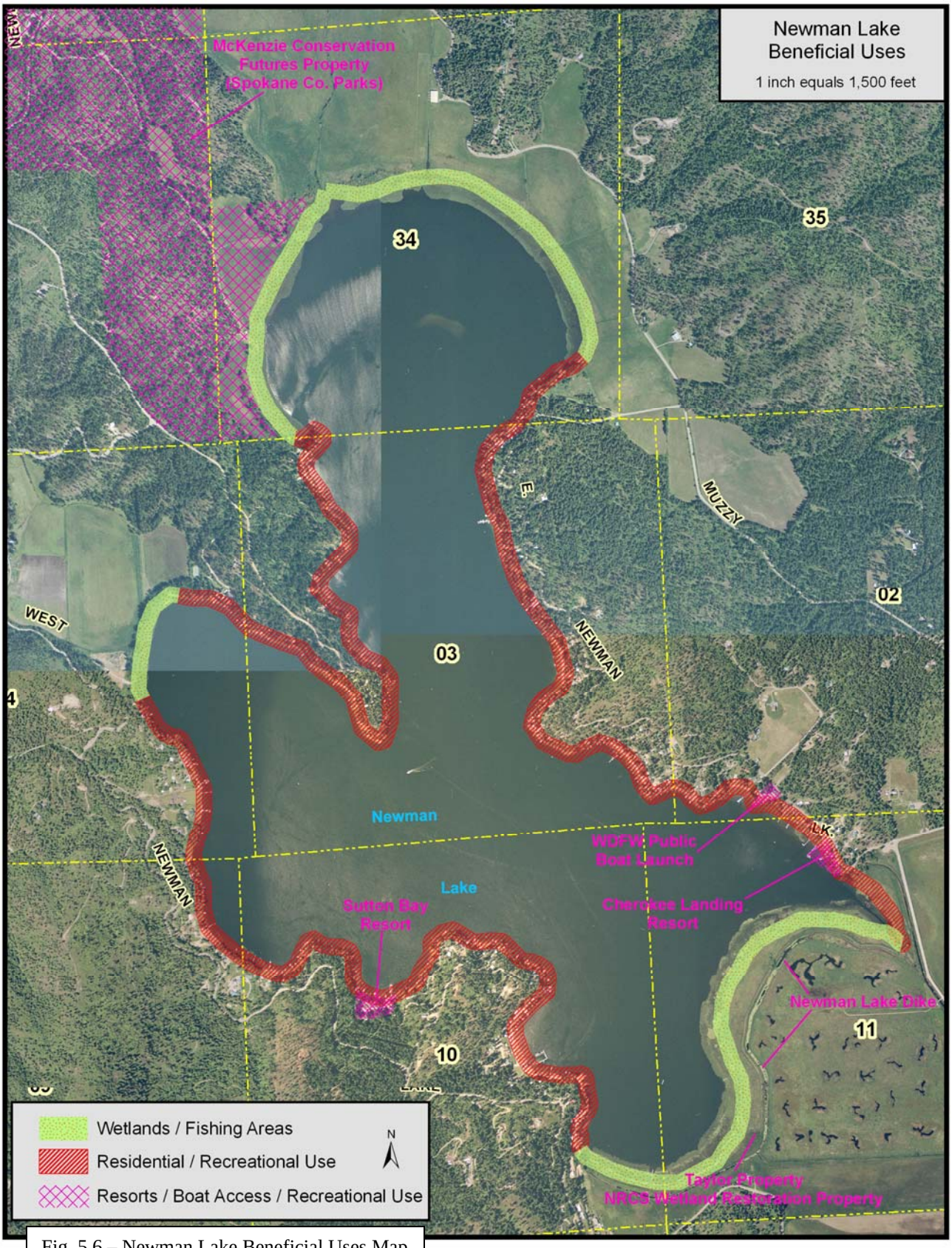

Fig. 5.6 – Newman Lake Beneficial Uses Map

Vegetation, Wildlife and Waterfowl: Wildlife enthusiasts enjoy Newman Lake also. It is not uncommon to see bald eagles, great blue herons, hawks, kestrels, osprey, and abundant waterfowl utilizing the lake and its wetland areas for feeding and nesting and migrating. Funk and Moore (1988) note that the lake serves as a stopover of about 5,000 waterfowl of various species. Other birds in the watershed include various songbirds, common yellow throat, warblers, flycatchers, sparrow, ruffed grouse. Mammals in the area include moose, elk, deer as well as cougar, coyote and black bear. For fish species see the fisheries information in the recreational uses section below.

Newman Lake is timbered with predominately ponderosa pine (*Pinus ponderosa)* with western red cedar, Douglas fir, grand fir, western larch, lodgepole pine, western white pine and hemlock also present. Cottonwoods and aspens thrive in the wetlands.

Priority Habitat and Species: WDFW delineates Moose, Rocky Mountain Elk, Northwest While-tailed Deer priority habitat species areas within 1/2 mile of and encompassing the entire Newman Lake shoreline. Wetland priority habitat areas are also associated with great blue heron foraging. Two Bald Eagle and several Osprey nesting areas have also been identified and are scattered around the lake. No rare plants have been identified by the State Dept. of Natural Resources. The Bald Eagle, a state and federal threatened species, is the only endangered or threatened species identified by state and federal wildlife agencies in the Newman Lake area.

Wetlands: From Shoreline Assessment for Spokane County, URS, 2002, the north and south ends of the lake have lacustrine/littoral emergent and palustrine emergent wetland complexes that are highly functional based on site observation and plant identification. Identified wetland indicator plant species include broad-leaved Cattail (*Typha latifolia*), Reed Canary Grass (*Phalaris arundinacea*), a noxious weed, Yellow Pond Lily (*Nuphar lutea (polysepalum*)), Tule (*Scirpus acutus (lacustris*)), Soft Rush (*Juncus effuses*). The hydrophytic vegetation appeared diverse and well established. The Lacustrine emergent wetlands are located in narrow strips along about 3 miles (1/3) of the shoreline of Newman Lake at the north, northwest and south ends. See green shaded areas in Fig. 5.6. Upland of these lacustrine wetlands, Palustrine emergent wetlands extend over about 1200 acres to the north and south of the lake. These areas are mostly agricultural, dominated by grass hay production with some grazing areas. Two-hundred and nine acres of these wetlands immediately south of the Lake have been protected under a Natural Resource Conservation Service (NRCS) Wetland Reserve Program easement. NRCS recently began restoration of this area include deleveling and planting with over 50,000 tree and shrub seedlings.

Water Supply: A list of Newman Lake water rights is provided in Appendix K. A large majority of the residents still utilize water from the lake. Most use it for irrigation purposes. A public water supply (Moab Irrigation) only serves a small number of residences on the south west side of the lake. Ground water wells near the lake are expensive (deep) and of limited capacity. So many residences do not have any other on-site water supply. Many residents (especially seasonal residents) also use lake water for domestic purposes, while bringing in bottled drinking water.

Shoreline Designation and Survey: The current shoreline designation for Newman Lake includes a mixture of conservancy and rural designations. See Appendix A for current and recommended future shoreline designations. The NLFCZD through the effort of volunteers recently completed a photographic inventory of the entire shoreline. They also visually categorized the shoreline by use and

vegetation. Result provided in table 5.1. Note that approximately 1/2 the shoreline has retained natural its vegetation.

TABLE 1 NEWMAN LAKE SHORELINE LAND USE BY CATEGORY 2004	
LAND USE CATEGORY DESCRIPTION	PERCENT
Residential/ Predominantly Natural Shore	22%
Residential / Not Natural Vegetation at Shore	26%
Residential / Bulkheaded at Shore	16%
Commercial (Resorts)	2%
Public Access	1%
Non-residential/ Natural/ Agricultural	33%

Table 5.3 – Newman Lake Shoreline Land Use – from "Newman Lake Shoreline Survey 2004", NLFCZD, Feb. 2005

6.0 Aquatic Plant Characteristics

Milfoil is the only nonnative species of concern at this time at Newman Lake; however, there are several other state-listed noxious weeds present in Newman Lake including fragrant water lily, yellow flag iris, and reed canarygrass. The results of previous macrophyte surveys in 1986 and 1990 are provided as fig. 6.1 and 6.2. Shoreline macrophyte populations are dominated by Potamogeton robbinsii, Nuphar polysepala, and Brasenia scherberi. Nymphaea odorata (fragrant water lily), an eastern North American native not native to the northwest, does occur in very limited areas of the lake and has at least since

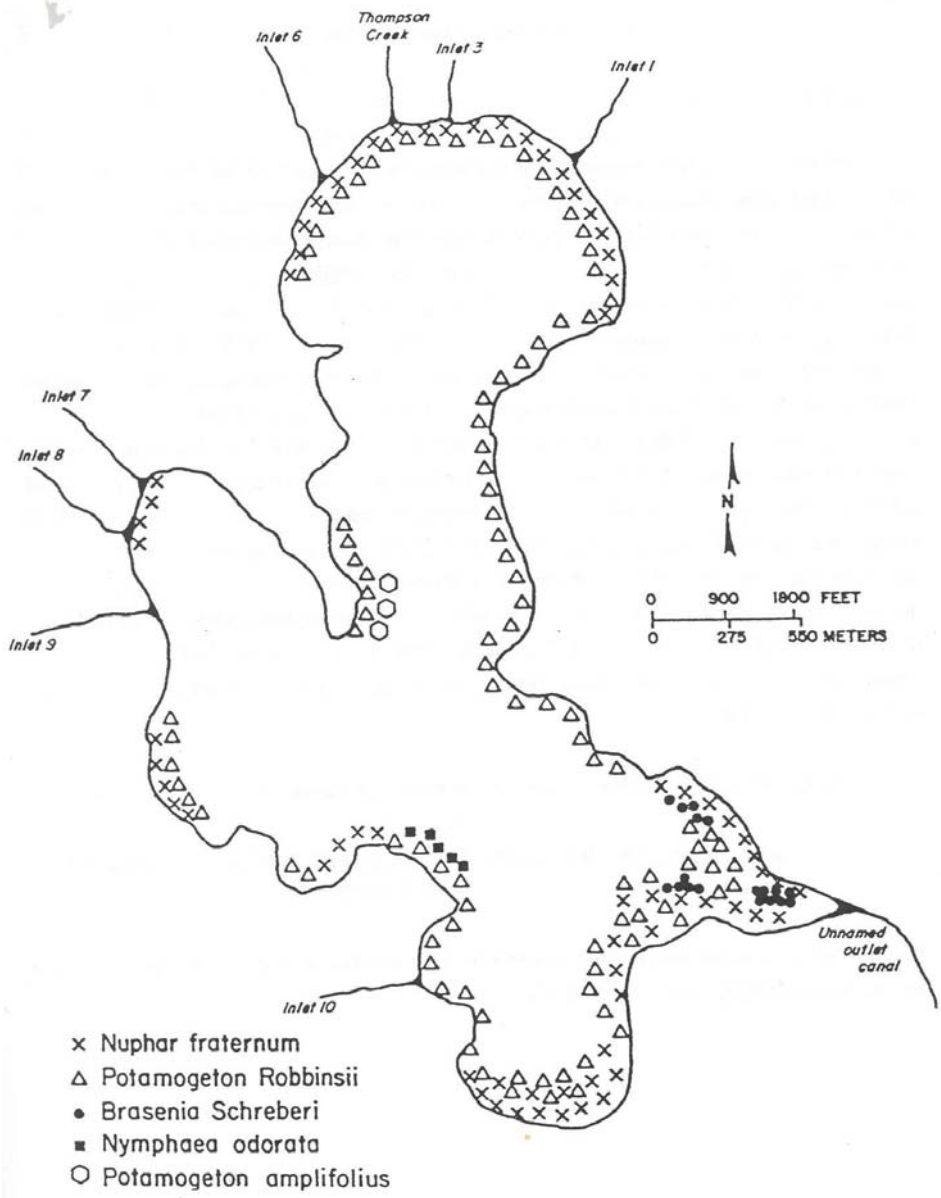

Figure 10. Macrophyte population distribution at Newman Lake, Washington.

33

Fig. 6.1 - 1986 Newman Lake Macrophyte Population Distribution - from "Newman Lake Restoration Phase II- Final report", Funk etal, May 1998

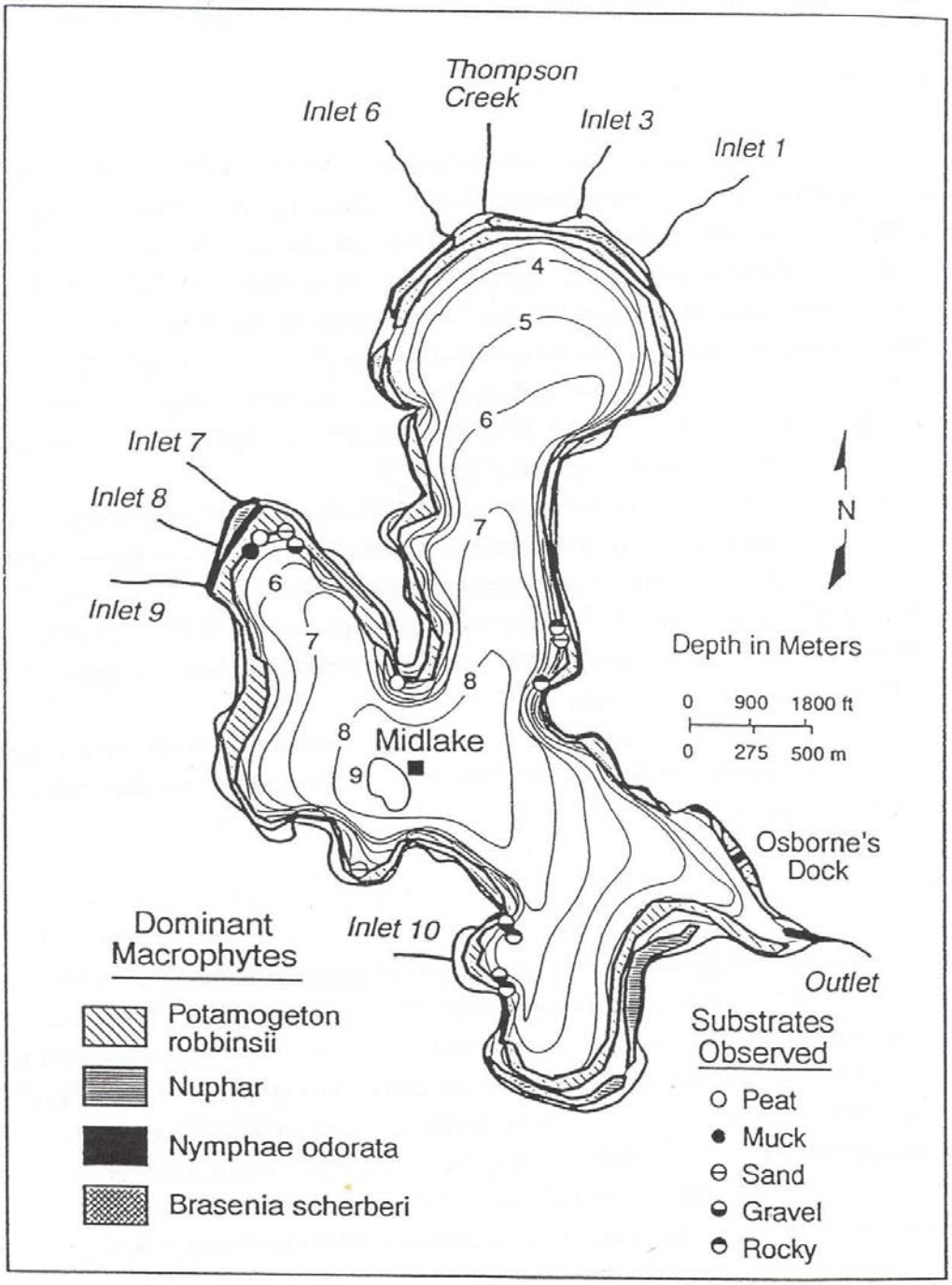

Figure 31. Present macrophyte locations and depths in Newman Lake

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Fig. 6.2: 1990 Newman Lake Macrophyte Population Distribution - from "Newman Lake Restoration Phase II- Final report", Funk etal, May 1998

1986; however it has not been as invasive as it can be in many lakes. In addition to the populations found in the previous macrophyte surveys noted above, we have recently found large populations of other native species including Elodia Canadensis (common waterweed), Potemegeton Amplipholeus (Big Leaf Pondweed), and Ceratophylum Demersum (Coontail). Ecology noted that *P. robbinsii* (fern leaf pondweed) is by far the dominant plant in Newman Lake. Native milfoil has not been found at Newman Lake to date.

Here are species that Ecology has identified in or along the shorelines of Newman Lake in a 2005 survey:

Brasenia schreberi	watershield
Ceratophyllum demersum	Coontail; hornwort
Chara sp.	muskwort
Elodea canadensis	common elodea
Fontinalis antipyretica	water moss
Iris pseudacorus	yellow flag
Juncus sp.	rush
Juncus sp. or Eleocharis sp.	small grass-like plants
Myriophyllum spicatum	Eurasian water-milfoil
Najas flexilis	common naiad
Nuphar polysepala	spatter-dock, yellow water-lily
Nymphaea odorata	fragrant waterlily
Phalaris arundinacia	reed canarygrass
Polygonum sp.	smartweed
Potamogeton amplifolius	large-leaf pondweed
Potamogeton robbinsii	fern leaf pondweed
Potamogeton sp (thin leaved)	thin leaved pondweed
Potamogeton sp.	pondweed
Scirpus sp.	bulrush
Spiraea sp.	spirea
Typha latifolia	common cat-tail
unknown plant	unknown
Utricularia sp.	bladderwort
Utricularia vulgaris	common bladderwort

Part 1: Non-Native Invasive Aquatic Plants

There are four identified species of non-native invasive aquatic plants at Newman Lake. By far the most problematic is Eurasian watermilfoil. It is the main concern of property owners and the main emphasis of aquatic weed management efforts. Characterizations of these four species follow. This information was taken from the Ecology web site for Aquatic Plants and Lakes at http://www.ecy.wa.gov/programs/wq/links/plants.html and the State Noxious Weed Control Board web site at http://www.nwcb.wa.gov/weed_info/weed_infohome.html.

EURASIAN MILFOIL CHARACTERIZATION

Species: *Myriophyllum spicatum L.*, Eurasian milfoil, Eurasian watermilfoil
Family: Haloragaceae

Eurasian watermilfoil (Figure 6.4) is an invasive "exotic" species listed on the state noxious weed list. Exotic means that it is not native to this area, but it is native to Europe, Asia and Northern Africa. Figure 6.3 illustrates the range of Eurasian watermilfoil throughout the United States.

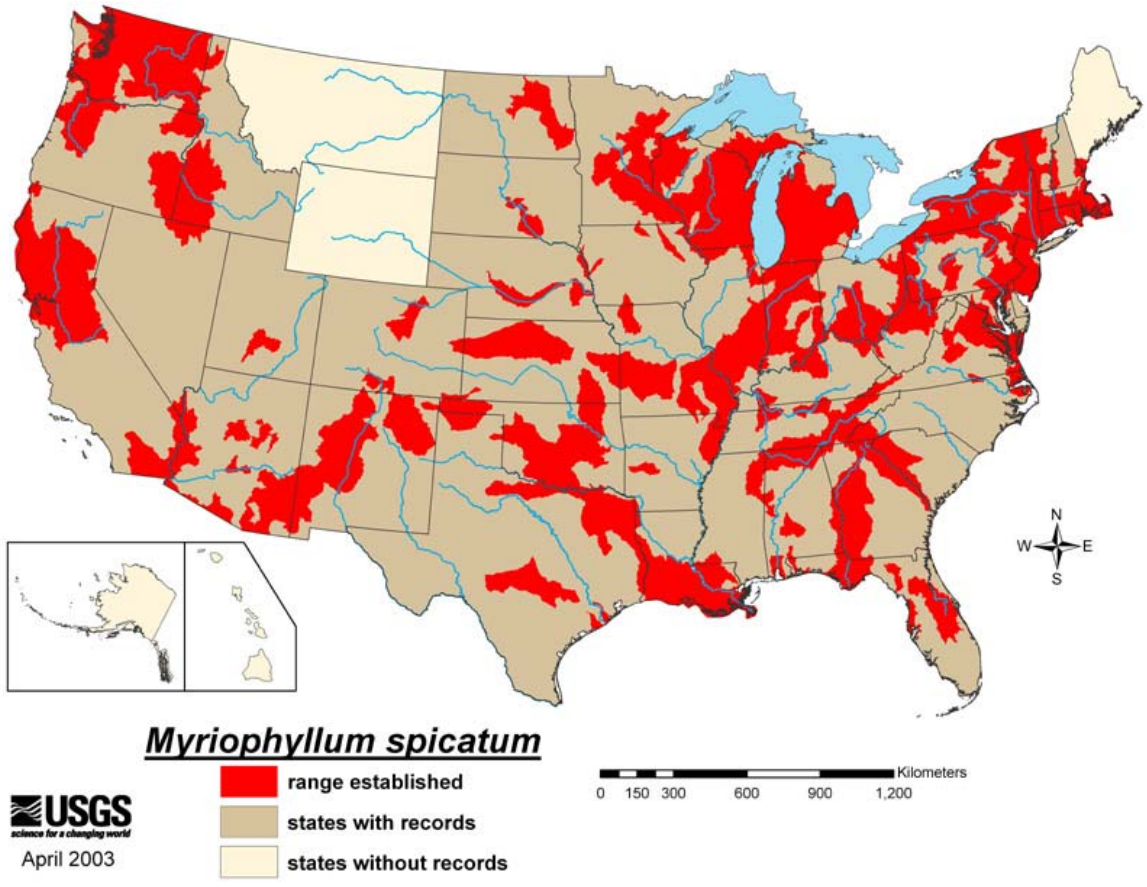

Figure 6.3 Range of Eurasian watermilfoil (Jacono and Richerson, 2003)

Eurasian watermilfoil is a perennial, rooted plant. It is mostly submerged, but can grow as an emergent in situations where the water level slowly recedes and strands the plants on higher ground. Typically, Eurasian milfoil can be found in depths to 20± feet. The stem is highly branched near the water surface. New leafy growth appears red early in the growing season. In late summer, most of the plant's mass is concentrated at the surface, forming characteristic floating mats. Either plants over winter in a dormant state or remain evergreen in milder climates. They are usually well established by mid-spring, flowering in June or July, and in full vegetative growth by August. Die back occurs during the fall to early winter season. Plant fragments are viable at all times of the year. Left undisturbed, Eurasian milfoil "auto-fragments" in the fall, when the plant becomes brittle and comes apart on its own. Sometimes sparse new green growth continues to be produced until December or January, at which time the plants become dormant or near dormant. Eurasian Milfoil can tolerate a large variation in environmental conditions, sediments, pH conditions, and fresh to brackish water (Daniel and Freeland, 1999).

Eurasian watermilfoil has slender stems whorled by submersed feathery leaves and tiny flowers produced above the water surface. The flowers are located in the axils of the floral bracts, and are either four-petaled or without petals. The leaves are threadlike, typically uniform in diameter, and aggregated into a submersed terminal spike. The stem thickens below the inflorescence and doubles its width further down, often curving to lie parallel with the water surface. The fruits are four-jointed nut-like bodies. Without flowers or fruits, Eurasian watermilfoil is difficult to distinguish from Northern watermilfoil. Eurasian milfoil is a variable species, often making it difficult to identify without chemical or DNA analysis. Because it is an extremely invasive plant, it is important to distinguish Eurasian milfoil from native milfoils. Eurasian watermilfoil has 9-21 pairs of leaflets per leaf; while Northern milfoil typically has 7-11 pairs of leaflets (see Figure 6.5). Coontail is often mistaken for the milfoils, but does not have individual leaflets (Wisconsin Department of Natural Resources, 2003). Table 6.1 characterizes *Myriophyllum spicatum L.*, Eurasian milfoil.

Figure 6.4 *Myriophyllum spicatum L.*, Eurasian milfoil

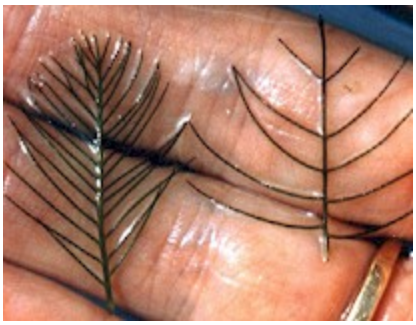

Figure 6.5 Eurasian watermilfoil *Myriophyllum spicatum* (left – 15 leaflet pairs) and Northern milfoil *Myriophyllum sibiricum* (right – 5 leaflet pairs) distinction

Eurasian watermilfoil reproduces primarily by “auto fragmentation” of the stems and propagating root crowns, thus it does not rely on seed for reproduction. This reproduction allows the plant fragments to be dispersed and carried by water currents and wind or inadvertently picked up by boaters. Seed production has been documented, but is considered a minor reproductive mechanism under typical growth conditions. "Milfoil reproduces extremely rapidly and can infest an entire lake within two years of introduction to the system (Washington State Department of Ecology, 2003)." Milfoil is most commonly transported via boats, motors, trailers, bilges, live wells, or bait buckets, and if moist can stay alive for weeks.

Eurasian milfoil is very invasive and can provide only a single habitat by replacing the native plant species and in turn threatening the integrity of aquatic communities. It also inhibits the aesthetic and recreational uses like swimming, boating, and fishing. Severely infested waters display a dense yellow-green matt of vegetation and give off the appearance that the water is "infested" or "dead". The decomposition of the plant mass at the end of the season results in nitrogen and phosphorus loading, and "the cycling of nutrients from sediments to the water column by Eurasian watermilfoil may lead to deteriorating water quality and algae blooms of infested lakes" (Wisconsin Department of Natural Resources, 2003).

Eurasian watermilfoil was believed to have been introduced to the eastern United States around the 1940s, but it may have arrived as early as the late 1800s. The first known herbarium milfoil specimen in Washington was collected from Lake Meridian near Seattle in 1965 (Washington State Department of Ecology, 2003).

Property	***Description***
Leaf	Two types. Submersed leaves: 2-4 cm long, feather-like, arranged in whorls of 4 around the stem. Leaves are often square at the tip and typically have greater than 14 leaflet pairs per leaf. On mature plants, the leaflets are closely crowded along the midrib. Emergent leaves: tiny (1-3 mm long), smooth edged to toothed, located on the flower spikes with one leaf beneath each flower, leaves

	shorter than flowers.
Stem	Long, often abundantly branched stems form a reddish or olive-green surface mat in summer.
Flower	Tiny. On reddish emergent spikes 4-8 cm long. Female flowers lack petals, 4 petals on male flowers, 8 anthers.
Fruit	Up to 3 mm in diameter, divided into 4 chambers, with 1 seed per chamber.
Root	Many, fibrous, from the plant base. Roots often develop from plant fragments.
Propagation	Plant fragments; rhizomes. Sprouting from seed is rare.
Importance of Plant	This invasive plant spreads rapidly, crowding out native species, clogging waterways, and blocking sunlight and oxygen from underlying waters.
Distribution	Native to Eurasia and northern Africa, but is a widespread weed in North America. Found in many lakes and rivers throughout Washington.
Habitat	Lakes, rivers, and ponds. Tolerates a wide range of water conditions.
May be confused with	Northern milfoil *(Myriophyllum sibiricum),* which has fewer than 14 leaflet pairs per leaf, generally has stouter stems, and produces winter buds. When lacking flower stalks, Eurasian milfoil is also easily confused with most other milfoils.

Table 6.1 Eurasian milfoil identification (Washington State Department of Ecology, 2001a).

FRAGRANT WATER LILY CHARACTERIZATION

Species: *Nymphaea odorata*, fragrant waterlily, white waterlily
Family: *Nymphaeaceae*

Fragrant water lilies (*Nymphaea odorata*) are exceptionally beautiful water plants with floating leaves and large many-petaled fragrant blossoms. They are wonderful additions to backyard ponds and even "tub gardens." The nursery industry has hybridized them and produced many color variations. They sell tropical water lilies and hardy water lilies. It is the hardy white and (sometimes) pink lilies that have become naturalized in Washington lakes and rivers. These plants are native to the eastern United States and it is believed that the water lily was introduced to Washington during the Alaska Pacific Yukon Exposition held in Seattle in the late 1800s. Because of their great beauty, water lilies have been intentionally planted in many Washington lakes, especially those lakes in western Washington. However, lake residents are strongly discouraged from planting fragrant waterlilies in lakes or natural waterbodies. Not only are water lilies aggressive plants, but sometimes "hitchhiker" plants such as hydrilla can also be introduced to our lakes when water lilies are planted.

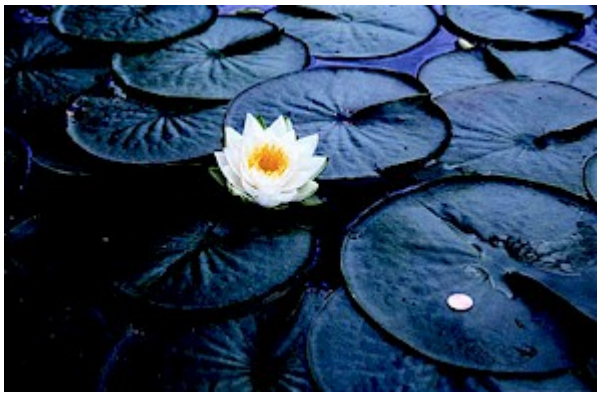

Fig. 6.6 - *Nymphaea odorata*, fragrant waterlily

Growth Habit**:** Water lilies grow in dense patches, excluding native species and even creating stagnant areas with low oxygen levels underneath the floating mats. These mats make it difficult to fish, water ski, swim, or even paddle a canoe through. Although relatively slow-spreading, water lilies will eventually colonize shallow water depths to six feet deep and can dominate the shorelines of shallow lakes. For this reason, planting water lilies in lakes is not recommended.

Water lilies reproduce by seed and also by new plants sprouting from the large spreading roots (underground stems called rhizomes). A planted rhizome will cover about a 15-foot diameter in about five years. Fragrant water lily has an interesting pollination strategy. Each white or pink flower has many petals surrounding both male and female reproductive parts, and is only open during the daytime for three days. On the first morning, the flowers produce a fluid in the cup-like center and are receptive to pollen from other flowers. However, they are not yet releasing pollen themselves. Pollen-covered insects are attracted by the sweet smell, but the flower is designed so that when they enter the flower, they fall into the fluid. This washes the pollen off their bodies and onto the female flower parts (stigmas) causing fertilization. Usually the insects manage to crawl out of the fluid and live to visit other flowers, but occasionally the unfortunate creature will remain trapped and die when the flower closes during the afternoon. On the second and the third days, the flowers are no longer receptive to pollen, and no fluid is produced. Instead, pollen is released from the stamens (the flexible yellow match-shaped structures in the flower center). Visiting insects pick up the pollen and transport it to flowers in the first day of the flowering cycle. After the three days the flowers are brought under water by coiling their stalks. The seeds mature under water and after several weeks are released into the water. Water currents or ducks, which eat the seeds, distribute them to other areas. This flowering regimen is followed nearly throughout the summer, producing many eye-pleasing blooms and a large supply of seeds.

In addition to reproducing by seeds, water lilies spread by rhizomes. Anyone who has tried to curtail this plant's growth in front of their dock knows how tenacious these root systems are. Also, if pieces of the rhizome are broken off during control efforts, they will drift to other locations and establish a new patch of lilies.

Native American Use: The fragrant water lily was utilized in many ways by Native Americans in the eastern United States. Roots of this and other water lilies were used medicinally as a poultice for sores and tumors, internally for many aliments including digestive problems, and rinse made for sores in the mouth. The leaves and flowers were also used as cooling compresses. In addition, the rhizomes were occasionally used as food and the young leaves and lower buds were eaten as a vegetable. Even the seeds were fried and eaten or ground into flour. Wildlife, including beaver, muskrat, ducks, porcupine, and deer also will eat the leaves, roots, or seeds. In moderate quantities the fragrant water lily can also benefit the lake by providing shelter and habitat for fish and invertebrates and shade to cool the water. However, our native water lilies, like spatterdock (***Nuphar polysepalum***) and watershield (***Brasenia schreberi***), will also provide the same benefits as the fragrant water lily and are not invasive.

Management: Water lilies can be controlled by cutting, harvesting, covering with bottom barrier materials, and aquatic herbicides (Rodeo®). Grass carp will not eat these plants. Lake residents have indicated that extremely persistent "picking" of emerging water lilies leaves every other day during the growing season for two to three seasons will eventually kill the plants. When waterlilies are killed by herbicides or other means, the dead and decomposing roots (rhizomes) will sometimes form floating mats in the lake or waterbody.

Identification: Because of their large, showy flowers, water lilies are easy to identify when flowering. They have white or pink showy flowers. When not in flower look for:

- Nearly-circular floating leaves, up-to-11 inches in diameter.
- The underside of the leaf is often red or purple with numerous veins.
- The stem is attached to the center of the leaf.
- The leaves each have a deep cleft to the stem.

Do not confuse with *Nuphar polysepala or* Spatterdock (also called yellow pond or cow lily) a native member of the lily family and very prevalent at Newman Lake. Spatterdock has a yellow "ball-shaped" flower and large elephant-ear-shaped leaves that often stick up above the surface of the water. Another floating leaved plant, Watershield has smaller floating leaves with the underside often coated in a gelatinous slime and inconspicuous purple flowers.

Distribution at Newman Lake**:** Fragrant water lily was identified at Newman Lake in the 1986 Macrophyte survey (see fig. 6.1) in the southwest shoreline along Park Beach. The 1989-90 survey (see fig. 6.2) identifies it in several locations: near the outlet gate and old outlet area, at Cherokee resort (Osborne's Dock on map), just north of the WDFW boat launch, Shallow Beach (1/2 mile north of Bass point) and at the north end of the west bay of the lake near inlets 7, 8 and 9, between Sutton and Shadow Bays at the southwest side of the lake, again along Park Beach, and south of Honeymoon Bay.

Past Management Efforts: Fragrant water lily through a non- native species has not been especially invasive or a community concern at Newman Lake at least to date. Population distribution has not seemed to have changed significantly since the 1989-90 survey. Individual property owners may use hand raking around docks or beaches if they interfere with their recreational use.

REED CANARYGRASS CHARACTERIZATION

Species***:*** *Phalaris arundinacea*

Description and Variation

A highly variable species, reed canarygrass (*Phalaris arundinacea* L.) is a rhizomatous perennial grass that can reach three to six feet in height. The sturdy, often hollow stems can be up to 1/2 inch in diameter, with some reddish coloration near the top. The leaf blades are flat and hairless, 1/4 to 3/4 of an inch wide. The flowers are borne in panicles on culms high above the leaves. The panicles are generally three to six inches in length. The species flowers in June and July (Weinmann et al. 1984; Hitchcock et al. 1969).

Economic Importance

Detrimental - Reed canarygrass forms dense, highly productive single species stands that pose a major threat to many wetland ecosystems. The species grows so vigorously that it is able to inhibit and eliminate competing species (Apfelbaum and Sams 1987). In addition, areas that have existed as reed canarygrass monocultures for extended periods may have seed banks that are devoid of native species (Apfelbaum and Sams 1987). Unlike native wetland vegetation, dense stands of reed canarygrass have little value for wildlife. Few species eat the grass, and the stems grow too densely to provide adequate cover for small mammals and waterfowl (Maia 1994). The species is considered a serious weed along irrigation banks and ditches because infestations can increase siltation (Marten and Heath 1973). When in flower, the species produces abundant pollen and chaff, which aggravate hay fever and allergies (Weinmann et al. 1984).

Although reed canarygrass is planted as a forage crop in some areas, the species poses a significant threat to the state's wetlands. Reed canarygrass is extremely aggressive and often forms persistent, monocultures in wetlands and riparian areas. Infestations threaten the diversity of these areas, since the plant chokes out native plants and grows too densely to provide adequate cover for small mammals and waterfowl. The grass can also lead to increased siltation along drainage ditches and streams. Once established, reed canarygrass is difficult to control because it spreads rapidly by rhizomes.

Beneficial - Frequently cultivated as a forage species, reed canarygrass is an important component of lowland hay from Montana to Wisconsin (Hitchcock 1950). In some areas, the grass has been used for erosion control. The variegated-leaved variety *picta* L. is sometimes grown as an ornamental under the common name "ribbon grass" or "gardener's garters" (Hitchcock 1950; Hitchcock et al. 1969).

Geographic Distribution

Reed canarygrass is a circumboreal species (Larson 1993). While possibly native to North America, European cultivars have been widely introduced for use as hay and forage on the continent; there are no easy traits known for differentiating between the native plants and European cultivars (White et al. 1993). The species is rather common throughout most of southern Alaska and Canada, as well as all but the southeastern portion of the U.S. (Hitchcock et al. 1969).

Habitat

A wetland plant, this species typically occurs in soils that are saturated or nearly saturated for most of the growing season, but where standing water does not persist for extended periods. However, established stands can tolerate extended periods of inundation. Ideal conditions typically occur in

roadside ditches, rights-of-way, river dikes and levees, shallow marshes, and meadows (Weinmann et al. 1984).

Growth, Development, and Reproduction

Reed canarygrass is a perennial species. It spreads by seeds or by creeping rhizomes. The species will also produce roots and shoots from the nodes of freshly cut, well-jointed culms (Marten and Heath 1973). It flowers from June through August in Washington.

Response to Herbicides

Glyphosate, Amitrol, Dalapon, and Paraquat have all been tried with some success. Maximum control depends on the timing of application (Apfelbaum and Sams 1987). These herbicides provide control for up to two years at the most. After this period, reed canarygrass recolonizes a treated area from adjacent stands or from seed bank recruitment (White et al. 1993). However, only glyphosate (Rodeo®) is licensed for use in aquatic systems in Washington. Rodeo® application, followed in two to three weeks by prescribed burning has also been effective. The use of fire helps to ensure mortality by killing resprouts and germinants (Apfelbaum 1993).

Response to Cultural Methods

Studies in the Midwest indicate that prescribed burning is effective in areas with an existing component of native plants, either above ground or in the soil seed bank. To be effective, burns should be conducted in the late spring, early to mid-summer, or early to mid-fall. Early spring burning stimulates the production of shoots (Apfelbaum 1993).

Response to Mechanical Methods

Heavy equipment has been used unsuccessfully in reed canarygrass removal. Rapid regrowth occurs from rhizomes and seeds that remain in the soil even after mechanical removal . Clipping back plants at ground level and covering them with opaque black plastic tarps can reduce but not eliminate populations (Apfelbaum and Sams 1987). However, this method is not always effective because reed canarygrass shoots can grow up through most materials, and seasonal inundation may displace covering materials (Gillespie and Murn 1992). Mowing may be a valuable control method, since it removes seed heads before seed maturation and exposes the ground to light, which promotes the growth of native species. Studies in Wisconsin indicated that twice-yearly mowings (in early to mid-June and early October) led to increased numbers of native species in comparison to reed canarygrass-infested plots that were not mowed (Gillespie and Murn 1992).

YELLOW FLAG IRIS CHARACTERIZATION

Species: *Iris pseudacorus* L**.**

Family: *Iridaceae*

Description and Variation: When flowering, yellow flag is unmistakable with its showy yellow flowers colorfully displayed along the edge of water and in wetlands. In Washington, the flowers occur in late spring or early summer. Several flowers can occur on each stem, along with one or two leafy bracts. Each flower resembles a common garden iris with 3 large (3 to 8 cm) downward facing yellow sepals and three smaller upward pointing petals. The sepals are often streaked with brown to purple lines. The plant, including flower stalk, is up to 1.5 m tall. The leaves are mostly basal and are folded and clasp the stem at the base in a fan-like fashion. They stand erect or bent at the top, with shorter leaves toward the outside of the plant. Yellow flag iris is perennial, and will remain green during winter where the weather is mild. It has stout rhizomes 1 to 4 cm in diameter and roots to 30 cm long. The fruits are a large capsule to 8 cm long. It is 3-angled, glossy green and contains many flattened brown seeds. The seeds are corky and about 7 mm across. The plants spread rhizomatously and grow tightly bunched together. This is the only yellow iris found in Washington's wet areas, but when not flowering it may be confused with cattail (Typha latifolia) or broad-fruited bur-reed (Sparganium eurycarpum). Look for the fruits in the summer, or the fan-shaped plant-base at other times of year.

There is little variation in the appearance of yellow flag, aside from flowers which may range from cream to bright yellow. Some horticultural varieties have been developed with variegated leaf color.

Economic Importance: Yellow flag is a popular ornamental plant for wet areas or well-mulched soil. It is widely sold in nurseries and on the internet. It has often been planted in wastewater or stormwater treatment ponds.

Yellow flag has been used medicinally. The roots have been used for several ailments, but all parts of the plant can also causes vomiting and diarrhea. Flowers have been used to make a yellow dye, and the roots a black or brown dye.

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

Yellow flag is listed on invasive species lists in Vermont, Virginia, Connecticut, and Massachusetts. It is also considered invasive in New Zealand and Australia. The Pacific Northwest Exotic Pest Plant Council lists it as 'A-2 Most Invasive-Regional' (highly to moderately invasive but still with a potential to spread).

Geographic Distribution: Yellow flag is native to Europe, Great Britain, North Africa and the Mediterranean region. It has been introduced in temperate areas nearly world wide and occurs throughout the United States except in the Rocky Mountains. It is found in wet areas throughout Washington, though it appears to be most common near developed areas.

Habitat: Yellow flag grows in temperate wetlands (to 68° N in Scandinavia). It is found on both sides of the Cascades in wetlands and along the margins of lakes and slow-moving rivers. It will grow in water to .25 meters deep, though is most common in very shallow water or mud. It will tolerate drying and anoxic sediment and is also tolerant of at least some salinity, as it is found in brackish marshes in its native range. It is also tolerant of high soil acidity, occurring from pH 3.6 to 7.7. It does well in nutrient rich conditions, and has a high nitrogen requirement. It prefers part shade or full sun exposure.

History: Yellow flag is native to Europe, the British Isles, North Africa and the Mediterranean. It is a very popular garden plant for wet or very well mulched soil, and has been introduced as an ornamental throughout the world. It was first collected in North America in 1911 in Newfoundland, and was established in British Columbia by 1931. The earliest collection in Washington is from Lake McMurray in Skagit County in 1948. It has also been used to control erosion, and is known to take up metals and nutrients in waste water treatment facilities.

Growth and Development: Yellow flag dies back in harsh winter conditions, but the rhizomes will overwinter. In spring the long leaves and flower stalks regrow from the rhizomes and flower by late spring or early summer. The rhizomes spread to form dense stands that exclude native wetland species, including typically aggressive species such as *Typha latifolia* (common cattail).

Reproduction: Yellow flag spreads by rhizomes and seeds. Up to several hundred flowering plants may be connected rhizomatously. Rhizome fragments can form new plants if they break off and drift to suitable habitat. The flowers are pollinated by humble-bees and long-tongued flies.

Seed germination is not light dependent, needs temperatures above 15° C and is most successful at temperatures of 20° to 30° C. Germination is increased by scarification. Submersed seeds will not germinate.

Response to Herbicides: Resistant to terbutryne. Cutting followed by treatment with glyphosate using a dripless wick has been suggested.

Response to Cultural Methods: Seeds germinate and grow well after being burned in late summer. Also readily resprouts from rhizomes after burning.

Response to Mechanical Methods: If pulling or digging yellow flag care should be used to protect the skin as resins in the leaves and rhizomes can cause irritation. Because rhizome fragments can grow to form new plants, care must be taken to collect all fragments.

Biocontrol Potentials: No biological control work has been done for yellow flag iris.

Part II: Prevalent Native Aquatic Plants at Newman Lake

American Waterweed

American waterweed (*Elodea canadensis*) is what many people commonly think of as "that aquarium plant." It is also known by several other common names such as Canadian waterweed, common elodea, or anacharis. The use of these names causes it to be confused with similar-looking nonnative plants like Brazilian elodea or hydrilla. American waterweed is an attractive aquarium plant, and is a good substitute for Brazilian elodea since it is native to Washington's lakes, ponds, and rivers. In fact, due to its availability in the aquarium trade, it has been introduced to several countries where it is not native, and is now considered a noxious weed in those regions (parts of Europe, Australia, Africa, Asia, and New Zealand).

American waterweed is usually fairly easy to distinguish from its more notorious relatives, like Brazilian elodea and hydrilla. All of them have leaves in whorls around the stem. However, American waterweed has three leaves per whorl, whereas hydrilla and Brazilian elodea almost always have more than three leaves per whorl. Brazilian elodea is also a much larger, bushy plant with longer leaves. In the photograph (fig. 6.7), Brazilian elodea is the plant to the right. The two American waterweeds plants are at the top left - the plant in the middle is bushy because it was growing in higher light than the more spindly waterweed plant to its left. American waterweed also looks very much like another native elodea, *Elodea nuttallii*, which generally has three narrower leaves per whorl.

Fig. 6.7 - American waterweed (l) and Brazilian Elodea (r)

American waterweed lives entirely underwater with the exception of small white flowers which bloom at the surface and are attached to the plant by delicate stalks. It produces winter buds from the stem tips which overwinter on the lake bottom. It also often overwinters as an evergreen plant in mild climates. In the fall leafy stalks will detach from the parent plant, float away, root, and start new plants. This is American waterweed's most important method of spreading, with seed production playing a relatively minor role.

Silty sediments and water rich in nutrients favor the growth of American waterweed and in nutrient-rich lakes, it is sometimes perceived as a nuisance. However, it will grow in a wide range of conditions, from very shallow to deep water, and in many sediment types. It can even continue to grow unrooted, as floating fragments. It is found throughout temperate North America, and is one of the most common aquatic plants in Washington.

American waterweed is an important part of lake ecosystems. It provides good habitat for many aquatic invertebrates and cover for young fish and amphibians. Waterfowl, especially ducks, as well as beaver and muskrat eat this plant. Also, it is of economic importance as an attractive and easy to keep aquarium plant.

Spatterdock

Spatterdock, a useful native plant, is a rooted, floating-leaved plant with bright yellow flowers commonly seen in Washington lakes and ponds. Its scientific name is *Nuphar polysepala*, and it is also commonly called the yellow pond or cow lily. Spatterdock can sometimes be confused with the fragrant water lily (*Nymphaea odorata*), a similar looking exotic plant that has been introduced in many Washington lakes. However, if they are blooming they can be easily distinguished, for the fragrant water lily has showy white or sometimes pink many-petaled flowers.

In early spring the spatterdock's leaves are below the surface, light green in color, and look like lettuce growing on the lake bottom. But by late spring the broad, dark green, heart-shaped leaves float on the water's surface or often stand above the water as the summer progresses. See photo fig. 6.8.

Fig. 6.8, *Nuphar polysepala*, Spatterdock

The floating leaves are connected by long stalks to large horizontal roots in the sediments. The roots can be up to six inches in diameter and many feet long! The roots look something like palm-tree trunks, with knobby scars where leaves have grown. The line drawing of the spatterdock root (fig. 6.9) is the copyright property of the University of Florida Center for Aquatic Plants (Gainesville). Used with permission.

The bright yellow, ball-like flowers bloom from June to mid-August and also stand just above the water surface. They are composed of several broad fleshy yellow sepals, with many inconspicuous petals inside. In the center is a yellow flask-shaped seed pod. The flower emits a strong brandy-like odor which attracts pollinating insects. Spatterdock reproduces by seeds and spreads by growth of its large fleshy roots. It will also grow from fragments of roots if the plant is broken up.

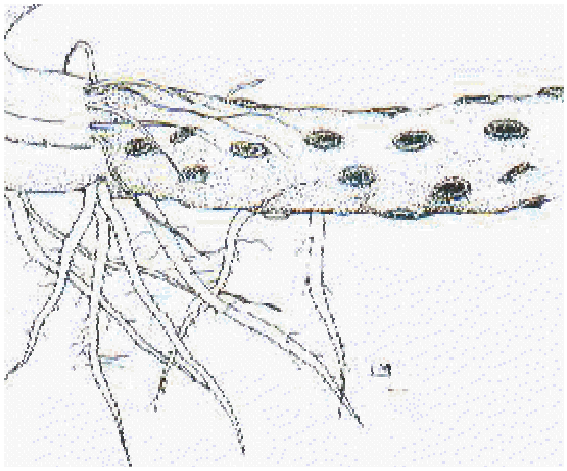

Fig. 6.9, Line drawing of spatterdock root

Humans have put spatterdock to many uses. Historically many cultures ate the roots cooked fresh in stews or dried and ground into flour for baking. The seeds were gathered by Native Americans and either ground into flour or popped like popcorn. The leaves and roots also contain tannin which was put to use in dyeing and tanning. Medicinally, the leaves were used to stop bleeding, and roots were used in a poultice for cuts, swelling, and other ailments. The Quinault Tribe believed that some of the roots looked like men, and others like women, so they chose a root appropriate for the patient before using it as a pain remedy. Most recently spatterdock has been used as an aquarium and water garden plant.

Spatterdock is also a valuable plant for fish and wildlife habitat. Its large leaves provide shade, cover from predators, and a home for many tiny invertebrates which fish use for food. The seeds are eaten by ducks and other birds, and muskrat, beaver, and nutria will eat the roots. Deer have also been known to browse the flowers and leaves. When spatterdock is accompanied by other native aquatic plants, it is very beneficial to wildlife habitat and an important part of a lake ecosystem.

Coontail

Coontail (*Ceratophyllum demersum*) is a completely submersed plant commonly seen in Washington lakes with moderate to high nutrient levels. It is also known by the common name hornwort. The common names refer to its full, bottle-brush-like growth form and its forked, antler-shaped leaves. The Latin name *Ceratophyllum* pertains to the horned leaf edges - Cerato derives from the Greek word "keras" (horn, as in rhinoceros). Phyllum means leaf.

The serrated, forked leaves of coontail are arranged on the stems in whorls, with usually 5-12 leaves in each whorl. It is generally a dark, olive green color, and is often rather hard and crusty to the feel. This is especially true where it grows in hard water lakes (the calcium in the water becomes deposited on the leaf surface, making it seem crunchy). The photograph of coontail is by Larry Jensen.

Fig. 6.10 – Coontial, *Ceratophyllum demersum*

The tiny flowers of coontail are located at the leaf bases. Each flower is either male or female, though both are borne on the same plants. The flowers are on very short stalks, so they never grow to the water's surface. This means pollination must occur under water. Coontail accomplishes this by releasing the stamens from the male flowers. These stamens rise to the surface where they split open and release their pollen. In still water, the pollen grains sink slowly, pollinating any female flowers they come in contact with. The release of pollen in the water is unusual, even for aquatic plants. Because pollen usually needs to be dry until it reaches the female flower, most aquatic plants have flowers which rise above the surface to be pollinated by insects or wind. However, the pollen of coontail has adapted to being wet, so the plant can complete its entire life cycle under water. After pollination, a small, hard, oval seed with 3 spines is produced. Coontail spreads to new areas either through germination of these seeds, or by regrowth of stem fragments.

Coontail does not produce roots, instead it absorbs all the nutrients it requires from the surrounding water. If it is growing near the lake bottom, it will form modified leaves which it uses to anchor to the sediment. However, it can float free in the water column, and sometimes forms dense mats just below the surface. Because it gets nutrients from the water, it grows best where these nutrient levels are high. It will also tolerate a wide range of water hardness, even growing in some highly alkaline lakes of central Washington.

This plant is often used in cool-water aquariums, and because it is a native plant, it makes a good choice for local aquarium hobbyists. It is also used as an "oxygen" plant for aquatic gardens. In the wild it provides habitat for young fish and other aquatic animals. Waterfowl will eat the seeds and foliage, though it is not a favorite food plant. Coontail is found growing in most parts of the world and can cause weed problems where it has been introduced outside its native range.

Fig. 6.11 - Coontail, *Ceratophyllum demersum*

Water-shield

Species: *Brasenia schreberi* Gmel., water-shield, dollar bonnet, water target
Family: Cabombaceae

Water-shield is identified by the thick coating of gelatinous slime covering the young stems, buds, and the undersides of young leaves. The long reddish leaf stalks are attached to the centers of the floating oval leaves, giving them an umbrella-like appearance. Water-shield flowers are small, purplish, and rise slightly above the water, but are not particularly showy. Because of the floating leaves, some taxonomists consider water-shield to be in the water-lily family (Nymphaeaceae). See photo fig. 6.12.

Leaf: Oval leaves (4-12 cm long and 3-8 cm wide) float on the water surface. The leaves have purple undersides with long, centrally-attached leaf-stalks up to 2 m long. A slimy gelatinous substance usually covers the stalks and underside of young leaves and stems.
Stem: Arise from submersed, branching, reddish creeping rhizomes.

Flower: The 5-20 cm long flower stalks each bear a single purplish flower with 3 sepals and 3 (4) similar-looking petals. Each flower measures up to 2.5 cm across and is elevated slightly above the water surface. Blooms May to September.

Fruit: Each flower produces 4-18 separate narrowly egg-shaped, leathery fruits between 6-8 mm long. Each fruit usually contains 2 seeds. They ripen underwater and decay to release seeds.

Fig. 6.12 - *Brasenia schreberi, Water-shield*

Root: Slender, branched, creeping rhizomes.

Propagation: Rhizomes, seeds, winter buds.

Importance of plant: The rhizomes and leaves have been used for food and medicinal purposes by Native Americans. The Japanese use the young leaves and stems in salads. Provides habitat for fish and aquatic insects; seeds and vegetation are eaten by waterfowl.

Distribution: Throughout most of the United States and southern Canada. Also occurs in Central America, Cuba, Africa, East Asia and Australia.

Habitat: Shallow ponds, lakes, and slow-moving streams. It grows in water 0.5-3 m deep.

May be confused with: Fragrant water-lily (Nymphaea odorata), some floating-leaved pondweeds (Potamogeton spp.), or yellow floating heart (Nymphoides peltata) but only water-shield is covered by a slimy coating with the stem attached at the center of an oval leaf. Water-lilies have showy white or pink flowers and leaves cleft to the stalk. Floating-leaved pondweeds have the stem attached at the leaf edge and yellow floating heart has yellow flowers with fringed edges.

Big-Leaf Pondweed

Species: Potamogeton amplifolius Tuckerman, big-leaf pondweed
Family: Potamogetonaceae

Big-leaf pondweed has two leaf types: large, usually wavy-edged underwater leaves which are curved into a banana shape, and oval, leathery floating leaves that grow on or near the water surface. The underwater leaves often decay late in the growing season, making big-leaf pondweed easy to confuse with other floating-leaved pondweeds. See photo fig. 6.13.

Leaf: Alternate leaves of two types. Submersed leaves: bright to dark green, translucent, 8-20 cm long and 2-7.5 cm wide, folded along the midrib, curved backwards into a banana-shape, and sometimes with wavy margins. They have short stalks (1-2cm) and 19-45 lengthwise veins. These leaves often decay in late summer. Floating leaves: often absent. The opaque, leathery, oval leaves taper at both ends and are

5-10 cm long and 2.5-5 cm wide. They have 25-45 veins and 3-10 cm long stalks that are generally longer than the floating leaves. Sheaths (stipules) are up to 10 cm long, whitish, translucent, occur at leaf bases, but are not attached to the leaves. They become stringy with age.
Stem: Few or unbranched stem (to 3 mm thick) to 5 m long.

Flower: Small flowers have 4 petal-like lobes. Up to 16 whorls of tightly clustered flowers are arranged into an up to 5 cm long spike on stalks rising above the water. The flower stalks are thicker than the stem and are 5-15 cm long.

Fruit: Seed-like achene is 3-5 mm long, has flattened sides, a 0.5-1 mm beak, and is orange to pinkish when ripe. The back is rounded or keeled when dry.

Root: Fibrous, from creeping underground rhizomes.

Propagation: Seeds, fragments, rhizomes.

Importance of plant: Plants may show rapid early season growth, with plants over 3 m tall observed in early May. Seeds and entire plant are good wildlife food and habitat.

Distribution: Throughout North America. Particularly common in western and northeastern Washington lakes.

Habitat: Lakes and ponds. Will grow in clear water as deep as 6 m.

May be confused with: Without floating leaves, may be confused with other broad leaved pondweeds such as Illinois pondweed (P. illinoensis), and white stem pondweed (P. praelongus). However these do not have as many leaf veins, and white stem pondweed has no leaf stalks. Big-leaf pondweed will hybridize with other pondweeds, forming plants with intermediate characteristics.

Fig.6.13, *Potamogeton amplifolius* underwater leaves.

Fern-leaf Pondweed

Species: *Potamogeton robbinsii* Oakes, fern-leaf pondweed
Family: Potamogetonaceae

Fern-leaf pondweed is a stiff, robust plant with underwater leaves only. It is usually easily recognized because its dark green, closely spaced leaves are arranged in a rigid, flattened spray, giving it a palm

frond or fern-like appearance. Fern-leaf pondweed is usually a low-growing plant and only approaches the water surface when flowering. The flowering stalks have more widely spaced leaves that are less fan-like in appearance. Like other pondweeds, fern-leaf pondweed has membranous appendages (stipules) at the leaf bases. Stipules form a short sheath around the stem and are partially fused to the leaf blades causing the leaves to seem jointed or bent at the base if they are pulled from the stem. See photo, fig. 6.14.

Leaf: Fern-leaf pondweed has all submersed leaves. The olive green to brown stiff leaves are linear, minutely toothed, and are attached about halfway along the stipular sheaths, which are then attached to the stem. Leaves measure up to 12 cm long and 6 mm wide and have many parallel veins. Leaves from a rigid flattened spray that resembles the leaf arrangement of a palm frond or a swordfern. The white sheaths (stipules) are less than 3 cm long with the lower 10-15 mm fused to the blade; the sheath tip shreds into fibers.
Stem: Fern-leaf pondweed has stout stems up to 3 m long that often creep along the bottom and will root at the lower nodes.

Flower: Small flowers with 4 petal-like lobes occur on spikes near the water surface. The up to 2 cm long spikes occur on flat, stiff stalks with widely spaced leaves.

Fruit: The achenes are up to 4 mm long, are keeled, and have a curved beak to 1 mm long.

Fig. 6.14 - Closeup of Potamogeton robbinsii leaves and stems

Root: Fibrous roots emerge from slender rhizomes and the lower stem.

Propagation: Seeds, rhizomes, winter buds.

Importance of plant: Seeds and vegetation provide food and cover for aquatic animals and waterfowl.

Distribution: Northern North America.

Habitat: Shallow to deep water, usually with low alkalinity.

May be confused with: The dark color and palm-frond-like appearance of fern-leaf pondweed are distinctive. It may hybridize with other pondweeds to form plants with intermediate characteristics.

7.0 Aquatic Vegetation Control Strategies

Based on the experience of other lakes, effective and affordable control requires a long-term commitment and early action. It involves frequent surveying to determine milfoil locations, implementation of control actions up to 2 or 3 times per year, and education to prevent continued re-infestation.

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 Spring Lake Integrated Aquatic Vegetation Management Plan, King County Department of Natural Resources and Parks. Information therein is gathered 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 therein were also derived from the 2001 draft version of the King County Regional Milfoil Plan.

Control/eradication methods discussed herein include the No Action Alternative, Environmental Manipulation (Water Level Control, Nutrient Reduction), Mechanical Controls (Rotovation, Harvesting, Cutting, and Diver Dredging), Manual Controls (Hand Pulling, Cutting, Raking, and Bottom Barriers-Screens), Biological Controls (Grass Carp and Watermilfoil Weevil), and Chemical Controls (Aquatic Herbicides).

7.1 No Action Alternative

One option for managing aquatic weeds in Newman Lake is to let milfoil continue to grow, and do nothing to control it. 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.

Application for Newman Lake
The milfoil infestation in Newman Lake is currently moderate in density and contained to limited areas within the lake; if control measures are not continued, it is likely to increase each growing season in the future until the entire shoreline and littoral zone of the lake is dominated by milfoil especially in heavily organic sediment areas which dominate Newman Lake. Based on annual survey results by the NLFCZD and Clearwater Company and Newman Lake and nearby Liberty Lake surveys, the infestations of milfoil have cycled based on treatment areas, and during some years, experienced rapid growth and population expansion. If there is no control effort, it is likely that weed infestations will continue to grow, making Newman Lake a prime source of milfoil fragments for other nearby lakes with public access and boat launch facilities. Even if some of the residents chose to control the aquatic weeds near their properties, large areas 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. Consequently, a once thriving recreational lake would become unfavorable for the community and its inhabitants. The NLFCZD and the Newman Lake community do not support the No Action alternative for Newman Lake.

7.2 Environmental Manipulation

Water Level Control

Lowering the water level of a lake or reservoir could 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 drawdown can also make it difficult to establish native aquatic plants for fish (esp. spawning areas), wildlife, and waterfowl habitat in some reservoirs.

Application for Newman Lake

Newman Lake has no natural outlet; the only outlet or disposal for flows from the lake and runoff is through an outlet control gate and 3-mile long outlet channel to an infiltration area of permeable gravels at the north edge of the Spokane-Rathdrum Prairie Aquifer. This control and drainage system was begun in the late 1800's by local farmers but was repaired and reconstructed in 1981 under a SCS Watershed Work Plan. At that time design early summer lake elevation was set at 2125.6 feet and normal winter elevation at 2123.9 feet. The decision was designed to maintain adequate lake storage levels to control flooding and runoff, while preserving recreational use and accommodate farmers at the north and south ends of the lake. Even though the outlet gates become dry at an elevation of 2120.0 lowering the lake below 2123.9 feet is not normally feasible. This is only done when extremely high winter snow pack dictates the need for more spring runoff storage. Lowering can risk not being able to fill the lake back to the normal early summer elevation of 2125.6 impacting boat access and recreational use of the lake. Resident's water intake pipes become susceptible to freezing. Drawdown would also cause significant damage to the ecosystem, particularly in the large wetlands at the south and north ends of the lake. The amount of drawdown required to impact milfoil would damage native plants and animals in both the lake and the adjacent wetland and have many negative implications for residents living around the lake. Also, response of the fragrant water lily to water level drawdown has been variable. Drawdown is not a viable control strategy for Newman Lake.

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.

Application for Newman Lake

Since the 1970s, nuisance water quality conditions occurring in Newman Lake initiated scientific studies to verify and refine nutrient sources from sediment, recycling, and the interaction of aquatic plants and algae blooms.

Newman Lake area citizens began to raise water quality concerns in the late 1970's and early 1980's. Serious algae blooms were having an impact on the beauty and recreational use of the lake. To allow the District to assist in efforts to study and alleviate water quality problems, citizens initiated a campaign to revise state law to allow flood control zone districts to fund water quality improvements. This was accomplished in 1983.

In 1985, again driven by community concern, the District applied for and received a grant from the Washington State Department of Ecology (DOE) to study the Lake's water quality problems. This began Phase I of the Lake Restoration Program. This study identified the problem as overloading of nutrients, most particularly phosphorus from watershed runoff and recycling of in-lake sediments. This was feeding excessive algae growth and creating a high biological oxygen demand that was causing extremely low oxygen levels in the lower level of the lake, damaging fish habitat. Proposed solutions included: an alum treatment to bind up phosphorus in the water column and cap sediments to reduce nutrient recycling; a hypolimnetic aeration system to increase oxygen in lower lake levels and thereby reduce nutrient recycling and improve fish habitat; and reduce sediment/nutrient loading input from the watershed with a watershed management plan, public education, and a septic system survey.

These recommendations were implemented as Phase II of the Lake restoration with grant funding from DOE in 1989. The goal of this grant was reduction of nutrient levels in the lake now and into the future. The District provided 25% of the matching funds with a lake restoration benefit assessment that it began collecting in 1989. Total cost of the Phase II restoration program was about one million dollars. The surface alum treatment (about 520 dry tons alum) was done in 1989 at total cost of $265,000. The Hypolimnetic Aeration system, constructed at a cost of $539,000, began operation in 1992. In addition, the Spokane Regional Health District conducted a survey of lake front septic systems and public involvement was encouraged through the establishment of the Newman Lake Watershed Committee (NLWSC), a watershed management plan was prepared, a "Lake Book" was published to provide information to homeowners, and a water quality monitoring program was initiated.

The implementation of Phase II has significantly improved Lake water quality, with improved dissolved oxygen levels, and reduced algae blooms. Since 1992, the NLFCZD has taken many measures to protect and maintain the Newman Lake Water Quality. In 1997, with the effects of the initial surface alum treatment decreasing, the District continued Lake water quality improvement efforts with construction of a Micro-Floc alum injection system, using the existing aeration system as a distribution system. Total cost, funded solely from District lake restoration benefit assessments, was about $57,000. Prior to this construction, the District prepared the Comprehensive Plan of Development for Stormwater Control in the Newman Lake Watershed. This report's recommendations provide the guidance for our current watershed management and water quality improvement activities.

The Outline for Implementation of the Comprehensive Plan of Development in the Newman Lake watershed has several major parts. Implementation requires the cooperation and assistance of the Newman Lake community, including the Newman Lake Watershed Committee and the Newman Lake Property Owners Association. The Implementation Plan includes the following:

a. Land Use Regulation Enforcement: The use of District and community volunteer resources to implement and encourage enforcement of existing land use regulations (Federal, State and local agencies) in the Newman Lake watershed.

b. Education of the Community: This will take the form of regular newsletters, Watershed Committee meetings, preparation of educational materials, and involvement of residents and students in restoration projects and monitoring, etc.
c. Restoration Projects: Work with property owners on riparian, wetland and floodplain preservation and restoration projects and other structural Best Management Practices (BMP's) in the watershed, with priority to Thompson Creek.
d. Septic Systems: Plan includes efforts to work with the Spokane Regional Health District to improve septic compliance and monitoring in-lake for problem areas.
e. Operation of the Alum Injection and Aerator Systems: These systems are needed to control internal recycling of nutrients.
f. Monitoring: A comprehensive lake and watershed water quality monitoring program is also part of the plan.
g. Annual Report: The final major component of the Implementation Plan is a comprehensive Annual report covering all district and volunteer activities in the watershed and results of water quality monitoring.

Given the numerous studies conducted, and the protective measures already in place for algae control, nutrient reduction for aquatic weeds alone is not an appropriate method for Newman Lake. Protective measures coexist with an already established nutrient reduction program, and if used alone, nutrient reduction is 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; as cited in Creed and Sheldon, 1995).

Macrophytes were also used as an indicator for healthy nutrient levels in Liberty Lake. Morency (1979) found an inverse (opposite) relationship between macrophyte productivity and inorganic nutrient concentrations. Thus, macrophyte and phytoplankton productivity were also inversely related, possibly due to increased competition for limited nutrients. For example, reduced inorganic nutrient input may reduce phytoplankton productivity, increase light penetration, and stimulate macrophyte productivity. Nutrient supply is also dependent on the importance of sediment nutrient release in supplying phytoplankton and macrophyte growth (Bronmark and Hansson, 1998). The removal of macrophytes as part of lake restoration could reduce nutrient competition, thereby enhancing phytoplankton productivity (Hartman, 2001).

Historic water quality problems and lake characteristics suggest a need to reduce the external nutrient loading into Newman Lake. 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 (King County Department of Natural Resources and Parks, 2003).

Nutrient reduction as the primary method of weed control would be beyond the scope of any project that could be undertaken at Newman Lake and would not be effective in reducing milfoil populations. The

nutrient reduction program and protective measures already established will continue in order to reduce and prevent point and non-point source pollution.

7.3 Mechanical Controls

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 that 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.

Application for Newman Lake
None of these options is suitable for the level of milfoil infestation at Newman 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 should not be used in systems where milfoil is not already widespread. In a moderate infestation such as Newman 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 overall goal is to eliminate milfoil from the system, these are not compatible control strategies. Harvesting and cutting do not remove root systems, and rotovation would cause disturbance to the highly organic lake sediments. All are scenarios that are not favorable for Newman Lake.

Again with the small scale of fragrant water lily infestation at Newman Lake mechanical controls are probably not the best option. Mechanical controls such as cutting and harvesting are popular methods of controlling water lilies. Cutting is less efficient than harvesting because cut plants must then be removed from the water. Harvesters both cut and collect the plants. Both methods create open areas of water. However, because water lilies grow in shallow water and grow rapidly, they must be cut several times a year. Harvesting has been used extensively on Long Lake, Thurston County to control water lilies.

Underwater rototilling (called rotovation) was successfully used to remove water lilies from a small Seattle area lake where the drowning of two people was attributed to the presence of dense plant beds. Rotovation dislodges the large, fleshy water lily rhizomes which can then be removed from the water.

Although rotovation is a much more expensive process than harvesting or cutting, it results in the permanent removal of water lily rhizomes.

Thurston County has experimented with using a barge-mounted backhoe to excavate water lily rhizomes from the sediment. Like rotovation, excavating the rhizomes results in permanent removal of the plant. Both rotovation and excavation requires that the project proponent obtain a number of environmental permits before proceeding.

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. 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
Diver dredging requires Hydraulic Approval from the Department of Fish and Wildlife. City, county, or local government permits may also be required. Verification of requirements is recommended before proceeding with a diver-dredging project. In addition, 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 surveys).

Application for Newman Lake
Diver dredging could be used after herbicide applications to remove plants that were missed or unaffected by the herbicide. The soft sediments in Newman Lake should make this method effective. However, this would cause disturbance to the highly organic lake sediments, a scenario that is not favorable for Newman Lake. Diver dredging greatly disturbs sediments and can affect nutrient concentrations and algal production in a lake (see Disadvantages above). Stirring up the sediments also reduces the visibility to zero which makes it difficult for divers to target milfoil instead of native species. If other techniques for removal are suitable, this should not be considered.

7.4 Manual Controls

Hand-Pulling, Cutting, And Raking

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 the person who is hand pulling to sink deeply into the sediment. Organic sediments also tend to create turbid conditions limiting visibility.

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.

A battery-operated cutting tool called a Swordfish is also commercially available. It works similarly to an underwater lawn mower.

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.

Clean-up
All of the manual control methods create plant fragments. It is 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.

- These methods are environmentally safe.
- Manual methods do not 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 that 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.

Diver Harvesting

- Hand-pulling allows the flexibility to remove undesirable aquatic plants while leaving desirable plants.
- Appropriate in conditions of low milfoil density.
- Can provide precise location and control of individual plants.
- Potential rapid mobilization and response.
- High risk of fragmentation-appropriate care must be given.

Milfoil Diver Requirements

- Special training required.
- Experienced in milfoil identification.
- Highly competent divers only, especially in buoyancy control and navigation skills.
- Motivated- requires patience and meticulous attention to root removal and fragment control.

Diver services

- Especially useful for accurate detection and mapping in moderate to low visibility conditions.
- Useful for treatment assessment and follow-up. (after Moore, 2003)

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. For

noxious weed removal projects a pamphlet called *Aquatic Plants and Fish*, available from WDFW can serve as *Hydraulic Project Approval*.

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
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

Application for Newman Lake
Much of the currently infested areas in Newman Lake are too large and visibility is too poor to use manual techniques as the sole source of control for Eurasian watermilfoil. These methods would fit best as a supplement to other control methods such as herbicide applications. As with diver dredging, the hand pulling method could be used after herbicide applications to remove plants that were missed or unaffected by the herbicide. Also, the hand pulling method can be used when there is only an occasional scattered plant and water restrictions associated with herbicide use, such as irrigation or drinking water restrictions, are not feasible. Hand harvesting is the most applicable manual method for the supplemental control of milfoil in Newman Lake. Additionally, the soft sediments in Newman Lake should make this method effective. However, caution should be used when using manual methods as they have the potential for missing Eurasian watermilfoil plants, (especially after stirring up sediments) and for fragmentation, exacerbating the existing Eurasian watermilfoil problem. Manual methods will also be vital in combating new infestations of Eurasian watermilfoil that may appear, or in helping contain the infestation at the current level at current locations.

Bottom Barriers - Screens

A bottom barrier or benthic screen 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 barriers. Some people report success using pond liner materials. There is also a commercial bottom barrier fabric called Texel, a heavy, felt-like polyester material, which is specifically designed for aquatic plant control. An ideal bottom barrier 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 barriers 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 barrier, 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 barriers will control most aquatic plants; however, freely floating species such as the bladderworts or coontail will not be controlled by bottom barriers. 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.

Pioneering colonies that are too extensive to be hand pulled can sometimes be covered with bottom screening material. For these projects, it is suggested 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. When using this technique for Eurasian watermilfoil eradication projects, divers should recheck the barrier within a few weeks to make sure that all milfoil plants remain covered and that no new fragments have taken root nearby.

Bottom barriers 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 barrier installation.
Research has shown that much more gas is produced under bottom barriers that are installed over the top of aquatic plants. The less plant material that is present before installing the barrier, the more successful the screen will be in staying in place. Bottom barriers 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 Appendix D for instructions on constructing and installing bottom barriers (http://www.ecy.wa.gov/pubs/wqfa9401.pdf).

Advantages

- Installation of a bottom barrier creates an immediate open area of water.
- Bottom barriers are easily installed around docks and in swimming areas.
- Properly installed bottom barriers 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 barriers reduce habitat by covering the sediment, they are suitable only for localized control.
- Cost and maintenance of bottom barriers confine them to very small-scale use.
- For safety and performance reasons, bottom barriers must be regularly inspected and maintained.
- Harvesters, rotovators, fishing gear, propeller backwash, or boat anchors may damage or dislodge bottom barriers.
- Improperly anchored bottom barriers may create safety hazards for boaters and swimmers.
- Poorly maintained anchors used to pin bottom barriers to the sediment may injure swimmers.
- Some bottom barriers are difficult to anchor on deep muck sediments.
- It is sometimes very difficult to place and secure the fabric to densely packed, tough, fleshy waterlily rhizomes
- Bottom barriers interfere with fish spawning and bottom-dwelling animals.
- Without regular maintenance, aquatic plants may quickly colonize the bottom.

Permits
Bottom screening in Washington requires hydraulic approval, obtained free from the Department of Fish and Wildlife. In certain instances, a shoreline permit may also be 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.

Application for Newman Lake
The Eurasian watermilfoil infestation at Newman Lake is too wide spread to consider this method for large-scale eradication. The extent of the infestation encompasses large area at the north and south end's of the lake. The infested areas are too scattered and cover too large an area to use a bottom barrier without becoming cost prohibitive. Most importantly, the bottom barrier would also just reduce habitat and native vegetation by covering the sediment and blocking all growth.

Bottom barriers at Newman Lake would be appropriate on small stretches of shoreline that are free from native vegetation and habitat (i.e. Peninsula or McFadden or Sutton Bay area where sandy bottoms are prevalent). Barriers could also be effective in preventing re-infestation after initial control, or in areas that have dense milfoil and have shown resistance to the herbicide.

7.5 Biological Controls

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

Classic biological control uses control agents that are host specific. These organisms attack only the species targeted for control. Generally, these bio-control agents are found in the native range of the nuisance aquatic plants and, like the targeted plant, these bio-control 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.

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 affecting other aquatic plant species) are rejected as biological control agents. Insects that affect 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. The cost 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.

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 bio-control 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 is not 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.

Biological Control Agents

Grass Carp (*Ctenopharynogodon idella*)

The following information and citations are taken from the Washington State Department of Ecology's website on Aquatic Plant Management (http://www.ecy.wa.gov/programs/wq/plants/management/aqua024.html).

Another type of biological control uses **general agents** such as grass carp 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.

The grass carp, 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. Legalized in 1990 for plant management, triploid (sterile) 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. 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 will. 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 may result in the loss of most submersed species, whereas the emergent or floating vegetation remains at pre-stocking levels.

Pauley and Bonar (Bonar, et. al, 1995) 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 in Table 7.1.

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 grass carp within the state, all 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.

Potamogeton crispus (curly leaf pondweed)
P. pectinatus (sago pondweed)
P. zosteriformes (flat-stemmed pondweed)
Chara spp.(muskgrasses)
Elodea canadensis (American waterweed)
Potamogton spp. (thin-leaved pondweeds)
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)
Polygonium amphibium (water smartweed)
P. natans (floating leaved pondweed)
P. amplifolius (big leaf pondweed)
Brasenia schreberi (watershield)
Juncus spp.(rush)
Egeria densa (Brazilian elodea) (fingerling fish only)
Nyphaea spp. (fragrant waterlily)
Typha spp. (cattail)
Nuphar spp. (spatterdock)

Table 7.1 Relative preference rank of Pacific Northwest aquatic plant species as food items for grass carp. (Bonar, et. al, 1995).

Grass Carp Facts:

- 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 until aquatic vegetation is depleted, although juvenile 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 68ºF.
- Prefer flowing water to still waters (original habitat is fluvial).
- Are difficult to recapture once released.
- 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 $13 per fish.

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.
- The native plants preferred by grass carp are also preferred by migratory waterfowl
- Concerns from anglers about grass carp.
- Initial investment very expensive.
- Introduction of grass carp has generally been discouraged by State agencies, especially in systems like Newman Lake.

Application for Newman Lake

Grass carp are not suitable for aquatic plant control in Newman 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 Newman Lake (thin leaved pondweeds and American waterweed), which might be grazed before the milfoil. They could remove all the beneficial plants that support a healthy fish habitat and provide erosion protection. Without cover, and the invertebrates associated with beneficial native aquatic vegetation, the water quality would be degraded and some species (invertebrates, fish, etc.) may be eradicated. In addition, if grass carp eliminated all

beneficial submersed vegetation, the removal could reduce nutrient competition, thereby enhancing phytoplankton productivity. Research in lakes with grass carp in Washington has shown that grass carp increase the turbidity mostly due to increased suspension of sediment into the water column. Newman Lake is visited by migratory waterfowl and removal of palatable aquatic plants by grass carp may adversely impact these and resident waterfowl. If other techniques are suitable, stocking grass carp into Newman Lake should not be considered.

Watermilfoil Weevil (*Euhrychiopsis lecontei)*

Size: 2-3 mm, equivalent to a grain of rice

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).

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 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 conducted 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 waters that are more alkaline. However, it is also present in cooler, wetter western Washington.

The milfoil weevil has been associated with declines of Eurasian watermilfoil in the United States (e.g. Illinois, Minnesota, Vermont, and Wisconsin). Researchers in Vermont found that the milfoil weevil could negatively affect 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^2) and then decreased to about 1 hectare (<15 g/m^2) 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^2 in July of 1996 to 14 g/m^2 in September of 1996. Eurasian watermilfoil remained below 5 g/m^2 in 1997, then increased to 44 g/m^2 in June and July of 1998 and declined again to 12 g/m^2 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, 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. Creed speculated that declines of Eurasian watermilfoil in Lake Osoyoos and the Okanogan River might have been caused by the milfoil weevil. In Minnesota, Cenaiko 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. [This is somewhat out of date information. Recent information shows that stocking milfoil weevils into some Midwestern lakes has resulted in declines in milfoil populations in those lakes.- Kathy Hamel, 7/6/05]

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 of the state, including those with weevils. Work by Ecology botanist Jenifer Parsons seems to support Dr. Newman's premise that sunfish populations may control weevil densities in lakes. 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.

There are no effective biological control agents available at this time for water lily control, nor are there likely to be any.

Advantages

- Milfoil weevils offer a biological alternative to aquatic plant control.
- They may be cheaper than other control strategies.
- Bio-controls 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, bio-controls can decimate a weed population.

Disadvantages

- There are many uncertainties as to the effectiveness of this bio-control in western Washington waters.
- There have been no documented declines of Eurasian watermilfoil in Washington State that can be attributed to the milfoil weevil, although there are some lakes in eastern Washington that once had thriving populations of Eurasian watermilfoil that has declined, perhaps due to weevil or other invertebrate feeding.
- Many of our lakes, including Newman Lake, have introduced sunfish populations that may predate on the milfoil weevils.
- Bio-controls often do not 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 few companies are 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 July 31, 2003, no permits have been issued to bring in outside weevils to Washington. There are concerns about introducing a different genotype of weevil into Washington, but also concerns over exotic hitchhikers in the transport water (e.g. zebra mussels). However, there have been a few studies using weevils in Washington. In these cases, weevils were collected in Washington and reared on Washington milfoil. The offspring (larvae) were used to augment existing weevil populations or to introduce weevils to the test sites (Kathy Hamel, pers. comm. 2003).

Application for Newman Lake

Since the milfoil weevil is a new bio-control agent, it has not been intentionally released widely in 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 control Eurasian watermilfoil.

In addition, the infestation of milfoil in Newman Lake is not heavy enough to warrant bio-control introduction when other methods are still available. Bio-control is generally used when the target species is widely spread within a water body. The infested areas in Newman Lake are too scattered over a large area for bio-controls to be effective. Newman Lake also has introduced sunfish populations that may predate on the milfoil weevils. At this time, the milfoil weevil is not an option for milfoil control at Newman Lake

7.6 Chemical Controls

Aquatic Herbicides

Description of Method
The following information and citations were taken from the Washington State Department of Ecology's website on Aquatic Plant Management (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 are applied to the water in 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 are exposed to, 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 9th 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 United States. 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 that 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. However as of 2005, Ecology is working on developing a new lakes NPDES permit that will combine both the nuisance and noxious weed permits into a single permit. This permit will break down projects into control project and eradication projects. The Newman Lake milfoil project is classified as an eradication project. This permit should be available by March, 2006.

Although there are a number of EPA registered aquatic herbicides, the Department of Ecology currently issues permits for seven aquatic herbicides (Diquat dibromide, Endothall, Glyphosate, 2, 4-D, Fluridone, Imazapyr, and Triclopyr) noxious aquatic weed treatment for lakes, rivers, and streams. Weed control in

irrigation canals is covered under another permit. Other herbicides are undergoing review and it is likely that other chemicals may be approved for aquatic use in Washington in the future.

The chemicals that are permitted for use in 2005 are listed below (see Appendix E for applicable herbicide labels).

Washington Department of Ecology Permitted Aquatic Herbicides

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

- **Fluridone** – Trade names for fluridone products include Sonar® and Avast!®. Fluridone is a slow-acting non-selective systemic herbicide used to control Eurasian watermilfoil and other underwater plants. It may be applied as a pellet 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 generally considered effective for spot treatments of areas less than five acres, but new slow-release formulations may now be effective for spot treatment. It is slow acting and may take six to twelve weeks before the dying plants fall to the sediment and decompose. When used to manage Eurasian watermilfoil in Washington, fluridone is applied several times during the spring/summer to maintain a low, but consistent concentration in the water. Although fluridone is considered a broad-spectrum herbicide, when used at very 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.

- **2,4-D** –There are two formulations of 2,4-D approved for aquatic use. The granular formulation contains the low-volatile butoxy-ethyl-ester formulation of 2,4-D (trade names include AquaKleen® and Navigate®). The liquid formulation contains the dimethylamine salt of 2,4-D (Trade name - DMA*4IVM). Both the granular and liquid formulations can be effective for spot treatment of Eurasian watermilfoil and other broad-leaved species. 2,4-D has been shown to be selective to Eurasian watermilfoil when used at the labeled rate, leaving native aquatic species relatively unaffected. For additional information on 2,4-D characteristics and environmental impacts, refer to Ecology's risk assessment for 2,4-D conducted by toxicologists at Compliance Services International, 2000 (see Ecology's website).
    - **Navigate® and AquaKleen®** - (Appendix E) Active ingredient 2,4-D BEE. These granular products contain the low-volatile butoxy-ethyl-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. Species controlled with Navigate® and AquaKleen® and effectiveness of control are listed in Appendix F.

- **DMA*4IVM**® - (Appendix E) 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.

- **Triclopyr (TEA)** – (Appendix E) Trade name Renovate® was registered on April 4, 2003 (EPA Registration number 62719-37-67690). This aquatic herbicide is a selective systemic herbicide used to control submerged, emergent, and floating aquatic plants. Triclopyr functions by disrupting plant growth metabolism by mimicking the plant hormone auxin, causing uncontrolled and disorganized plant growth that ultimately leads to plant death. It has little or no impact on grasses. There are two basic formulations of triclopyr - a triethyamine salt, and a butoxyethyl ester, however only the salt is registered for aquatic use. In soils, both formulations degrade to the parent compound, triclopyr acid. In water, the salt formulation is soluble and degradation occurs primarily through photolysis and hydrolysis and may degrade in several hours. Renovate® water-soluble triethylamine salt formulation contains three pounds of triclopyr acid equivalent per gallon (http://tncweeds.ucdavis.edu/products/handbook/20.Triclopyr.pdf).

- **Endothall - Dipotassium Salt** – Trade name Aquathol®. Endothall is a fast-acting non-selective contact herbicide that destroys the vegetative part of the plant but generally does not kill the roots. Endothall may be applied in a granular or liquid form. Typically, 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, endothall can be used to selectively remove exotic weeds; leaving some native species unaffected. Because it is fast acting, endothall can be used to treat smaller areas effectively. Endothall is not effective in controlling Canadian waterweed (*Elodea canadensis*) or Brazilian elodea (*Egeria densa*).

- **Diquat** – Trade name Reward®. Diquat is a fast-acting non-selective contact herbicide that destroys the vegetative part of the plant but does not kill the roots. It is applied as a liquid. Typically, diquat is used primarily for short-term (one season) control of a variety of submersed aquatic plants. It is very fast acting and is suitable for spot treatment. However, turbid water or dense algal blooms can interfere with its effectiveness. Diquat was allowed for use in Washington in 2003.
- **Imazapyr** - Imazapyr (Habitat®) is from the herbicide family imidazolinone, non-selective systemic and slow acting herbicides for control of weeds, broadleaved herbs, and woody species. It is suitable only for the control of emergent species or floating leaved species such as the water lily.

Advantages

Aquatic herbicide application can be less expensive than other aquatic plant control methods, especially when used in controlling widespread infestations of state-listed noxious aquatic weeds.

- Aquatic herbicides are easily applied around docks and underwater obstructions.
- Washington has had some success in eradicating Eurasian watermilfoil, a state listed noxious weed, from some smaller lakes (350 acres or less) using fluridone products.

- 2,4-D has been shown to be effective in controlling smaller infestations (not lake-wide) of Eurasian watermilfoil in Washington.
- Westerdahl and Getsinger report excellent control of the fragrant water lily with glyphosate. Good control was obtained with endothall dipotassium salt and fluridone. Generally glyphosate is the recommended herbicide for water lily control because it can be directly applied 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 controls the plants that were missed during the first herbicide application.
- Newly registered imazapyr may also be a good choice to control water lilies.

Disadvantages

- Some herbicides have swimming, drinking, fishing, irrigation, and water use restrictions (check the label and general permit).
- 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 endothall and diquat may cause low oxygen conditions to develop as plants decompose. Low oxygen can cause fish kills.
- A drawback of using herbicides, is the "uplifting" of mats of decomposing waterlily roots that can form large floating islands in the waterbody after the herbicides have killed the plants.
- 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. Find out what lake residents think about chemical use before deciding to treat your water plants with herbicides.
- Some cities or counties may have policies forbidding or discouraging the use of aquatic herbicides. Check before hiring an aquatic herbicide applicator.

Permits

A National Pollutant Discharge Elimination System (NPDES) permit is needed to apply any aquatic pesticide (including herbicides) to waters of the state. Both the noxious aquatic weed and nuisance plant and algae NPDES permits require the development of integrated aquatic vegetation management plans before the third season of treatment. Some herbicide residue monitoring may also be required. . In addition, only state-licensed applicators with an aquatic endorsement may purchase and legally apply herbicides to state waters.

For nuisance weeds and filamentous algae control, apply to the Ecology's Eastern Regional office for a permit in winter before plants become a problem. If you are accepted for coverage under the permit, the permit fee is $300 per year. Talk to your regional permit writer for details.

With the development of a new lakes NPDES permit, permitting requirements may change. Check with the Kathy Hamel and the regional permit writer to determine new permitting requirements

Costs of Herbicide Treatment Approximate costs for one-acre herbicide treatment:

- Glyphosate: $250
- Fluridone: $900 to $1,000
- Endothall: $650
- 2,4-D: $600
- Diquat: $300 to $400
- Triclopyr: $300 to $800
- Imazapyr: Not sure of costs since this is so new, but it is expensive.

These costs are estimates and will vary from site to site depending on treatment rates and water depths.

Other Considerations

The focus of the discussion below is the active ingredient 2,4-D. The Newman Lake Flood Control Zone District, and with input from Watershed Committee, community, DOE and consultants, have chosen this chemical as the primary control option for Eurasian watermilfoil for Newman Lake (see Chapter 8). Since 2,4-D is a relatively fast-acting, selective, systemic herbicide it was chosen as the primary option. It can be effective for spot treatment of Eurasian watermilfoil, and 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.

EPA studies yield the parameters LD50 (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). The LD50 value is useful for comparing one compound with another and for grouping compounds into general hazard classes.

According to Felsot (1998), any pesticide 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. 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. The half-life of 2,4-D is about 7 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.

The granular formulation of 2,4-D is typically applied using a bow-mounted centrifugal or blower-type spreader and the pellets are uniformly spread over the water above the milfoil beds and slightly beyond. The clay particles sink to the bottom or are caught up in the plants. The herbicide slowly releases from the clay over the next day. A few days after the 2,4-D treatment, observers will see the growing tips of milfoil plants twist and look abnormal. These plants will sink to the sediments usually within one to two weeks of treatment. Unless treatment takes place in dense beds of milfoil, it is unlikely for low oxygen conditions to develop. Results of spot treatment may be variable depending on water movement, size of treatment plot, density of milfoil, weather conditions, underwater springs, etc. Granular formulations are generally recommended for spot treatment since liquid applications may have tendencies to drift away

from the milfoil beds. When the liquid formulation is used, it is applied using subsurface trailing hoses (http://www.ecy.wa.gov/programs/wq/plants/management/2,4D_strategies.html).

Restrictions for aquatic 2,4-D applications are limited compared to other herbicides; there are no fishing restrictions, and three to five days after treatment the water is generally below the drinking and irrigation water standards when using the granular formulation. Although 2,4-D should not damage grass or other monocots, it is recommended that no one use treated water to water lawns and especially other landscape plants during the first three to five days after a treatment. Water within the treatment areas cannot be used for drinking until 2,4-D concentrations have declined to 70 ppb, and water used for irrigation cannot be used until 2,4-D concentrations are 100 ppb or less. There is no swimming restriction for 2,4-D use although the Washington Department of Health advises waiting 24 hours after application before swimming in the treated area.

Human and General Mammalian Health

The oral LD50 for 2,4-D (acid) is 764 mg/kg and the dermal LD50 is >2000 mg/kg. This chemical has a low acute toxicity (from an LD50 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, 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, 2001).

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, 2001). 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 from 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, 2001). 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,

2001). 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, 2001). 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 (liquid formulation) has a low acute toxicity to fish (LC50 =100 to 524 mg a.i./L for the rainbow trout and bluegill sunfish respectively). Chinook and coho salmon have been tested by the University of Washington (unpublished data) and did not exhibit high toxic effects. 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 Department of Ecology, 2001). 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 (LC50 = 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 ppm/0.3 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 (LC50 = 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 ppm/20 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 Department of Ecology, 2001). 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. Also data collected under the Noxious Weed NPDES permit indicates that levels of 2,4-D in the water column following application of BEE granules rarely exceed the irrigation water standard of 100 ppb.

Application for Newman Lake

Aquatic herbicides can provide an effective method for control and eventual eradication of noxious weeds when used in conjunction with diver hand removal or bottom barrier installation. 2,4-D is a selective herbicide and milfoil is particularly susceptible at a labeled rate of about 100 -200 pounds per acre (granular product). Most milfoil plants are killed, while re-growth can be controlled for as little as six weeks to as long as one year. The use of a formulation of 2,4-D should provide excellent primary control of the Eurasian watermilfoil while allowing for the more-appropriate spot treatments in scattered infestation areas. For localized reductions of scattered plants especially in more populated stretches of shoreline, the Newman Lake Flood Control Zone District with the input of the NLWSC and the community through this AWMP, recommends hand pulling. These methods can improve swimming safety and fishing conditions in limited areas. Follow-up is essential to ensure the success of eradication. Used alone, 2,4-D is not an eradication tool. Some plants survive the treatment and regrow, so these plants must be removed by other means. In this case, the NLFCZD recommends hand pulling, or depending on the initial treatments success, a secondary 2,4-D treatment.

However, there are factors to consider when choosing this chemical treatment. The most important of which is the possibility of over application. This would be detrimental to fish and wildlife and possibly to water quality. 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. Since the maximum use rate should 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, neither formulation of the herbicide (2,4-D BEE or 2,4-D DMA) will 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 Department of Ecology, 2001).

There is also some concern that the granular formulations of 2,4-D BEE found in Navigate® and AquaKleen® may settle by gravity into high organic and flocculent sediments, which could inhibit the release of the 2,4-D to the water column. 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. This phenomenon is called residue aging and involves changes in the forces governing interactions of the chemical with the soil matrix over time. 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 in certain instances. However, the experience to date has shown the granular formulation to be effective at Newman Lake, thought liquid may be considered in the future. There has been some experience to date in Washington of high long-term residual concentrations after liquid applications. After 10 days, 2,4-D residual concentrations were still above the Label irrigation restriction level of 100 ppb. (See monitoring results for Spring Lake and other Washington Lakes at http://www.ecy.wa.gov/programs/wq/pesticides/final_pesticide_permits/noxious/monitoring_data/monitoring_index.html.) The use of the liquid formulation could limit the ability of Newman Lake residents to irrigate when needed, therefore the preferred herbicide formulation remains the BEE formulation in areas near water intakes.

One of the main reasons to eradicate milfoil 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 will be conducted by methods designed to preserve (and eventually enhance or conserve) the native plant communities. Most of the native submersed macrophyte species are monocots (i.e. *Potamogeton* spp.) that should be relatively unaffected by the 2,4-D application. Removing the noxious invaders will halt the degradation of the system and allow the dynamic natural equilibrium to be maintained. A herbicide selective to Eurasian watermilfoil will be used for its ability to spot treat scattered milfoil infestations and will not require a whole-lake treatment that would expose all the submersed plants to the herbicide. Follow-up control methods will focus specifically on the target species and should leave beneficial plants intact.

An experienced herbicide applicator can selectively target individual weed species and minimize collateral damage to other species. This is especially true when infestations are small so that large areas with a diverse plant distribution do not have to be treated. Since the Eurasian watermilfoil infestations at Newman 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 have noted that in 2003 when the treating areas that included Nuphar polysepala (Spatterdock), the Nuphar was "burnt" back some and experienced some curled growth the next year. We therefore now minimize application to the nuphar-dominated areas. This is a stable and important native plant community that we do not want to damage. This would be the preferred method in sensitive wetland areas to avoid damage to native plants.

Since 2003, aquatic 2,4-D (Navigate® and AquaKleen® granular 2,4-D) herbicide treatments have occurred on Newman Lake with success. We have had great decimation of Eurasian watermilfoil plants using AquaKleen® granular 2,4-D applied at the labeled use rate. Most of these treatments inherently have had variable overall success due to the plant's capacity for rapid vegetative spread. When treatments first began in 2003, an herbicide treatment (AquaKleen® granular 2,4-D) was initiated treating nearly 20 acres, later treatments occurred over smaller acreages. Monitoring showed that 2,4-D levels in the lake remained very low, while still providing effective treatment for milfoil plants.

Long-term success for control and eventual eradication of Eurasian watermilfoil will require long-term community commitment and involvement as well as educational and communication efforts. The Newman Lake Flood Control Zone District is willing to fund the follow-up activities necessary to ensure continued milfoil management and control. Milfoil management has been incorporated into the mission and goals of the NLFCZD with the strong support of the Newman Lake community. Monitoring and management of the plant community will allow the beneficial uses such as fishing, boating, and swimming to exist.

8.0 Integrated Treatment Strategy

Eurasian watermilfoil:

The target species in Newman Lake is Eurasian watermilfoil (*Myriophyllum spicatum*). Based on the experience of other lakes, effective and affordable containment and eradication requires a long-term commitment and early action. It involves frequent surveying to determine milfoil locations, implementation of control actions up to 2 or 3 times per year, and education to prevent continued re-infestation.

Survey: Plans now include surveying the entire lakeshore by boat, foot and/or diver in late May or early June every year as we have done in the past two years. We will locate and map plants and infested areas with GPS. Identification before infestations have spread will reduce control costs. We will monitor troublesome areas routinely with full follow up surveys in summer and fall.

Treatment: As mentioned previously, the Newman Lake Flood Control Zone District and community favor the use of the combination of a chemical control agent, 2,4-D herbicide, and hand harvesting. Used alone, 2,4-D is not an eradication tool. Some plants survive the treatment and regrow, so these plants must be removed by other means. For that reason, hand pulling will continue in Newman Lake in order to remove any milfoil plants that are not killed by the treatment, or where infestations are too diffuse for a treatment to be applicable.

Education: The NLFCZD plans on continuing information and education with the general Newman Lake community through frequent newsletter articles on milfoil control efforts and best management practices. We will also continue maintenance of the signs at all the Newman Lake boat launches.

Assessment of Control Levels
Some of the following information was taken from the Washington State Department of Ecology's website on developing Integrated Aquatic Vegetation Management Plans (http://www.ecy.wa.gov/programs/wq/plants/management/manual/chapter11.html).

This step of the Plan development involves determining how much control is needed for Eurasian watermilfoil problems. For milfoil a high level of control is needed to prevent the plants from fragmenting and spreading around the lake. These control efforts are targeted to milfoil plants only. Every milfoil plant that is detected will be targeted for removal with either herbicides (when milfoil is found in large numbers) or by hand pulling (when milfoil is found in small numbers and in scattered locations). This plan does not address any control for nuisance weeds.

Are there plant zones around the lake that should be left alone, **no control**? Where should a **low level of control** be applied to allow some intermediate level of plant growth? In addition, under what circumstances would a **high level of control** be necessary, such as where a minimal amount of nuisance plants can be tolerated? Identification of plant problems in specific locations are done by assessing the control levels of each of the areas identified on the beneficial use map.

The different levels off control are identified as:

No Control: Areas of the lake that may be best to leave untouched. These include areas that may be too deep or unsuitable for Eurasian watermilfoil to proliferate. These areas might be best to be left alone or subjected to minimal treatments.

Low Level of Control: Low levels of control may be all that is needed to attain our management goals. This usually involves a partial removal of vegetation. Low-level control maximizes enjoyment of a water body while minimizing plant removal. A benefit of low-level control is the low treatment cost per acre because less plant material is being removed or treated. Examples include developing control strategies that consider depths and areas of control for activities such as water skiing, boating, aesthetics, and swimming.

High Level of Control: Certain situations may require aggressive control. High intensity levels of control-may include areas such as beaches, docks, and boat ramps where any infestations of Eurasian watermilfoil may be unacceptable. In addition, areas where native plant beds function as fish spawning, nesting and forage sites for waterfowl and other animals, and areas that are designated for wildlife conservancy may also require intensive control efforts. Lake-wide control efforts affecting 100 percent of aquatic plants are not appropriate, except in lakes where invasive non-native plants have been identified.

Although eradication of Eurasian watermilfoil is the end goal, control and management may be a more realistic scenario given the characteristics of the highly aggressive aquatic weed and the size of Newman Lake. However, given the highly invasive nature of Eurasian watermilfoil, we recommend that all susceptible locations in Newman Lake receive high levels of control, but only if needed as indicated by the presence of milfoil plants. Only those that are virtually unaffected by Eurasian watermilfoil will receive no control efforts (i.e. areas that are too deep for milfoil to proliferate).

We have however prioritized control areas and areas to focus survey efforts based on use and growth susceptibility. A map of beneficial uses at Newman Lake is provided as fig. 8.1. The most intense areas of infestation to date have been at the north and south ends of the lake along shallow areas with highly organic sediments. These areas are along the shoreline wetlands areas of dense emergent plant growth. These areas also provide prime fish habitat, are important natural wetlands and see a lot of use by fisherman. Most of these areas have not been developed for residential use and being shallower they do not see the intensity of other recreation uses such as swimming, high speed boat traffic and water-skiing. Uncontrolled growth of Eurasian milfoil in these areas has the potential to highly impact fish habitat, wetland vegetation and recreational fishing use. These areas deserve a high level of control but secondary priority due to less intense human use. These areas are indicated in yellow in Fig. 8.2.

Growth of Eurasian watermilfoil in other sandy/gravel shorelines has been spotty, with just a few scattered plants. Growth rates in these areas are also more moderate. These areas however are also in residentially developed shorelines and therefore experience more intense and varied recreational use. The possibility of stirring up and spreading fragments is increased with the more intense human use and the impact to recreational uses is greater in these locations if the growth gets out of control. These areas deserve a high level of survey and control, but secondary priority due to lower likelihood of fast growth. These areas are indicated in yellow in Fig. 8.2.

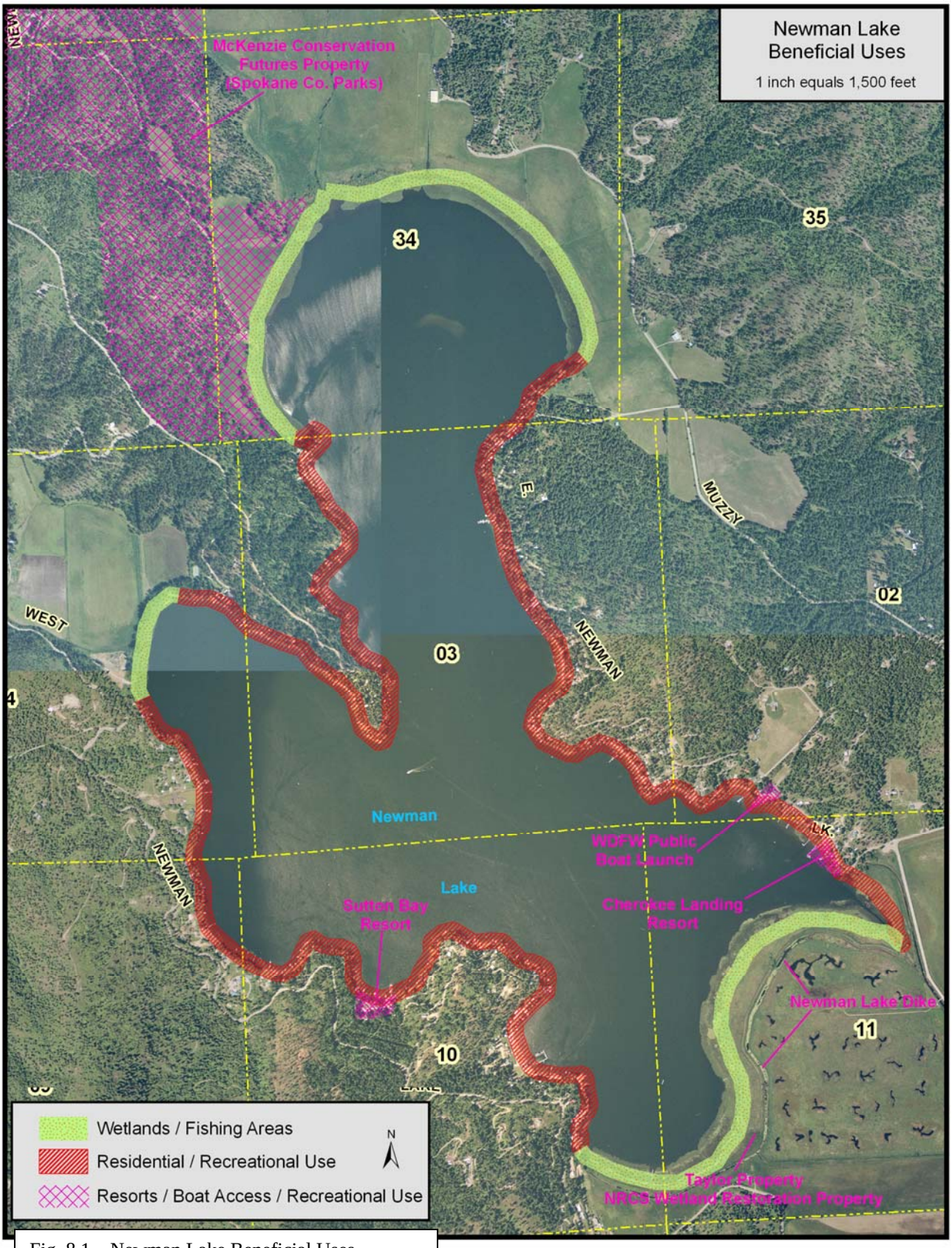

Fig. 8.1 – Newman Lake Beneficial Uses

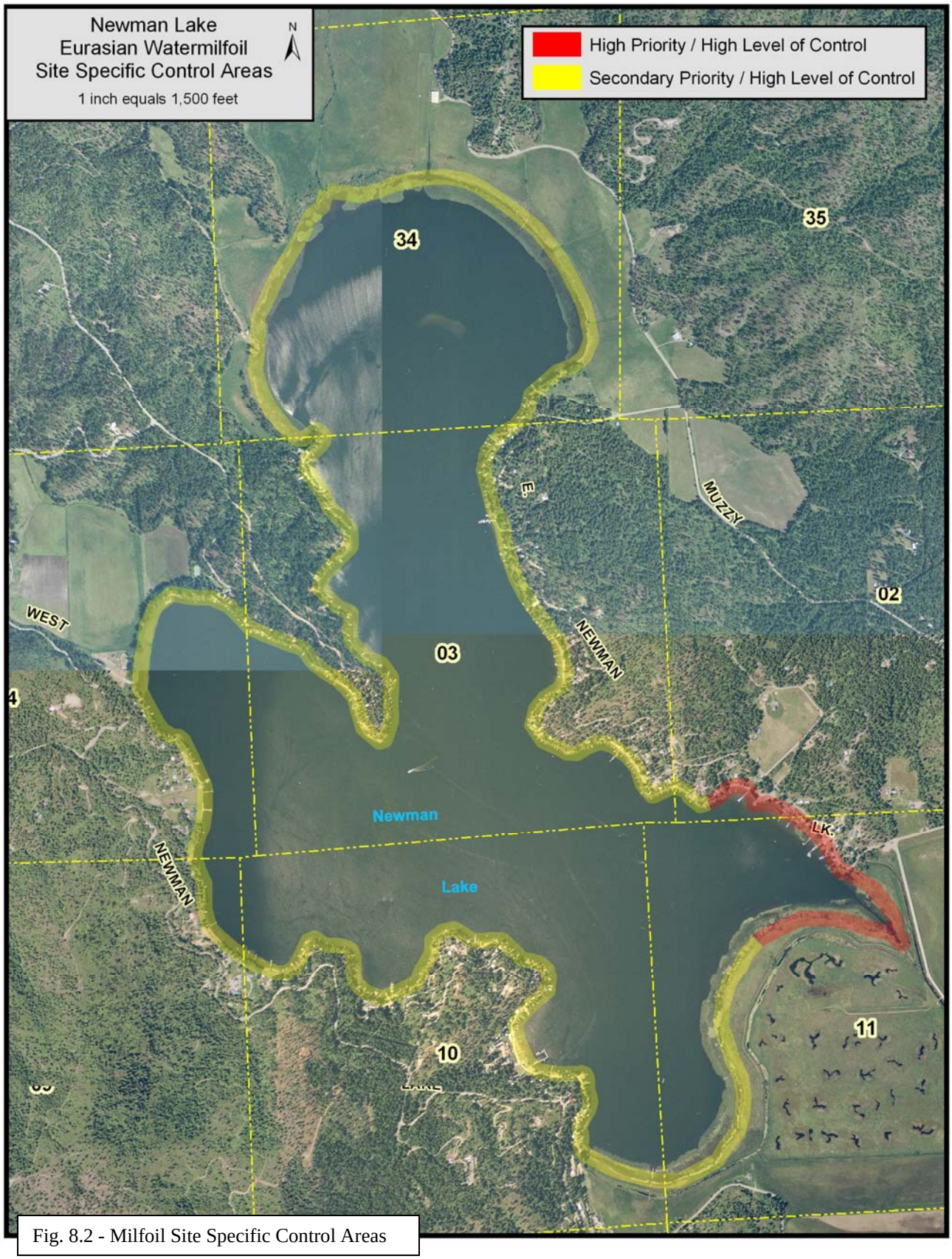

Fig. 8.2 - Milfoil Site Specific Control Areas

The most problematic areas will be those where residential uses overlap with the shallow organic sediments. Indicated in red on map of site specific control areas, fig 8.2. The southeast shore of the lake between the outlet gate and the WDFW boat launch is one of these areas that has already seen heavy milfoil infestation. This area is also the location of a private resort with boat a launch, moorage and boat rental, swimming and camping. In this location, high rates of growth are combined with high traffic and increased fragment spreading potential and potentially high impact to recreational uses. These areas deserve a high level of survey and control and the highest priority for Eurasian milfoil control due to high potential rates of growth and high recreational impact. See fig. 8.2, Eurasian Watermilfoil Site Specific Control Areas.

The levels of control in Newman Lake were determined by analyzing a combination of the aquatic plant density and distribution maps, the beneficial use map, and bathymetry. The combination of these maps produced the site-specific control map. Consideration was also given to these control areas based on past control efforts and suitable habitat for Eurasian watermilfoil observable in Newman Lake. All areas of milfoil infestation need high level of control though some areas have a higher priority.

Treatments: Control and management of Eurasian watermilfoil will be accomplished using an aquatic formulation of 2,4-D (DMA*4IVM®, AquaKleen® or Navigate® [Appendix E]) in late June to early July according to the annual survey results. Annual surface and dive surveys will be conducted over the entire lake to check the status of the infestation, and a GPS will be used to mark all the points that need treatment. When a treatment is near, the areas will be marked on the water's surface with buoys and then the application is performed by a licensed applicator via a boat to disperse the herbicide. Of the three available 2,4-D formulations, 2,4-D AquaKleen® is the preferred formulation at this time. The reason for this particular choice is based on our previous experience and knowledge of the product. We have felt that Newman Lake has experienced good control and management of Eurasian watermilfoil by the use of this formulation since 2003. Also water monitoring has shown that 2,4-D levels in the lake remain low after its use minimizing interference with water use. If the granular formulation proves less effective in the future we may consider use to the liquid formulation especially in area were water use is not a concern.

Follow-up applications may occur about three weeks after the initial treatment to pick up missed plants or late emergents. Diver hand-pulling will clean up any remaining milfoil found after both herbicide applications have had time to take effect or in areas that are not feasible for a chemical treatment (i.e. areas in which only one or two plants exist).

Surface and dive surveys after the initial application shall include a post evaluation of the site(s). The timing of this evaluation shall be appropriate for the herbicide used at the site. This evaluation shall include an estimate of the effectiveness of the application (qualitative or quantitative), any dead or dying organisms or plants, algae conditions, and any other environmental data which may be available (dissolved oxygen, pH, Secchi disk, turbidity, etc.). Survey evaluations are essential to determine the success of the effort, and will be used to determine what measures need to be implemented to improve the milfoil control. These late summer surveys will also be used to determine if a late summer/early fall herbicide treatment (as done in the previous two years) is needed.

Because of the environmental risks from improper application, aquatic herbicide use in Washington State waters is regulated by the National Pollutant Discharge Elimination System (NPDES) permit. All

specific protocols of the NPDES permit coverage from Washington Department of Agriculture (WSDA) and the label will be directly followed in Newman Lake by the licensed applicator and the NLFCZD.

As the years pass, 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. If we determine that the treatments have become less effective, we may a shift from AquaKleen® or Navigate® 2,4-D to Triclopyr if we find that the milfoil has build up a resistance to the herbicide. Triclopyr has just been registered and will be sold as Renovate® (see Appendix E for label). It is similar to 2,4-D in its mode of action (systemic), and is also another selective product. Irrigation water restrictions may be an issue in residential areas. Application will need to carefully follow label application instructions and restrictions. Triclopyr is not preferred over 2,4-D because it is more expensive than 2,4-D and the label has a long waiting period before irrigation can occur unless water testing shows that levels of triclopyr are below the irrigation water standard.

The other herbicides were not selected because they are either contact herbicides (diquat and endothall), are not effective for milfoil (glyphosate and imazapyr), or not selective (fluridone).

Protection of wildlife and waterfowl: The herbicide 2,4-D does not bioaccumlate in fish or waterfowl and does not concentrate up the food chain.

Protection of wetlands: All efforts will be made to avoid impacts to emergent wetlands. Most wetland plants are monocots (grasses, sedges) and are not particularly susceptible to selective herbicides such as 2,4-D and triclopyr. This is one reason why these herbicides were selected. The goal of this plan is to cause the least harm to native species while still effectively removing milfoil. Where impacts were noticed (as with the Nuphar), efforts were made to avoid treating in areas with this species. Spot treating with granular 2,4-D will effectively remove the milfoil that may be growing within shoreline wetlands without significantly damaging native wetland plants.

Protection of water rights: All residents within 1/4 mile of a planned treatment area are notified of the planned treatment dates, the herbicide to be used and use restrictions. We will offer to purchase water for those for whom these restrictions are a hardship. We will also notify water users when the water is again safe to use, testing for herbicide residuals if necessary.

Fragrant water lily - No control efforts are planned at this time. Future efforts will be based on individual situations and will follow recommended control methods presented in this report and currently recommended by the WDOE Aquatic Weed Management Program information.

9.0 Plan Elements, Costs, And Funding

This section outlines the tasks and estimated costs of control and management of the listed noxious weed species Eurasian watermilfoil on an annual basis. Total control costs for Newman Lake since Eurasian watermilfoil was first discovered in 2003 is $77,449.68. These costs are outlined in Table 9.1. Implementation of this Newman Lake AWMP will continue each year, at a total estimated cost of about $25,000 annually.

Milfoil Management Expenses		**2003**	**2004**	**2005** (to date)
2,4-D Treatment	AquaTechnex	$10,012.76	$5,059.25	$32,693.70
Residual Testing	Anatek Labs	$889.66	$1,485.00	$0
Dive Services	Clearwater Scuba & others	$911.25	$1,631.50	$4,362.48
Gas for boat			$38.29	
NLFCZD Staff Time	Barrentine + others	$6,595.85	$4,878.28	$8,801.66
Volunteer Time		$90.00	$0	$0
Total		**$18,499.52**	**$13,092.32**	**$45,857.84**

Table 9.1 – Newman Lake Milfoil Management Expenses 2003-2005

Costs for implementing this plan are based on an average of the last three years efforts. Table 10.2 outlines the tasks and estimated costs of implementation of this plan for 2006 and beyond.

Newman Lake Milfoil Management			
Estimated Future Annual Costs			
Task	Description	Quantity	Annual Cost
Contract/Grant Administration	NLFCD Staff time	18 hours	$800.00
Herbicide Treatment	Licensed applicator- Contract	30 acres	$16,185.00
Diver Survey and Pulling Services	Contractor	40 hours	$1,400.00
Survey and Management	NLFCD Staff time	150 hours	$6,600.00
Education and Newsletters	NLFCD Staff time	12 hours	$360.00
*Residual Sampling**	*NLFCD Staff time*	*12 hours*	*$360.00*
*Laboratory Services**	*Contractor*	*10 samples*	*$1,650.00*
Gas and Misc Supplies			$200.00
Total			***$27,555.00***
Total without Sampling			**$25,545.00**

*Sampling Not Required in 2005 - Future requirements uncertain

Table 9.2 – Estimated Future Annual Milfoil Control Costs

Funding

These planned eradication efforts are likely to be an ongoing effort of the NLFCZD. We do plan on applying for a grant from WDOE Aquatic Weeds Management Fund to continue these efforts for 2006-2009 at a 75% level. This would but NLFCZD matching fund requirements at about $6250 annually.

However, if these funds are not available, District assessments will need to be increased about 10% to cover these efforts.

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List of Abbreviations

NLFCZD – Newman Lake Flood Control Zone District

NLPOA - Newman Lake Property Owners Association

NLWSC – Newman Lake Watershed Committee

WDFW – Washington State Department of Fish and Wildlife

WDOE – Washington State Department of Ecology

Appendixes

Appendix A: Shoreline Designations and Recommendations

Appendix B: 2004 Newman Lake Water Quality profiles

Appendix C: Summary Milfoil Control Reports and NPDES Monitoring Forms - 2003 - 2005

Appendix D: Bottom Barrier installation Instructions

Appendix E: Herbicide label and MSDS sheets: Navigate®, AquaKleen®, DMA*4IVM®, and triclopyr (Renovate®)

Appendix F: Species controlled with Navigate® and AquaKleen® and effectiveness of control

Appendix G: Herbicide residential and business notification

Appendix H: Posting for direct aquatic applications

Appendix I: Newman Lake Newsletter Article, Spring 2003

Appendix J: 2003 Draft Preliminary Milfoil Management Plan

Appendix K: Newman Lake Water Rights List

Appendix L: Affidavit of Publishing Notice

Appendix A: Shoreline Designations and Recommendations

From "Shoreline Assessment For Spokane County Lakes", URS, Dec. 2002

Table 4.1: Existing and Recommended Shoreline Designations for Newman Lake

Shoreline Letter Designation	Existing Spokane County Shoreline Designations (1996)	Non-Point Source Pollution Potential to Affect Downgradient Areas	Proper Functioning Condition (Appendix B)	Ecological Need for Restoration	Ecological Sensitivity to Development	Recommended Shoreline Designations (2002)
Shoreline A	Conservancy	Moderate	Functional At Risk/Downward	Low (development restrictions)	High	A – Pastoral
Shoreline B	Rural	Moderate	Functional At Risk/Downward	Moderate (development restrictions)	Low	B – Rural (no change)
Shoreline C	Conservancy	Moderate	Functional At Risk/Downward	Moderate (development restrictions)	Low	B - Rural
Shoreline D	Rural	Moderate	Functional At Risk/Downward	Moderate (development restrictions)	Low	B - Rural (no change)
Shoreline E	Conservancy	Moderate	Functional At Risk/Downward	Moderate (development restrictions)	Low	B - Rural
Shoreline F	Rural	Moderate	Functional At Risk/Downward	Low (good condition)	High	C - Conservancy D - Rural (no change)
Shoreline G	Conservancy	Moderate	Functional At Risk/Downward	Moderate (development restrictions)	Moderate	D - Rural
Shoreline H	Rural	Moderate	Functional At Risk/Downward	Moderate (development restrictions)	Moderate	D – Rural (no change) E – Conservancy F – Rural (no change)

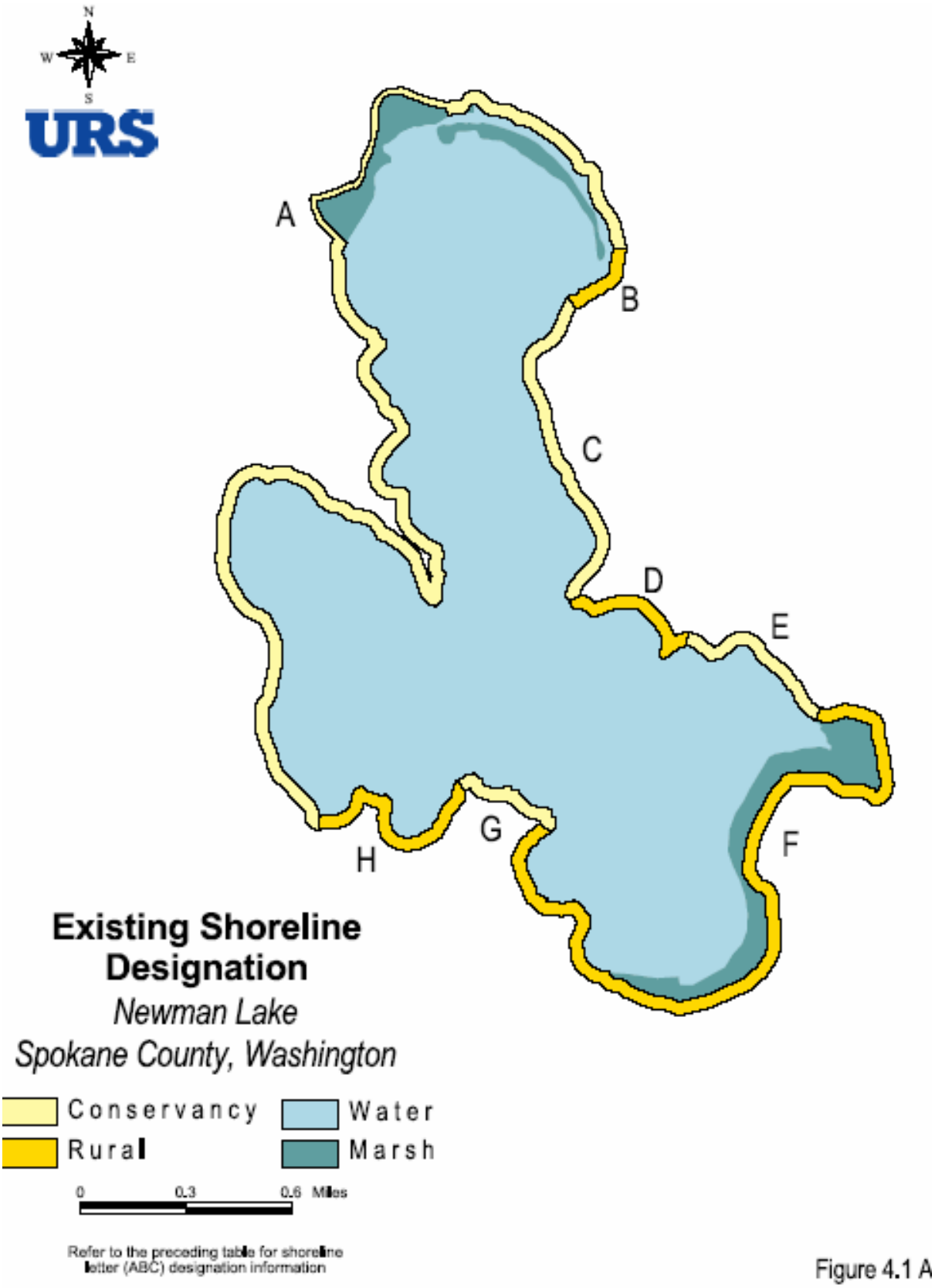

N
W
E
S
URS
A
B
C
D
E
F
G
H
Existing Shoreline Designation
Newman Lake
Spokane County, Washington
Conservancy
Rural
Water
Marsh
0
0.3
0.6 Miles
Refer to the preceding table for shoreline letter (ABC) designation information

Figure 4.1 A


N
W
E
S
URS
A
B
C
D
E
F
Recommended Shoreline Designation
Newman Lake
Spokane County, Washington
Conservancy
Rural
Pastoral
Water
Marsh
0
0.3
0.6 Miles
Refer to the preceeding table for shoreline letter (ABC) designation information

Figure 4.1 B

Appendix B: 2004 Newman Lake Water Quality Data

From "Newman Lake Annual Water Quality Report And Microfloc Alum Injection System Performance Update", Moore et al, WSU, Feb. 2005

Table 1. Temperature profiles in Newman Lake North Station, 2004. All values in degress Celcius.

Depth (m)	*3/26*	*4/16*	*5/11*	*6/10*	*6/24*	*7/14*	*8/4*	*8/12*	*8/26*	*9/9*	*9/23*	*10/8*	*10/27*
0	6.9	11.9	15.0	16.4	23.0	24.0	25.9	23.9	21.2	19.6	17.0	16.5	11.4
1	6.9	11.8	15.0	16.4	22.0	22.7	25.0	23.6	21.0	19.6	16.3	15.9	11.0
2	6.9	11.7	15.0	16.3	20.2	22.3	24.4	23.0	21.0	19.5	16.2	15.8	10.8
3	6.9	11.5	14.9	16.2	18.4	21.6	23.9	22.9	20.9	19.5	16.1	15.8	10.7
4	6.8	10.9	14.9	16.1	17.9	21.0	23.6	22.7	20.8	19.3	15.9	15.8	10.5
5	6.8	9.6	14.9	16.0	17.4	20.5	22.6	22.2	20.7	19.0	15.7	15.7	10.5
5.5		9.3		15.5		20.1				19.0			

Table 2. Temperature profiles in Newman Lake Mid-lake Station, 2004. All values in degress Celcius.

Depth (m)	*3/26*	*4/16*	*5/27*	*6/10*	*6/24*	*7/14*	*8/4*	*8/12*	*8/26*	*9/9*	*9/23*	*10/8*	*10/27*
0	6.5	11.1	16.0	16.6	22.8	23.4	24.5	24.1	21.1	19.5	16.0	15.9	11.2
1	6.4	11.1	16.0	16.6	22.9	22.8	24.3	23.9	21.1	19.5	16.1	15.8	11.2
2	6.3	11.0	15.9	16.6	20.9	22.7	23.9	23.7	21.1	19.4	16.0	15.8	11.1
3	6.3	10.3	15.5	16.4	18.9	21.8	23.8	23.2	21.1	19.4	16.0	15.7	11.0
4	6.4	10.1	15.3	16.1	18.4	21.1	23.6	22.6	21.1	19.3	16.0	15.7	11.0
5	6.3	9.9	15.1	16.0	17.6	20.7	22.8	22.4	21.1	19.3	16.0	15.8	11.0
6	6.3	9.5	15.0	16.0	17.4	20.1	22.6	22.2	21.1	19.3	16.0	15.7	11.0
7	6.3	9.4	14.7	16.0	17.1	20.0	22.4	22.1	21.1	19.3	16.0	15.7	11.0
8	6.3	9.2	14.8	15.8	16.6	19.7	22.1	22.1	21.1	19.3	16.0	15.7	11.0
8.5			14.6	15.5		19.3	21.9			19.2	15.9		
9		9.1											

Table 3. Temperature profiles in Newman Lake South Station, 2004. All values in degress Celcius.

Depth (m)	***3/26***	***4/16***	***5/27***	***6/10***	***6/24***	***7/14***	***8/4***	***8/12***	***8/26***	***9/9***	***9/23***	***10/27***
0	7.0	11.6	16.4	16.5	23.7	24.5	25.4	25.6	21.1	19.6	16.5	11.5
1	7.0	11.4	16.3	16.5	23.6	23.4	24.5	24.2	21.2	19.6	16.5	11.3
2	6.9	11.3	16.3	16.5	21.2	23.0	24.2	23.8	21.1	19.5	16.1	11.0
3	6.8	10.3	16.2	16.5	19.0	21.8	23.8	23.2	21.0	19.5	16.0	10.9
4	6.7	9.6	16.2	16.5	17.9	21.3	23.5	22.5	20.9	19.5	16.0	10.8
5	6.6	9.4	16.2	16.5	17.4	20.1	22.4	22.2	20.7	19.4	16.0	10.4
5.5			15.9	16.4					20.5	19.3		
6					17.1	19.9						

Table 4. Profiles of pH in Newman Lake North Station, 2004.

Depth (m)	**3/26**	**4/16**	**5/11**	**6/10**	**6/24**	**7/14**	**8/4**	**8/12**	**8/26**	**9/9**	**9/23**	**10/8**	**10/27**
0	6.3	7.1	7.7	7.2	7.7	8.0	7.3	8.0	7.1	7.8	7.7	7.4	7.3
1	6.3	7.5	7.8	7.3	8.1	8.3	7.4	8.0	7.1	7.8	8.0	7.4	7.2
2	6.4	7.5	7.8	7.3	8.8	8.3	7.5	7.9	7.1	7.7	8.1	7.3	7.2
3	6.4	7.4	7.7	7.3	8.6	7.9	7.4	7.5	7.1	7.7	7.7	7.3	7.1
4	6.4	7.3	7.7	7.2	8.1	7.3	7.2	7.1	7.1	7.6	7.2	7.2	7.1
5	6.4	7.1	7.4	7.1	7.2	6.7	6.4	6.6	7.1	7.2	7.1	7.2	7.1
5.5		6.8		6.8		6.4				6.7			

Table 5. Profiles of pH in Newman Lake Mid-lake Station, 2004.

Depth (m)	**3/26**	**4/16**	**5/27**	**6/10**	**6/24**	**7/14**	**8/4**	**8/12**	**8/26**	**9/9**	**9/23**	**10/8**	**10/27**
0	6.0	7.7	7.5	7.8	7.7	7.8	7.5	8.4	6.9	7.5	7.3	7.0	6.9
1	6.1	7.6	7.4	7.6	7.8	8.1	7.6	8.3	6.9	7.5	7.3	7.1	7.0
2	6.1	7.5	7.4	7.5	8.2	8.2	7.6	8.1	6.9	7.4	7.3	7.1	7.0
3	6.1	7.3	7.0	7.2	8.5	7.9	7.4	7.2	6.9	7.4	7.3	7.1	7.0
4	6.1	7.0	6.9	6.8	8.0	7.5	7.0	6.9	6.9	7.3	7.3	7.1	7.0
5	6.2	6.8	6.7	6.7	7.5	7.1	6.6	6.7	6.9	7.1	7.3	7.1	7.0
6	6.2	6.8	6.6	6.6	7.1	6.6	6.4	6.6	6.9	7.0	7.3	7.1	7.0
7	6.2	6.7	6.4	6.6	6.6	6.4	6.4	6.5	6.9	7.0	7.3	7.1	7.0
8	6.2	6.6	6.3	6.4	6.2	6.3	6.3	6.5	6.9	6.9	7.3	7.1	6.7
8.5			6.2	6.3		6.2	6.3			6.9	7.1		
9		6.5											

Table 6. Profiles of pH in Newman Lake South Station, 2004.

Depth (m)	**3/26**	**4/16**	**5/27**	**6/10**	**6/24**	**7/14**	**8/4**	**8/12**	**8/26**	**9/9**	**9/23**	**10/27**
0	6.5	6.8	7.4	7.4	7.7	8.1	7.7	8.5	7.3	7.9	7.8	7.0
1	6.5	7.3	7.4	7.4	7.8	8.2	8.0	8.6	7.0	7.9	7.8	7.0
2	6.5	7.5	7.4	7.4	8.3	8.1	7.9	8.5	7.0	8.0	7.7	7.0
3	6.5	7.4	7.4	7.4	8.7	8.2	7.6	7.5	7.0	8.0	7.5	7.0
4	6.4	7.1	7.4	7.4	8.1	7.6	7.0	6.9	7.0	7.9	7.3	7.0
5	6.4	7.0	7.3	7.4	7.3	6.7	6.3	6.5	6.9	7.8	7.0	7.0
5.5			7.0	7.3	6.8	6.4			6.8	7.4		

Table 8. Dissolved oxygen profiles in Newman Lake North Station, 2004. All values in mg/L.

Depth (m)	**3/26**	**4/16**	**5/11**	**6/10**	**6/24**	**7/14**	**8/4**	**8/12**	**8/26**	**9/9**	**9/23**	**10/8**	**10/27**
0	7.0	11.3	9.8	8.7	8.5	8.0	7.1	8.0	9.7	8.0	8.3	8.6	8.3
1	7.1	10.5	9.6	8.7	8.7	7.6	6.9	7.6	9.8	7.7	8.5	8.8	8.1
2	7.1	10.2	9.6	8.1	9.5	7.7	6.8	7.8	9.6	7.7	8.4	8.7	7.9
3	7.1	10.2	9.4	8.1	8.8	7.7	6.5	7.3	9.4	7.4	7.7	8.5	8.0
4	7.2	10.1	9.6	7.9	8.5	6.5	6.9	5.9	9.2	7.1	6.7	8.7	8.0
5	7.3	8.5	6.0	7.7	6.3	3.9	1.3	3.0	9.2	5.3	3.9	8.3	7.8
5.5		7.1		5.9		2.0				4.5			

Table 9. Dissolved oxygen profiles in Newman Lake Mid-lake Station, 2004. All values in mg/L.

Depth (m)	**3/26**	**4/16**	**5/27**	**6/10**	**6/24**	**7/14**	**8/4**	**8/12**	**8/26**	**9/9**	**9/23**	**10/8**	**10/27**
0	7.0	10.6	9.3	8.8	8.2	7.9	7.5	7.6	8.7	8.0	7.4	8.1	7.8
1	7.1	11.2	8.8	8.1	8.2	7.5	6.9	7.6	8.8	7.6	7.0	7.9	7.5
2	7.1	10.8	8.5	8.1	8.7	7.6	6.7	7.4	8.7	7.3	7.2	7.7	7.4
3	7.1	10.3	8.3	7.4	9.0	6.8	6.6	5.5	8.6	7.3	6.9	8.0	7.2
4	7.1	9.5	8.1	6.3	8.5	6.7	5.3	4.9	8.6	7.0	7.1	7.9	6.9
5	7.2	9.1	7.8	6.4	7.9	5.3	3.0	3.6	8.2	6.9	7.0	7.8	6.8
6	7.2	9.2	6.9	6.0	6.8	3.3	1.6	1.5	8.4	6.6	7.1	7.6	6.9
7	7.2	8.6	6.6	5.9	4.3	2.2	1.1	0.7	8.7	6.5	6.8	7.8	6.7
8	7.1	7.8	5.8	4.8	1.4	1.5	0.5	0.2	8.6	6.0	6.7	8.0	3.3
8.5		8.0	5.1	3.4		0.5	0.2			5.3	6.0		

Table 10. Dissolved oxygen profiles in Newman Lake Sorth Station, 2004. All values in mg/L.

Depth (m)	**3/26**	**4/16**	**5/27**	**6/10**	**6/24**	**7/14**	**8/4**	**8/12**	**8/26**	**9/9**	**9/23**	**10/27**
0	6.9	10.6	9.2	8.8	8.2	7.8	7.7	8.2	9.4	8.3	8.1	7.5
1	6.9	10.7	8.9	8.6	8.2	7.7	8.0	7.9	8.9	8.0	8.0	7.7
2	6.9	10.6	8.9	8.1	8.5	7.2	7.8	7.8	8.8	8.0	7.5	7.4
3	7.0	10.7	8.9	8.1	9.0	7.5	6.9	6.2	8.6	8.0	7.1	7.5
4	6.9	9.1	8.9	8.2	8.6	6.8	5.1	2.8	8.5	7.9	6.1	7.6
5	6.9	9.0	8.5	8.1	7.1	2.7	1.2	1.7	8.4	7.3	5.3	7.6
5.5		7.4	8.2	7.8	5.2	1.5			8.5	6.7		

Figure 11. Dissolved oxygen profiles in Newman Lake North Station, 2004. All values expressed as percent of saturation.

Depth (m)	**3/26**	**5/11**	**6/10**	**6/24**	**7/14**	**8/4**	**8/12**	**8/26**	**9/9**	**9/23**	**10/8**	**10/27**
0	61.7	102.5	94.5	105.9	101.4	93.2	101.8	86.1	92.5	90.4	94.5	81.1
1	61.8	100.5	94.5	104.9	94.2	88.3	95.7	86.9	89.9	92.0	95.7	78.4
2	61.9	99.6	88.0	111.9	94.5	87.4	96.8	84.1	89.0	90.4	93.5	75.9
3	62.4	98.8	88.4	100.4	93.7	82.3	90.8	82.6	86.4	84.0	89.9	76.9
4	63.2	100.4	84.5	95.4	77.5	86.9	70.0	79.4	81.1	72.6	93.5	76.3
5	63.5	61.0	83.2	71.0	46.8	16.2	36.6	78.0	61.1	38.6	89.2	75.2
5.5			63.0		23.5				51.2			

Figure 12. Dissolved oxygen profiles in Newman Lake Mid-lake Station, 2004. All values expressed as percent of saturation.

Depth (m)	**3/26**	**5/27**	**6/10**	**6/24**	**7/14**	**8/4**	**8/12**	**8/26**	**9/9**	**9/23**	**10/8**	**10/27**
0	61.0	100.9	96.2	101.7	99.3	96.5	97.6	73.4	93.0	79.8	87.7	75.4
1	61.2	10.0	88.2	101.3	93.9	87.3	95.7	73.9	87.2	75.5	86.0	72.2
2	61.5	92.5	87.7	103.3	93.3	85.3	92.9	73.4	84.9	76.6	82.8	72.2
3	61.4	88.2	81.0	103.8	84.6	82.8	68.0	72.9	84.6	74.5	86.2	70.5
4	61.7	86.1	68.6	96.7	79.8	67.5	58.2	71.6	80.0	77.3	84.7	66.3
5	62.5	82.8	69.2	89.2	63.2	38.0	44.6	67.2	78.7	74.9	83.4	65.1
6	62.1	72.9	64.5	76.0	38.5	19.0	18.5	68.8	76.7	76.0	82.0	66.2
7	62.1	68.5	62.5	47.4	26.3	12.8	8.0	73.0	74.3	73.0	82.5	63.2
8	61.4	61.7	51.4	14.7	7.0	5.8	2.9	71.0	69.2	73.7	86.6	29.1
8.5		53.8	37.8		5.4	2.1			61.1	65.6		

Figure 13. Dissolved oxygen profiles in Newman Lake South Station, 2004. All values expressed as percent of saturation.

Depth (m)	**3/26**	**5/27**	**6/10**	**6/24**	**7/14**	**8/4**	**8/12**	**8/26**	**9/9**	**9/23**	**10/27**
0	61.0	100.4	96.4	103.7	99.9	100.2	107.0	82.4	95.6	88.4	10.2
1	60.8	97.4	93.7	103.4	96.3	103.2	100.1	76.5	92.9	87.4	10.4
2	60.7	97.0	87.9	102.2	89.7	99.7	98.5	73.9	92.9	82.3	10.5
3	60.7	96.6	88.1	103.3	91.7	87.6	77.2	71.6	92.5	76.1	10.4
4	60.5	96.8	89.7	95.8	81.2	64.0	34.5	71.0	91.3	66.2	10.4
5	60.1	91.5	88.0	82.0	32.1	14.0	20.2	68.5	85.6	56.5	10.5
5.5		88.5	85.4	56.9	17.4			69.7	77.6		

Figure 14. Specific conductivity profiles in Newman Lake North Station, 2004. All values expressed in micro Siemens per cm.

Depth (m)	**3/26**	**4/16**	**5/11**	**6/10**	**6/24**	**7/14**	**8/4**	**8/12**	**8/26**	**9/9**	**9/23**	**10/8**	**10/27**
0	49	47	46	46	47	48	49	49	50	49	49	50	47
1	49	47	46	46	47	48	49	49	50	49	49	50	47
2	48	47	46	46	47	48	49	49	49	49	49	50	47
3	48	47	46	46	46	48	49	49	50	49	49	50	47
4	48	48	45	46	46	48	50	49	50	49	49	50	47
5		48	46	46	48	49	50	52	49	49	49	50	47
5.5		48		46		51				49.3			

Figure 15. Specific conductivity profiles in Newman Lake Mid-lake Station, 2004. All values expressed in micro Siemens per cm.

Depth (m)	**3/26**	**4/16**	**5/27**	**6/10**	**6/24**	**7/14**	**8/4**	**8/12**	**8/26**	**9/9**	**9/23**	**10/8**	**10/27**
0	50	48	46	46	47	48	49	50	51	49	49	50	47
1	50	48	46	46	47	48	50	50	50	50	49	50	47
2	50	48	46	46	47	48	49	50	50	50	49	50	47
3	50	49	46	46	47	48	50	50	50	50	49	50	47
4	50	49	47	46	46	48	50	50	50	51	49	50	47
5	50	49	47	46	46	48	51	50	50	51	49	50	47
6	50	49	47	46	47	49	52	51	50	51	49	50	47
7	50	49	47	46	48	49	52	52	50	51	49	50	47
8	50	49	47	47	50	50	52	52	50	51	49	50	47
8.5			48	47		51	53			51	49		
9		49											

Figure 16. Specific conductivity profiles in Newman Lake South Station, 2004. All values expressed in micro Siemens per cm.

Depth (m)	**3/26**	**4/16**	**5/27**	**6/10**	**6/24**	**7/14**	**8/4**	**8/12**	**8/26**	**9/9**	**9/23**	**10/27**
0	50	48	46	46	47	48	50	50	50	50	49	47
1	50	48	46	46	47	48	50	50	50	50	49	47
2	50	48	46	46	46	48	49	50	50	49	49	47
3	50	48	46	46	47	48	49	49	50	49	49	47
4	50	49	46	46	46	48	50	50	50	49	49	47
4.5	50											
5		48	46	46	46	49	51	51	50	49	50	47
5.5			46	46	47	50			49	49		

Figure 7. Alkalinity profiles in Newman Lake, 2004. All values in mg/L, as calcium carbonate.

	3/26	4/16	5/11	5/27	6/10	6/24	7/14	8/4	8/12	8/26	9/9	9/23	10/8	10/27
North-top	15.7	16.6	14.9	-	16.5	16.4	20.6	19.8	18.1	21.3	16.1	20.0	15.7	18.8
North-mid	16.2	16.7	15.1	-	15.5	15.7	19.8	19.4	20.0	20.8	19.2	17.2	16.4	19.2
North-bot	16.2	16.8	15.9	-	15.6	17.5	22.8	20.4	19.2	16.7	19.6	19.4	18.8	19.5
Mid-top	17.0	16.9	-	15.4	15.8	15.9	20.2	23.4	18.8	16.5	19.6	19.6	18.8	17.9
Mid-mid	17.5	16.6	-	15.1	15.9	16.2	18.1	22.0	20.0	19.2	17.6	17.4	16.1	20.4
Mid-bot	15.7	16.9	-	15.4	15.1	19.3	21.0	21.4	21.6	18.8	15.5	16.9	16.1	21.0
South-top	16.7	17.2	-	15.7	17.0	15.4	20.2	17.1	19.6	19.8	19.6	19.6	-	18.1
South-mid	16.0	16.4	-	15.7	16.0	15.6	21.2	20.6	19.6	20.4	19.2	16.9	-	21.0
South-bot	16.3	16.9	-	14.6	17.7	15.6	21.6	19.4	20.8	19.8	19.6	18.2	-	18.1

Figure 17. Secchi depths in Newman Lake, 2004. All values are in m.

	3/26	4/16	5/11	5/27	6/10	6/24	7/14	8/4	8/12	8/26	9/9	9/23	10/8	10/27
North	1.75	1.75	2.25		2.75	3.0	3.0	2.25	2.0	1.5	1.75	2.0	2.25	2.0
Mid-lake	1.75	1.75	-	2.25	3.00	3.5	3.0	2.25	1.5	1.5	1.5	1.75	1.75	2.0
South	2.0	2.0	-	2.25	3.25	3.5	3.0	2.25	1.5	1.5	1.5	2.0	-	1.75

Table 18. Total phosphorus in Newman Lake profiles, 2004. All values in mg/L, as P.

Date	*3/27/04*	*4/17/04*	*5/12/04*	*5/28/04*	*6/11/2004*	*6/25/2004*	*7/15/2004*	*8/5/2004*	*8/13/2004*	*8/27/2004*	*9/10/2004*	*9/24/2004*	*10/9/2004*
North-top	0.035	0.033	0.032	-	0.040	0.073	0.049	0.032	0.009	0.016	0.013	0.010	0.016
North-mid	0.030	0.036	0.038	-	0.056	0.093	0.071	0.039	0.011	0.026	0.012	0.017	-
North-bot	0.034	0.091	0.033	-	-	0.127	0.030	0.036	0.015	0.019	0.027	0.022	0.013
Mid-top	0.033	0.038	-	0.034	0.034	0.092	0.019	0.036	0.009	0.021	0.014	0.018	0.017
Mid-mid	0.036	0.041	-	0.030	0.018	0.084	0.010	0.034	0.011	0.023	0.016	0.020	0.018
Mid-bot	0.039	0.042	-	0.052	0.029	0.123	0.019	0.095	0.037	0.015	0.020	0.018	0.020
South-top	0.026	0.039	-	0.028	0.030	0.084	0.067	0.028	-	0.017	0.013	0.017	-
South-mid	0.034	0.040	-	0.031	0.025	0.096	0.025	0.038	0.007	0.017	0.016	0.022	-
South-bot	0.033	0.051	-	0.037	0.035	0.151	0.015	0.047	0.009	0.016	0.018	0.018	-

Table 19. Orthophosphorus in Newman Lake profiles, 2004. All values in mg/L, as P.

Date	*3/27/04*	*4/17/04*	*5/12/04*	*5/28/04*	*6/11/2004*	*6/25/2004*	*7/15/2004*	*8/5/2004*	*8/13/2004*	*8/27/2004*	*9/10/2004*	*9/24/2004*	*10/9/2004*
North-top	<.003	<.003	<.003	-	<.003	0.073	<.003	<.003	<.003	<.003	<.003	<.003	<.003
North-mid	<.003	<.003	<.003	-	<.003	0.093	<.003	<.003	<.003	<.003	<.003	<.003	-
North-bot	<.003	<.003	<.003	-	<.003	0.127	<.003	<.003	<.003	<.003	<.003	<.003	<.003
Mid-top	<.003	<.003	-	<.003	<.003	0.092	<.003	<.003	<.003	<.003	<.003	<.003	<.003
Mid-mid	<.003	<.003	-	<.003	<.003	0.084	<.003	<.003	<.003	<.003	<.003	<.003	<.003
Mid-bot	<.003	<.003	-	<.003	<.003	0.123	<.003	<.003	<.003	<.003	<.003	<.003	<.003
South-top	<.003	<.003	-	<.003	<.003	0.084	<.003	<.003	-	<.003	<.003	<.003	-
South-mid	<.003	<.003	-	<.003	<.003	0.096	<.003	<.003	<.003	<.003	<.003	<.003	-
South-bot	<.003	<.003	-	<.003	<.003	0.151	<.003	<.003	<.003	<.003	<.003	<.003	-

Appendix C: Summary Milfoil Reports and NPDES Monitoring Forms, 2003-2005

July - August 2003

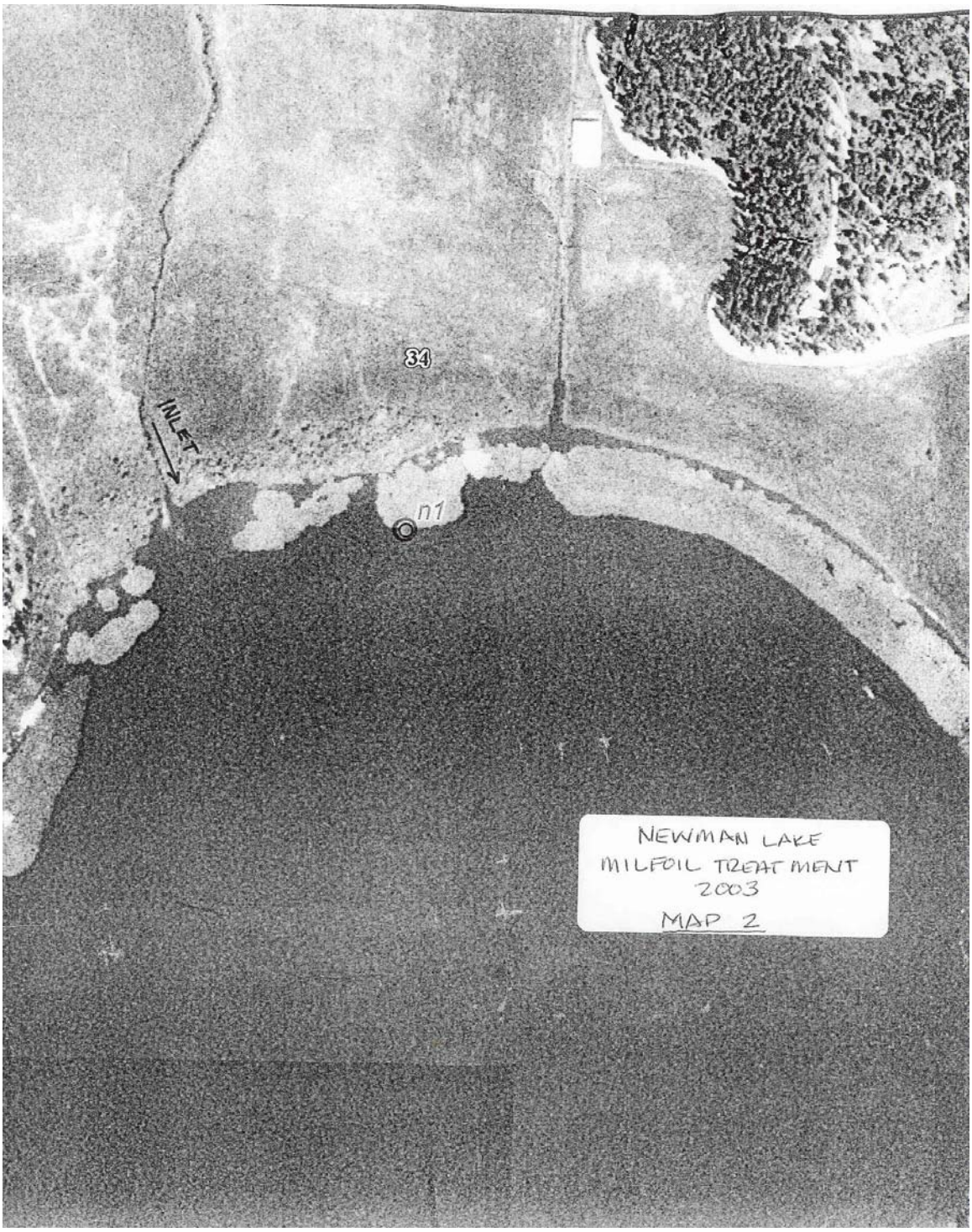
Newman Lake Milfoil - Treatment Areas July 2003

Location	Description	Treatment	Approx. Area (acres)
S3 to S9	Areas of sparse to dense infestations west and north west of outlet gate requiring herbicide application	Aqua-Kleen 7/28/2003	11.1
S2 to S3	Only one plant at S2, but area of potential infestation in between	Aqua-Kleen 7/28/2003	1.4
S1 and S1a	Large clump at each point	Aqua-Kleen 7/28/2003	0.25
HB1-HB2	One large plant plus other small ones	Aqua-Kleen 7/28/2003	0.5
HB3	One plant + other potential plants?	Aqua-Kleen 7/28/2003	0.25
N1	One plant	Diver Hand pulled, 7/28/03	0
HB4	1 large and 4 small plants in hampton bay	Diver Hand pulled, 7/28/03	0
Outlet Channel	1mile of outlet channel starting 100 feet below gate	Aqua-Kleen 8/25/2003	2
		Total Acres Treated	**15.5**
		Treatment Cost	**$7,950**

Map key of GPS points and Milfoil survey results (from surveys on 6/12 and 6/25/03):

S1	Large clump at about 4 ft depth
S1a	Large plant noted on dive survey 7/24/03
S2	1 small plant at 3 ft depth
S3	several plants off edge of pond lilies at 5 ft deep
S4	Several plants
S5	Many plants all around, 6-8 ft deep
S4-S5	Large open area in lilies infested with milfoil
S6	Many plants all around in old outlet area, treat all the way in, 10 ft deep at S6 but very shallow back in old outlet area
S7	Some plants off Bise property near new outlet
S8	Milfoil plants off resort in cleared areas
S9	No milfoil but aprox. End of treatment area- last plant spotted off of Davis/Munroe property about 100-200 feet SE
HB1,HB2	One plant spotted south of Hampton Bay in 10 ft of water, HB1 drifted as significant wind
HB3	One plant spotted south of Hampton Bay in 10 ft of water
HB4	1 large plant off Bolks dock (7/11/03 from dock) and 4 small plants in Hampton bay per dive survey 7/24/03
N1	One plant in about 5' water


Q1
Q3
1B
3B
hb3
hb2
hb1
s9
s8
outlet gage
s7
PRE
1A
3A
Q2
s6buoy2
s7buoy
s6
s5buoy2
s4buoy
s4
s5
s3buoy
s3
s2buoy
s2
s1a
s1
NEWMAN LAKE MILFOIL
TREATMENT - 2003
MAP 1
SCALE: 1" = 400'
- 2,4-D treatment
- Handpull
1A - SAMPLE LOCATION


34
INLET
n1
NEWMAN LAKE
MILFOIL TREATMENT
2003
MAP 2

NEWMAN LAKE
OUTLET CHANNEL
MILFOIL TREATMENT
AUGUST 25, 2003
MAP 3

NOXIOUS NPDES PERMIT HERBICIDE MONITORING FORM

Part I - Sample Collection Information

Sample(s) Collected by:	Marianne Barrentine	Waterbody Name:	Newman Lake
Representing:	Spokane County Engineers/NLFCZD	County:	Spokane
Mailing Address:	1026 W Broadway Ave	Targeted Plants:	Eurasian Water Milfoil
City/Zip	Spokane WA 99260-1070		
Telephone:	509-477-7443		
Email Address:	mbarrentine@spokanecounty.org		

Sample #	Dates Treated	Herbicide Applied (Trade Name)	Date & Time Sample Collected	Application Rate (ppm or lb per acre)	Treated Area (In Acres) *	Sample Location *	Collection Method and Shipping, Handling Protocols
PRE	7/28/03	Aqua-Kleen	7/24/03 5:40 pm	100 lb/ac	13.5	Off outlet gate	Surface sample taken per instructions; used brown glass bottle and transported to Anatek lab in Spokane on ice in cooler provided by lab; Lab courier transported to Moscow ID for analysis
1A	7/28/03	Aqua-Kleen	7/29/03 12:05 pm	100 lb/ac	13.5	Off outlet gate	
1B	7/28/03	Aqua-Kleen	7/29/03 12:10 pm	100 lb/ac	13.5	Off Boat Launch	
3A	7/28/03	Aqua-Kleen	7/31/03 12:40 pm	100 lb/ac	13.5	Off outlet gate	
3B	7/28/03	Aqua-Kleen	7/31/03 12:40 pm	100 lb/ac	13.5	Off Boat Launch	

* Include a map of the waterbody with the following information:

- Sample locations by sample number as listed in the table above
- Treatment area, if not the whole waterbody
- In-flow and out-flow locations, if applicable

Part II – Laboratory Analysis Information

Laboratory Name: Anatek Labs, Inc
Mailing Address: 1282 Alturas Dr.
City/Zip Moscow, ID 83843
Telephone: 208-883-2839
Email Address: Moscow@anateklabs.com

Accredited by Ecology for parameter analyzed: ☒ Yes ☐ No

Sample #	Date Analyzed	Parameter Name	Analytical Method Number	Chemical Abstract Service (CAS) Number	Method Detection Limit (MLD)	Laboratory Practical Quantitation Limit (PQL)	Concentration Detected (ppb or ppm)
PRE	7/29/03	2,4-D	8151A	94757	.05 ppb	0.1 ppb	ND
1A	7/30/03	2,4-D	8151A	94757	.05 ppb	0.1 ppb	34.1 ppb
1B	7/30/03	2,4-D	8151A	94757	.05 ppb	0.1 ppb	19.0 ppb
3A	8/4/03	2,4-D	8151A	94757	.05 ppb	0.1 ppb	111 ppb
3B	8/4/03	2,4-D	8151A	94757	.05 ppb	0.1 ppb	29.7 ppb

Additional Analysis: Additional Samples sent to Cerexagri Lab in King of Prussia, PA for 2,4D testing. This lab is not yet accredited by Washington State Dept. of Ecology and results were only provided verbally. Results per phone conversation with Jayne Walz, 8/1/03 are provided below:

Sample #	Date & Time Collected	Location Collected	Collection Method and Shipping and Handling	Results
Q1	7/29/03 12:20 pm	Secondary treatment area N. of boat launch	Surface sample taken per instructions in small brown plastic bottle provided by Aquatechnex, sample bottle placed in Ziploc bag & FedEx'd overnight on collection date to lab	40 ppb
Q2	7/30/03 10:40 am	Off outlet gate		110 ppb
Q3	7/30/03 10:40 am	Secondary treatment area N. of boat launch		21 ppb

Part III – Treatment Results (optional, but recommended)

Did you survey the treated areas after treatment?	Yes
Date of survey:	8/6/03
Survey methods	Visual assessment from boat and some docks in treated areas
Were the targeted plants dead or dying?	Yes
How would you rate the treatment efficacy?	95-100%
Secchi disk reading (if taken):	1.5 meters
Any adverse impacts (algae blooms/fish kill)?	Some burn back and wilting of lilies, *Nuphar polysepala* and *Nymphaea odorata* in treatment area. Did not seem to kill the plants though.

October 2003

Newman Lake Milfoil - Survey/Treatment Areas October 2003

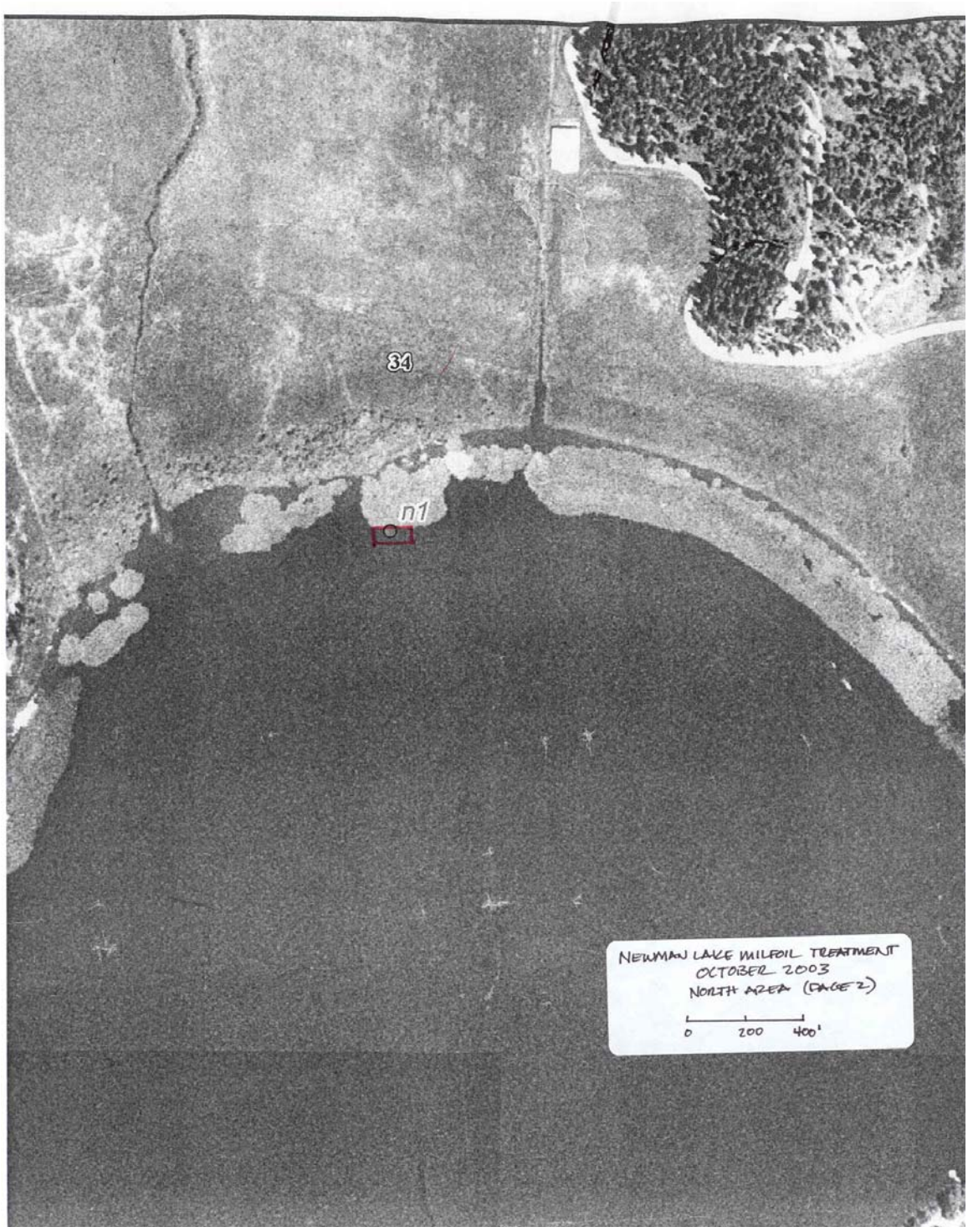
Location	Description	Treatment	Approx. treatment Area (acres)
S1-S4oct	Area of regrowth of large plants west of outlet gate (about 800' x 100') Water depth in area treatment about 3-6 feet	Aqua-Kleen, 10/21/03, 10:15 AM	2
BL1oct-BL4oct	Area of large bushy plants just north of boat launch (about 250' x 250') Water depth in treatment area about 5-10 feet	Aqua-Kleen, 10/21/03, 10:50 AM	1.5
S1oct and S1a	2-3 large vigorous plants and regrowth on brown plant at S1a Water depth in area treatment about 3-5 feet	Aqua-Kleen, 10/21/03. 11:20 AM	0.25
N1	Two small plants at location of summer hand pull Water depth in area treatment about 3-5 feet	Aqua-Kleen, 10/21/03, 12:00 Pm	0.25
		Total treatment area	**4**

Additional GPS points taken 10/21/03:		**Additional GPS points taken 10/24/03:**
N2Oct	Small scattered plants found in small bay adjacent to N1	bl100sam - sample point 100 m offshore from blsamp
N3Oct	East end of North treatment area	bl200sam - sample point 200 m offshore from blsamp
N4oct	West end of North treatment area	s100sam - sample point 100 m offshore from ssamp
blsamp	sample point in boat launch treatment area	s200sam - sample point 200 m offshore from ssamp
ssamp	sample point in south treatment area near outlet gate	

Map key of GPS points and Milfoil survey results (from surveys on 9/30 and 10/8/03):

S1oct	edge of regrowth area, occasional plant in shallows (3' depth) near edge of lilies
S2oct	Area of dense plants short green reqrowth on brown plants
S3oct	At outside edge, about 50', area still thick with plants
S4oct	End of regrowth area infestation, east of outlet gate
BL1oct-BL4oct	Many large vigorously growing plants, all green - gps points generally bracket area
N1	Two small plants in about 3' of water at edge of lilies (near location of hand pulled plant at N1)
S1oct*	2-3 large vigorous plants in far south summer treatment area, some regrowth on brown plant at S1a


WDFW PUBLIC BOAT LAUNCH
CHEROKEE RESORT BOAT LAUNCH
bl3oct
bl4oct
bl1oct
s3oct
s4oct
s1oct
s2oct
11
NEWMAN LAKE MILFOIL TREATMENT
OCTOBER 2003
SOUTH AREAS (PAGE 1)
0
200'
400'
s1oct


84
n1
NEWMAN LAKE MILFOIL TREATMENT
OCTOBER 2003
NORTH AREA (PAGE 2)
0
200
400'

NOXIOUS NPDES PERMIT HERBICIDE MONITORING FORM

(Use the Tab Key to navigate between form fields or place the curser to enter data)

Part I - Sample Collection Information

Sample(s) Collected by:	Marianne Barrentine	Waterbody Name:	Newman Lake
Representing:	Spokane County Engineers/NLFCZD	County:	Spokane
Mailing Address:	1026 W Broadway Ave	Targeted Plants:	Eurasian Water Milfoil
City/Zip	Spokane WA 99260-1070		
Telephone:	509-477-7443		
Email Address:	mbarrentine@spokanecounty.org		

Sample #	Dates Treated	Herbicide Applied (Trade Name)	Date & Time Sample Collected	Application Rate (ppm or lb per acre)	Treated Area (In Acres) *	Sample Location *	Collection Method and Shipping, Handling Protocols
PRE	7/28/03	Aqua-Kleen	7/24/03 5:40 pm	100 lb/ac	13.5	Off outlet gate	Surface sample taken per instructions; used brown glass bottle and transported to Anatek lab in Spokane on ice in cooler provided by lab; Lab courier transported to Moscow ID for analysis
1A	7/28/03	Aqua-Kleen	7/29/03 12:05 pm	100 lb/ac	13.5	Off outlet gate	
1B	7/28/03	Aqua-Kleen	7/29/03 12:10 pm	100 lb/ac	13.5	Off Boat Launch	
3A	7/28/03	Aqua-Kleen	7/31/03 12:40 pm	100 lb/ac	13.5	Off outlet gate	
3B	7/28/03	Aqua-Kleen	7/31/03 12:40 pm	100 lb/ac	13.5	Off Boat Launch	

* Include a map of the waterbody with the following information:

- Sample locations by sample number as listed in the table above
- Treatment area, if not the whole waterbody
- In-flow and out-flow locations, if applicable

Part II – Laboratory Analysis Information

Laboratory Name: Anatek Labs, Inc
Mailing Address: 1282 Alturas Dr.
City/Zip Moscow, ID 83843
Telephone: 208-883-2839
Email Address: Moscow@anateklabs.com

Accredited by Ecology for parameter analyzed: ☒ Yes ☐ No

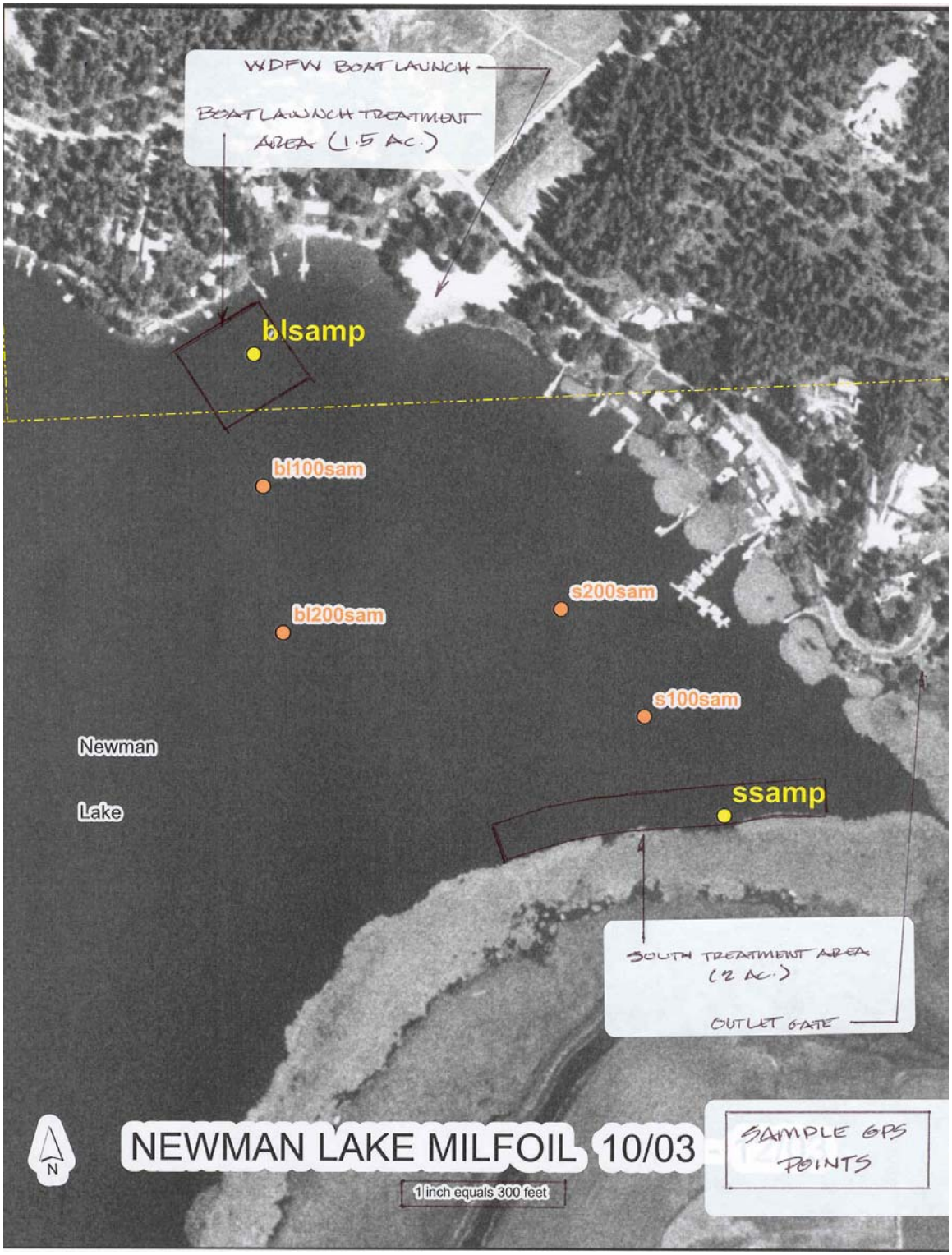
Sample #	Date Analyzed	Parameter Name	Analytical Method Number	Chemical Abstract Service (CAS) Number	Method Detection Limit (MLD)	Laboratory Practical Quantitation Limit (PQL)	Concentration Detected (ppb or ppm)
PRE	7/29/03	2,4-D	8151A	94757	.05 ppb	0.1 ppb	ND
1A	7/30/03	2,4-D	8151A	94757	.05 ppb	0.1 ppb	34.1 ppb
1B	7/30/03	2,4-D	8151A	94757	.05 ppb	0.1 ppb	19.0 ppb
3A	8/4/03	2,4-D	8151A	94757	.05 ppb	0.1 ppb	111 ppb
3B	8/4/03	2,4-D	8151A	94757	.05 ppb	0.1 ppb	29.7 ppb

Additional Analysis: Additional Samples sent to Cerexagri Lab in King of Prussia, PA for 2,4D testing. This lab is not yet accredited by Washington State Dept. of Ecology and results were only provided verbally. Results per phone conversation with Jayne Walz, 8/1/03 are provided below:

Sample #	Date & Time Collected	Location Collected	Collection Method and Shipping and Handling	Results
Q1	7/29/03 12:20 pm	Secondary treatment area N. of boat launch	Surface sample taken per instructions in small brown plastic bottle provided by Aquatechnex, sample bottle placed in Ziploc bag & FedEx'd overnight on collection date to lab	40 ppb
Q2	7/30/03 10:40 am	Off outlet gate		110 ppb
Q3	7/30/03 10:40 am	Secondary treatment area N. of boat launch		21 ppb

Part III – Treatment Results (optional, but recommended)

Did you survey the treated areas after treatment?	Yes
Date of survey:	8/6/03
Survey methods	Visual assessment from boat and some docks in treated areas
Were the targeted plants dead or dying?	Yes
How would you rate the treatment efficacy?	95-100%
Secchi disk reading (if taken):	1.5 meters
Any adverse impacts (algae blooms/fish kill)?	Some burn back and wilting of lilies, *Nuphar polysepala* and *Nymphaea odorata* in treatment area. Did not seem to kill the plants though.


WDFW BOAT LAUNCH
BOAT LAUNCH TREATMENT AREA (1.5 AC.)
blsamp
bl100sam
bl200sam
s200sam
s100sam
Newman
Lake
ssamp
SOUTH TREATMENT AREA (2 AC.)
OUTLET GATE
N
NEWMAN LAKE MILFOIL 10/03
1 inch equals 300 feet
SAMPLE GPS POINTS

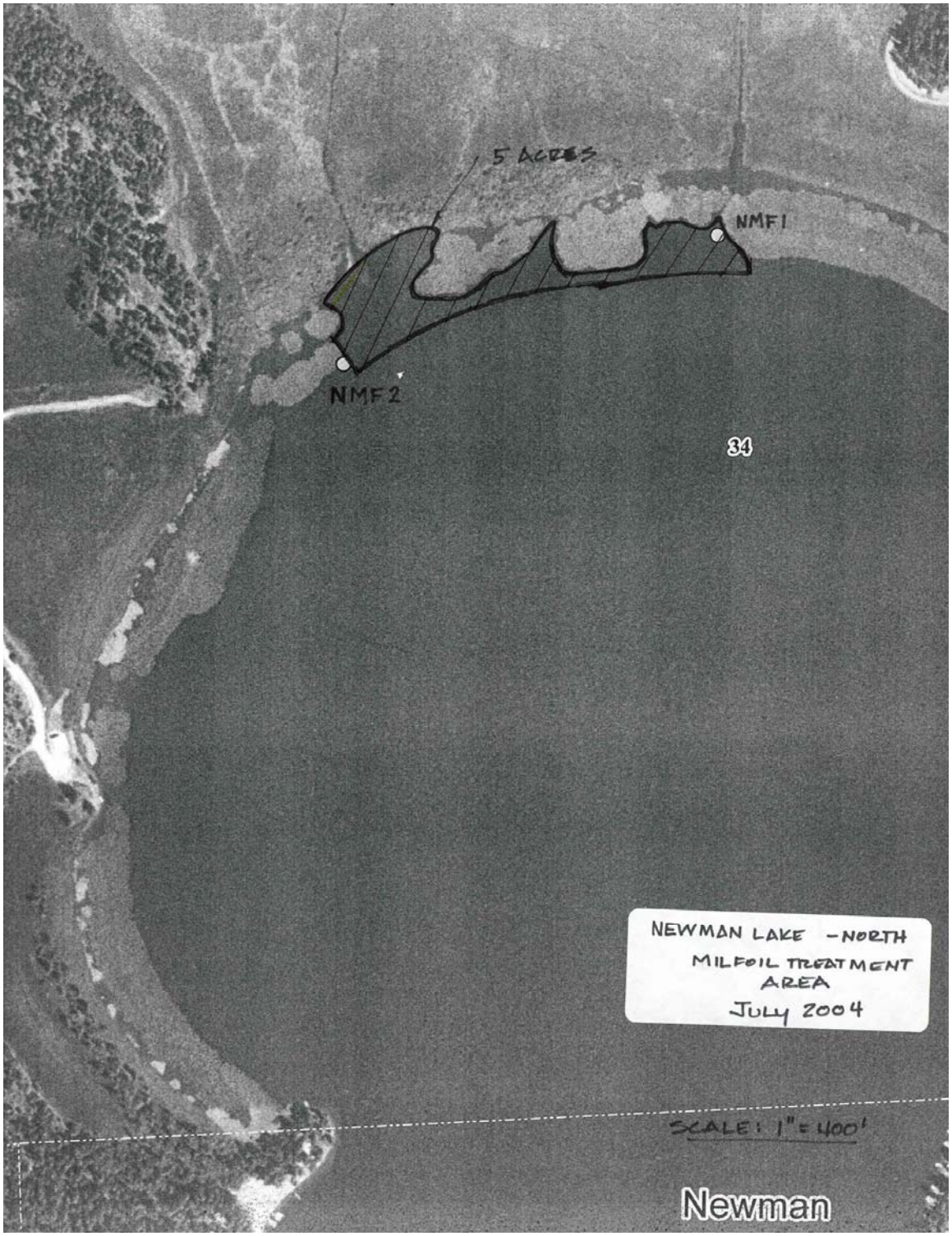
2004 Treatment Reports

Newman Lake Milfoil - Treatment Areas June 2004

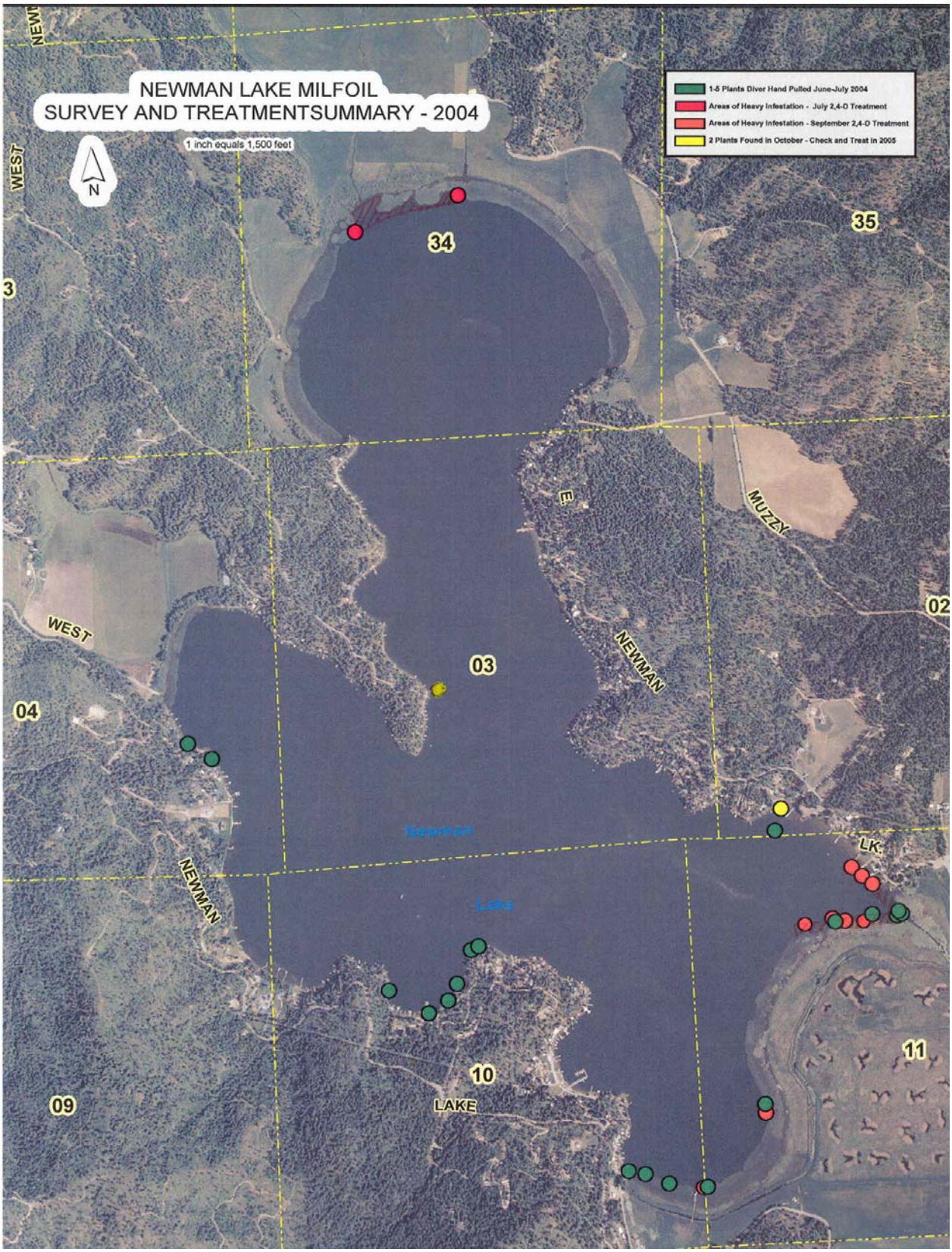
Location	Description	Treatment	Approx. Area (acres)
NMF1-2	Large area of many plants	Aqua-Kleen 7/6/2004 (10:10-10:45 AM)	5
		Total Acres Treated	**5**

Newman Lake Milfoil - Treatment Areas September 2004

Location	Description	Treatment	Approx. Area (acres)
smf1-3ck	Area of numerous small plants at south end from Cherokee resort to outlet gate	Aqua-Kleen	3
smf4-6	many large plants growing along nuphar west of outlet gate	Aqua-Kleen	1.5
swmf8 swmf9	Single large plant, spot treat with 50x100' area Single large plant, spot treat with 50x150' area	Aqua-Kleen	0.3
		Total Acres Treated	**4.8**


5 ACRES
NMF1
NMF2
34
NEWMAN LAKE -NORTH
MILFOIL TREATMENT
AREA
JULY 2004
SCALE: 1" = 400'
Newman


smf1ck
smf2ck
smf3ck
smf6
smf5
smf4
11
swmf8
swmf9


NEWMAN LAKE MILFOIL
SURVEY AND TREATMENTSUMMARY - 2004
1 inch equals 1,500 feet
N
1-5 Plants Diver Hand Pulled June-July 2004
Areas of Heavy Infestation - July 2,4-D Treatment
Areas of Heavy Infestation - September 2,4-D Treatment
2 Plants Found in October - Check and Treat in 2005
WEST
34
35
3
E.
MUZZY
02
WEST
NEWMAN
03
04
Newman
LK.
NEWMAN
Lake
11
10
09
LAKE

NOXIOUS NPDES PERMIT HERBICIDE MONITORING FORM

(Use the Tab Key to navigate between form fields or place the curser to enter data)

Part I - Sample Collection Information

Sample(s) Collected by:	Marianne Barrentine	Waterbody Name:	Newman Lake
Representing:	Spokane County Engineers/NLFCZD	County:	Spokane
Mailing Address:	1026 W Broadway Ave	Targeted Plants:	Eurasian Water Milfoil
City/Zip	Spokane WA 99260-1070		
Telephone:	509-477-7443		
Email Address:	mbarrentine@spokanecounty.org		

Sample #	Dates Treated	Herbicide Applied (Trade Name)	Date & Time Sample Collected	Application Rate (ppm or lb per acre)	Treated Area (In Acres) *	Sample Location *	Collection Method and Shipping, Handling Protocols
1NORTH	7/6/04	Aqua-Kleen	7/2/04 9:35 am	100 lb/ac	5	Treatment area @ nsam1	Surface sample taken per instructions; used brown glass bottle and transported to Anatek lab in Spokane on ice in cooler provided by lab; Lab courier transported to Moscow ID for analysis
2NORTH	7/6/04	Aqua-Kleen	7/9/04 10:40 pm	100 lb/ac	5	Treatment area @ nsam1	
3NORTH	7/6/04	Aqua-Kleen	7/9/04 10:50 pm	100 lb/ac	5	200 M South of Treatment area @ nsam2	
4NORTH	7/6/04	Aqua-Kleen	7/16/04 1:50 pm	100 lb/ac	5	Treatment area @ nsam1	
5NORTH	7/6/04	Aqua-Kleen	7/16/04 1:40 pm	100 lb/ac	5	200 M South of Treatment area @ nsam2	

* Include a map of the waterbody with the following information:

- Sample locations by sample number as listed in the table above
- Treatment area, if not the whole waterbody
- In-flow and out-flow locations, if applicable

Part II – Laboratory Analysis Information

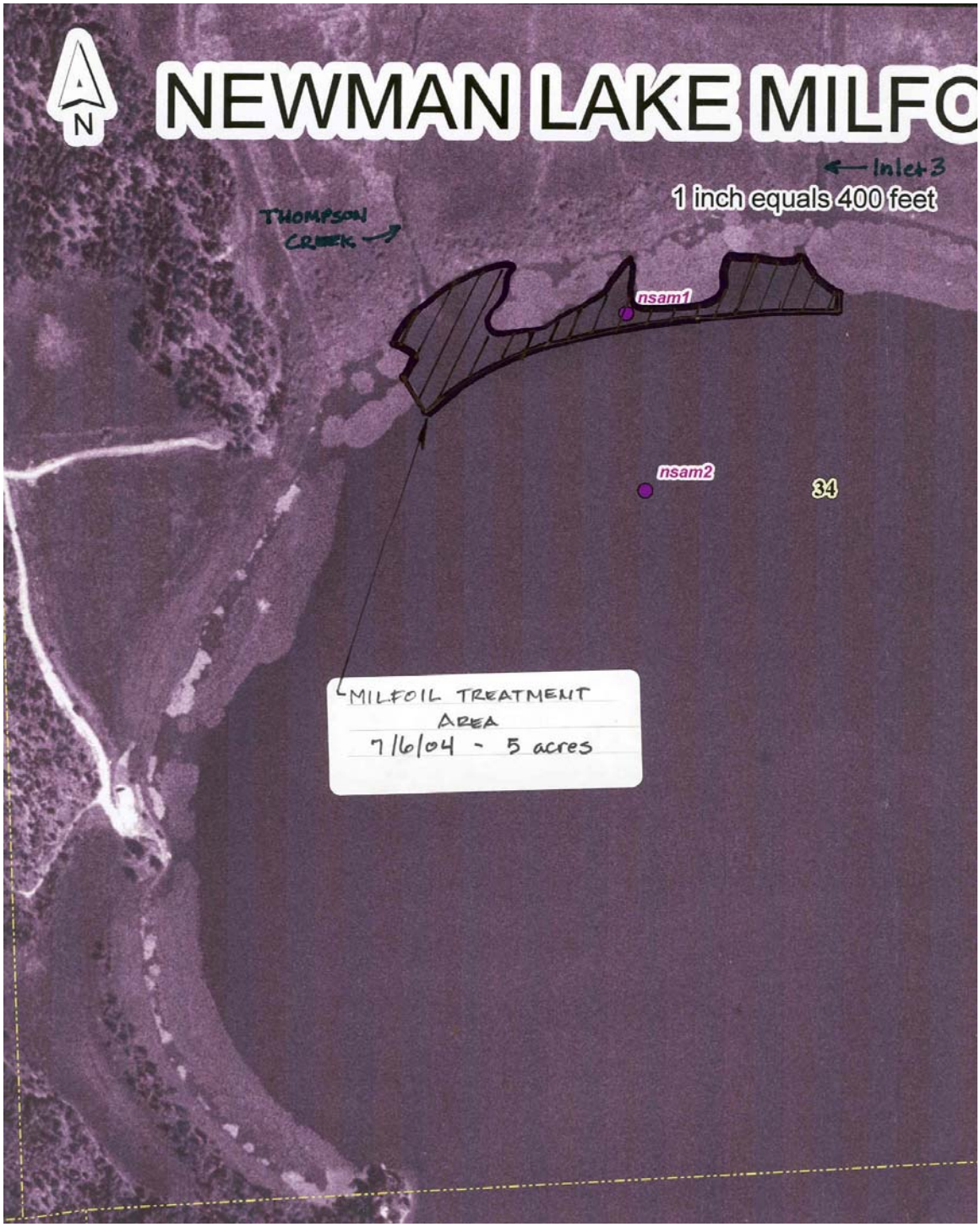
Laboratory Name:	Anatek Labs, Inc
Mailing Address:	1282 Alturas Dr.
City/Zip	Moscow, ID 83843
Telephone:	208-883-2839
Email Address:	Moscow@anateklabs.com

Accredited by Ecology for parameter analyzed: ☒ Yes ☐ No

Sample #	Date Analyzed	Parameter Name	Analytical Method Number	Chemical Abstract Service (CAS) Number	Method Detection Limit (MLD)	Laboratory Practical Quantitation Limit (PQL)	Concentration Detected (ppb or ppm)
1NORTH	7/9/04	2,4-D	8151A	94757	.05 ppb	0.1 ppb	ND
2NORTH	7/22/04	2,4-D	8151A	94757	.05 ppb	0.1 ppb	11.0 ppb
3NORTH	7/22/04	2,4-D	8151A	94757	.05 ppb	0.1 ppb	6.4 ppb
4NORTH	7/22/04	2,4-D	8151A	94757	.05 ppb	0.1 ppb	10.2 ppb
5NORTH	7/22/04	2,4-D	8151A	94757	.05 ppb	0.1 ppb	3.4 ppb

Part III – Treatment Results (optional, but recommended)

Did you survey the treated areas after treatment?	Yes
Date of survey:	8/18/04
Survey methods	Visual assessment from boat in treated areas
Were the targeted plants dead or dying?	Yes
How would you rate the treatment efficacy?	95% (found only two small milfoil brown but trying to re-grow)
Secchi disk reading (if taken):	1.5 meters
Any adverse impacts (algae blooms/fish kill)?	None


N
NEWMAN LAKE MILFO
Inlet 3
1 inch equals 400 feet
THOMPSON CREEK
nsam1
nsam2
34
MILFOIL TREATMENT AREA
7/6/04 - 5 acres

NOXIOUS NPDES PERMIT HERBICIDE MONITORING FORM

(Use the Tab Key to navigate between form fields or place the curser to enter data)

Part I - Sample Collection Information

Sample(s) Collected by:	Marianne Barrentine	Waterbody Name:	Newman Lake
Representing:	Spokane County Engineers/NLFCZD	County:	Spokane
Mailing Address:	1026 W Broadway Ave	Targeted Plants:	Eurasian Water Milfoil
City/Zip	Spokane WA 99260-1070		
Telephone:	509-477-7443		
Email Address:	mbarrentine@spokanecounty.org		

Sample #	Dates Treated	Herbicide Applied (Trade Name)	Date & Time Sample Collected	Application Rate (ppm or lb per acre)	Treated Area (In Acres) *	Sample Location *	Collection Method and Shipping, Handling Protocols
1SOUTH	9/21/04	Aqua-Kleen	9/21/04 9:35 am	100 lb/ac	4.8	Treated area – off of Cherokee resort dock	Surface sample taken per instructions; used brown glass bottle and transported to Anatek lab in Spokane on ice in cooler provided by lab; Lab courier transported to Moscow ID for analysis
2SOUTH	9/21/04	Aqua-Kleen	9/23/04 4:10 pm	100 lb/ac	4.8	Treated area – off of Cherokee resort dock	
3SOUTH	9/21/04	Aqua-Kleen	9/23/04 4:20 pm	100 lb/ac	4.8	500 m ENE of treatment area	
4SOUTH	9/21/04	Aqua-Kleen	1/1/04 10:55 am	100 lb/ac	4.8	Treated area – off of Cherokee resort dock	
5SOUTH	9/21/04	Aqua-Kleen	1/1/04 10:50 am	100 lb/ac	4.8	500 m ENE of treatment area	

* Include a map of the waterbody with the following information:

- Sample locations by sample number as listed in the table above
- Treatment area, if not the whole waterbody
- In-flow and out-flow locations, if applicable

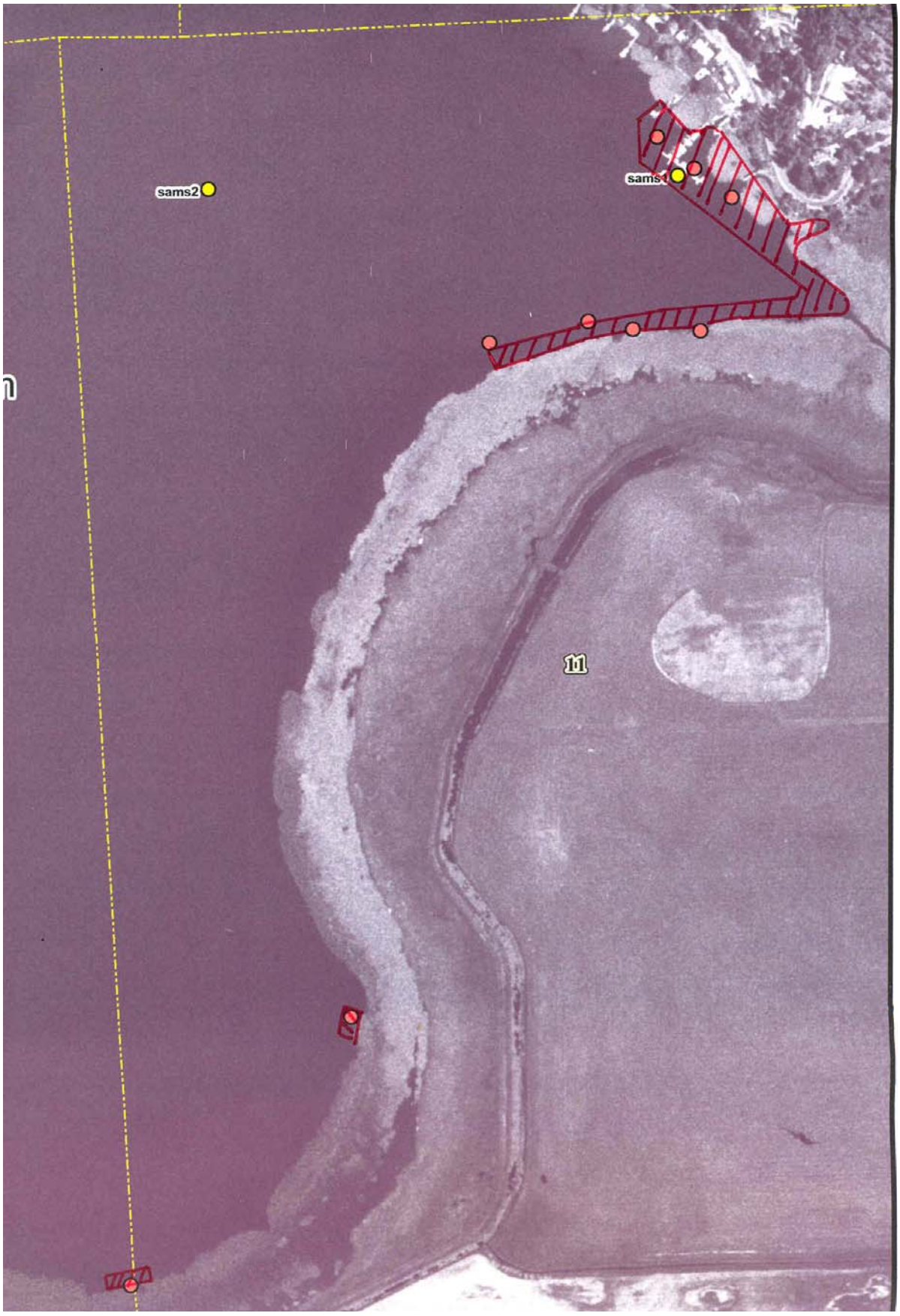
Part II – Laboratory Analysis Information

Laboratory Name: Anatek Labs, Inc
Mailing Address: 1282 Alturas Dr.
City/Zip Moscow, ID 83843
Telephone: 208-883-2839
Email Address: Moscow@anateklabs.com
Accredited by Ecology for parameter analyzed: ☒ Yes ☐ No

Sample #	Date Analyzed	Parameter Name	Analytical Method Number	Chemical Abstract Service (CAS) Number	Method Detection Limit (MLD)	Laboratory Practical Quantitation Limit (PQL)	Concentration Detected (ppb or ppm)
1SOUTH	-----	Sample bottle damaged & not analyzed					
2SOUTH	10/1/04	2,4-D	8151A	94757	.05 ppb	0.1 ppb	51.7 ppb
3SOUTH	10/1/04	2,4-D	8151A	94757	.05 ppb	0.1 ppb	ND
4SOUTH	10/8/04	2,4-D	8151A	94757	.05 ppb	0.1 ppb	25.7 ppb
5SOUTH	10/8/04	2,4-D	8151A	94757	.05 ppb	0.1 ppb	4.1 ppb

Part III – Treatment Results (optional, but recommended)

Did you survey the treated areas after treatment?	Yes
Date of survey:	10/8/03
Survey methods	Visual assessment from boat in treated areas
Were the targeted plants dead or dying?	Smaller plants yes… Larger plants still at least partially green
How would you rate the treatment efficacy?	?? unclear at this time… will need to check next year
Secchi disk reading (if taken):	2.0 meters
Any adverse impacts (algae blooms/fish kill)?	None yet


sams2
sams1

Newman Lake Milfoil - Treatment Areas 2005

Location	Description	Treatment	Dimensions	Approx. Area (acres)
EASTSIDE (MAP SE) - 7/25/05				
BL3	Scattered small plant	gran 2,4-D- 150/ac	400x300	2.75
E1-E2 and Hampton bay	Numerous small plants	gran 2,4-D- 150/ac	1200'x100' + 600x100'	4.15
BL1-BL2	Numerous med. to large plants off nuphar	gran 2,4-D- 150/ac	400'x350'	3.2
blsptr2/bl3	additional spot treat	gran 2,4-D- 150/ac	2-50'x50'	0.1
			subtotal east shore	**10.2**
SOUTHEAST SHORE (MAP SE) - 7/26/05				
S1-S2 + outlet	Numerous large to med. plants	gran 2,4-D- 150/ac	1200 x 100' +1/2(500x300) + 600x50	5.15
str1	Additonal area of large plants off of S!	gran 2,4-D- 150/ac	200x250	1.1
			Subtotal South Shore	**6.25**
SOUTHEAST SHORE (MAP SW) - 7/26/05				
W9-W10	Honeymoon Bay - numerous med plants	gran 2,4-D- 150/ac	400x100+200x150+600x200+150x100x1/2+450x100	5.55
S13-S10	HMBay rd to east of Wicks dock	gran 2,4-D- 150/ac	1400'x50'	1.6
s11,s17,s18 and w12	add'l spot treatments	gran 2,4-D- 150/ac		0.2
			Subtotal SE Shore	**7.35**
NORTH & NORTHWEST SHORE (MAP N & NW) 7/26/05				
NW2	Numerous med. Plants off nuphar	gran 2,4-D- 150/ac	400'x100'	0.9
N3-N5	Area of numerous med. plants east of TC inlet	gran 2,4-D- 150/ac	400' x 100' +1/2(300x100)	1.25
N4	few small plants in shallow water (<3')	gran 2,4-D- 150/ac	250' x 150'	0.85
N6	Numerous med. Plants just off nuphar	gran 2,4-D- 150/ac	300x50	0.35
			Subtotal N/NW Shore	**3.4**
PARK BEACH/SUTTON BAY (MAP W2) - 8/1/05				
WDS6 - W2	Numerous small to med. Plants in Sutton Bay	gran 2,4-D- 150/ac	900' x 100'	2.1
w8 - w3	Numerous small to med. Plants in along beach btw HM and Sutton bays	gran 2,4-D- 150/ac	1900' x 100'	4.4
			Subtotal ParkBeach/SuttonBay	**6.5**
PENINSULA/Northeast shore (MAP NW2) - 8/22/05				
NW3-NW22	Scattered sm to med. Plants along	gran 2,4-D- 150/ac	1800'x75'	3.1

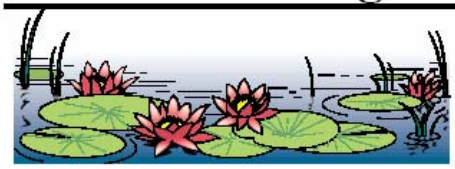
	shore west side pen.			
nw4-nw7	numerous small to med plants along shore east side pen.	gran 2,4-D- 150/ac	2000x100'	4.6
nw9 & nw10	small plants near shore (ne pen.)	gran 2,4-D- 150/ac	50x100 + 100x400	1
ns1-e12	numerous small to med plants along northeast shore	gran 2,4-D- 150/ac	3300x75 + 600x150	7.7
Bass pt	numerous small to med plants along shore	gran 2,4-D- 150/ac	1700'x75'	2.9
			Subtotal Penin. & NE shore	**19.3**
Outlet gate area (Map SE2) 8/23/05				
Cherokee Resort	numerous small plants near shore, 2 + lg plants off shore	gran 2,4-D- 150/ac	600x400 + 200X200	**6.4**
Sutton Bay Add	scattered small plants near shore	gran 2,4-D- 150/ac	600x100	**1.4**
		Total Acres Treated		**60.8**

Appendix D: Bottom Barrier Installations Instructions

From WDOE web site

A Department of Ecology Fact Sheet

Instructions for Building and Installing Bottom Screens



Many lake-front residents have problems with aquatic plants growing in swimming areas or alongside docks. Bottom screening provides an inexpensive and effective means of controlling these plants. This document provides instructions for building and installing bottom screens.

A bottom screen is a cloth-like material that covers the lake bottom like a blanket. Bottom screens block light, preventing the growth of aquatic plants. Bottom screening (bottom barriers) can be an excellent method of controlling aquatic plants at swimming beaches and in boat mooring areas.

Most aquatic plants can be controlled with bottom screens. Waterlilies are controlled well, although installation and maintenance difficulties can be created by their large roots and the mucky sediments in which they sometimes grow. Plants such as coontail and bladderwort that do not root in the sediment, can not be controlled by bottom screening.

Bottom screens can be installed by the home owner. The material may be placed directly on the lake bottom or attached to frames to facilitate handling under water. The use of bottom screens is usually confined to shallow water, unless diving gear is available.

Materials Required for Three 12'x12' Bottom Screen Frames

- Fifteen 2" x 2"s, each twelve feet long.
  Note: Fir and cedar 2" x 2"s are suitable and may be more readily available, in twelve foot lengths, than pine.
- Nails (#6 Spiral) or screws, 2" long.
- Marine plywood, ¼" for making gussets. Forty-eight gussets are required for bracing, top and bottom of each of the three 12'x12' frames *(see sketch below)*. Approximately twelve square feet of plywood is required.
- Lath (if nails instead of staples are used for securing material to the frames). About 165 lineal feet required.
- Screening material, allowing for some selvage, about 440 square feet required.
- Twelve polypropylene bags 2'x2' for use as sandbags.
- Clean sand or gravel to fill twelve bags approximately ¾ full, about 1 cubic yard.

Tools Required

- Hammer
- Saw
- Utility knife or heavy scissors for cutting material.
- Staple gun (if staples are used instead of lath for securing material to the frames).

Building Instructions

A. Screening Materials

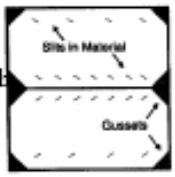
Screening materials should be opaque and of a sturdy material that doesn't tear easily. Ideally these materials should be heavier than water and permeable to the gases that will be generated by rotting vegetation.

Materials suitable for screening include burlap, woven synthetics, perforated black mylar, landscaping fabric (sold in hardware stores and at plant nurseries), and geotextiles used in road construction. Keep in mind that some fabrics, such as burlap, will deteriorate more rapidly than others.

Instructions for Building and Installing Bottom Screens Publication #WQFA-94-1 Page 1

B. *Screen Construction*

1. Lay out the 2 x 2's for one frame - four sides, plus middle brace.
2. Measure and cut gussets from the ¼" marine plywood. These will be triangular pieces with each side 5" long. Sixteen gussets are required for each frame.



3. Nail or use screws to secure gussets at each corner of the frame and at both ends of the center brace on the "up" or visible side of the frame.
4. Carefully turn the frame over and lay the screening material on top.

   Note: Screening material can be used in six foot widths if it is more conveniently available.
5. Nail gussets or use screws to secure them to one end of the frame with the screening material underneath.
6. From the opposite end of the frame, pull the material tight and nail or screw down gussets.
7. Staple the screening material to each of the 2 x 2's so that it is secured along the entire length (or nail down, using the lath).
8. Trim excess material even with the outside of the frame.

9. Repeat for other frames.

C. *Sand Bags*

Sand bags are used to anchor the bottom screens to the sediment. Even the most porous materials will billow due to gas buildup, sometimes causing the frame to "lift off " the bottom. Therefore, it is very important to anchor the bottom screen securely. 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.

1. Fill each bag about ⅔ full with <u>clean</u> sand or gravel (fill material containing dirt cloud the water as the bags are put into place). If the screen site has a soft or muck bottom try filling the bags only ½ full. The bags may cause the screens to sink if the sediment is very soft.
2. Tie the bags closed with string.

D. *Placing Bottom Screens*

Site Considerations:

Installation is easier in the winter or early spring when plants have died back. In summer, it's desirable to cut or hand-pull the plants first.

Be aware that boat propellers may dislodge bottom screens in shallow areas. Also fish hooks can get caught in the material. If the screened area is to be used for boat mooring, swimming, fishing, or wading, it may be prudent to post a sign telling users that the bottom screen is in place.

1. Remove any sticks and stones from the area to be screened, especially where the edges of the frame will lie.
2. Slide the frame into the water. This can be more easily done with two people.
3. While the screens are floating on the surface, cut slits about one inch long in the material, in a pattern similar to that shown in the sketch shown above. This will allow the air trapped under the screen to escape, making it easier to lower the screen to the bottom. The slits will also allow gases generated by rotting vegetation to escape.
4. If you are installing the screen near a dock, line up the frame with the dock. Lower the frame into place by placing a sandbag on each corner and allowing the frame to slowly sink. Once it is on the bottom and in the position you want, add a sandbag to each end of the center brace.
5. Install the second and third frames adjacent to each other. If two people are working together, one can push while the other squeezes the frames together. Make sure there are no gaps between each frame and that the cross pieces are parallel with the other frames.

6. Place the remaining sand bags, concentrating the weight where the frames meet. Overlap the bags so that they rest partly on each frame. This will help to keep the frame in place.
7. Pull the aquatic weeds along the edge of the frames to keep them from growing over the screened area. Milfoil tends to "canopy" over adjacent areas.
8. If any mechanical harvesting is taking place on the lake, notify the equipment operator about the bottom screen and ask him/her not to harvest in this area.

D. *Relocating Screens*

Bottom screens installed during the growing season will suppress the plants within about four weeks. The bottom screens can then be moved to a new location or be removed for storage. If bottom screens have been in place during the growing season, plant suppression will usually be effective for the remainder of the summer.

Screens are easily moved underwater by two people. They can be moved around the same dock or to an adjacent dock.

E. Maintenance

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 screen and the durability and longevity of the material. Regular maintenance can extend the life of most bottom screens.

1. Frequently check the bottom screen for gas bubbles. If gas bubbles are forming under the material, cut one or two additional slits on top of the bubble to release the gas.
2. If the screens are not removed from the water at the end of the season, they should be checked at the beginning of the new growing season for any accumulation of sediment This can be removed by sweeping or up-ending the screens. Check with the Department of Fish and Wildlife to determine if you need a permit to clean the bottom screens.

F. *Fish Spawning Areas*

Screens covering spawning beds should be moved in the early spring and not replaced until the spawning activity is over, usually sometime during the early summer.

Permits

Bottom screening requires a type of permit called a hydraulic approval, obtained free from the Washington State Department of Fish and Wildlife. In some counties, a shoreline permit may also be required. Check with your local jurisdiction to determine if a shoreline permit is required.

Contacts

Contacts are provided for your convenience. It is not our intention to endorse or promote specific vendors or products and this list may not be comprehensive.

The following companies install bottom screens and may sell bottom screening kits to home owners.

AquaZone
82 Foreman Rd.
McCleary, Washington 98557
(206) 495-3920

Resource Management, Inc.
2900B 29th Ave. SW
Tumwater, Washington 98512
(206) 754-3460

Allied Aquatics
4426 Bush Mountain Dr. SW
Olympia, Washington 98502
(206) 357-3285

Global Diving
2763 13th Ave. SW
Seattle, Washington 98134
(206) 623-0621

If you have special accommodation needs, please contact Kathy Hamel at (206) 407-6562 or (206) 507-7155, Telecommunications Device for the Deaf (TDD).

Acknowledgement: Tom Clingman of Thurston County Lakes Program for his help in preparing this Fact Sheet.

Appendix E: Herbicide labels and MSDS sheets: Navigate®, AquaKleen®, DMA*4IVM®, and Triclopyr (Renovate®)

NAVIGATE®

GRANULAR AQUATIC HERBICIDE FOR CONTROLLING CERTAIN UNWANTED AQUATIC PLANTS

ACTIVE INGREDIENTS:	
2,4-Dichlorophenoxyacetic acid, butoxyethyl ester.....	..27.6%
INERT INGREDIENTS:	...72.4%
TOTAL	100.0%

*Isomer specific by AOAC method No. 6.D01-5
*2,4-Dichlorophenoxyacetic acid equivalent 19% by weight

EPA Reg. No. 71368-4-8959 **EPA Est. No. 407-IA-2**

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

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.

PRECAUTIONARY STATEMENTS
CAUTION
HAZARDS TO HUMANS AND DOMESTIC ANIMALS
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.

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. Do not apply to waters used for irrigation, agricultural sprays, watering dairy animals or domestic water supplies.

Clean spreader equipment thoroughly before using it for any other purposes. Vapors from this product may injure susceptible plants in the immediate vicinity. Avoid drift of dust to susceptible plants.

MIXING OR LOADING: 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.

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

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

STORAGE
Store in original container in a dry secured storage area.

PESTICIDE DISPOSAL
Pesticide wastes are toxic. 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.

NAVIGATE is a trademark of Applied Biochemists
NET WT. 50 LBS. (22.68 KG) **13529**

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.

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.
SUSCEPTIBLE WEEDS		
Water Milfoil (Myriophyllum spp.)	100 TO 200	5
Water stargrass (Heteranthera dubia)		
SLIGHTLY TO MODERATELY RESISTANT WEEDS		
Bladderwort (Utricularia spp.)		
White water Lily (Nymphaea spp.)		
Yellow water lily (Nuphar spp.) Or spatterdock*	150 to 200	7-1/2 to 10
Water shield (Brasenia spp.)		
Water chestnut (Trapa natans)		
Coontail* (Ceratophyllym Demersum)		

- Repeat treatments may be needed

LIMITED WARRANTY AND DISCLAIMER
The manufacturer warrants (a) that this product conforms to the chemical description on the label; (b) that this product reasonably fit for the purposes set forth in the directions for use when it is used in accordance with such directions; and (c) that the directions, warning and other statements on the label are based upon responsible experts' evaluation of reasonable tests of effectiveness, of toxicity to laboratory animals and to plants, and of residues on food crops and upon reports of field experience. Tests have not been made on all varieties or in all states or under all conditions. THE MANUFACTURER NEITHER MAKES NOR INTENDS, NOR DOES IT AUTHORIZE ANY AGENT OR REPRESENTATIVE TO MAKE, ANY OTHER WARRANTIES, EXPRESS OR IMPLIED, AND IT EXPRESSLY EXCLUDES AND DISCLAIMS ALL IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

THIS WARRANTY DOES NOT EXTEND TO, AND THE BUYER SHALL BE SOLELY RESPONSIBLE FOR, ANY AND ALL LOSS OR DAMAGE WHICH RESULTS FROM USE OF THIS PRODUCT IN ANY MANNER WHICH IS INCONSISTENT WITH THE LABEL DIRECTIONS, WARNINGS OR CAUTIONS.

BUYER'S EXCLUSIVE REMEDY AND MANUFACTURER'S OR SELLER'S EXCLUSIVE LIABILITY FOR ANY AND ALL CLAIMS, LOSSES, DAMAGES, OR INJURIES RESULTING FROM THE USE OR HANDLING OF THIS PRODUCT, WHETHER OR NOT BASED IN CONTRACT, NEGLIGENCE, STRICT LIABILITY IN TORT OR OTHERWISE SHALL BE LIMITED. AT THE MANUFACTURER'S OPTION, TO REPLACEMENT OF, OR THE REPAYMENT OF THE PURCHASE P0RICE FOR, THE QUANTITY OF PRODCUT WITH RESPECT TO WHICH DAMAGES ARE CLAIMED. IN NO EVENT SHALL MANUFACTURER OR SELLER BE LIABLE FOR SPECIAL, INDIRECT OR CONSEQUENTIAL DAMAGES RESULTING FROM THE USE OR HANDLING OF THIS PRODUCT.

NOTICE TO BUYER
Purchase of this material does not confer any rights under patents governing this product or the use thereof in countries outside of the United States.

MANUFACTURED FOR:

applied biochemists
MILWAUKEE, WI 1-800-558-5106

Material Safety Data Sheet

EMERGENCY

FOR CHEMICAL EMERGENCY: SPILL, LEAK, FIRE, EXPOSURE OR ACCIDENT CALL
CHEMTREC - DAY or NIGHT - (800) 424-9300

Product Name: **AB NAVIGATE** EPA Reg. No. 71368-4-8959

SECTION I - GENERAL INFORMATION

Manufacturer's Name: APPLIED BIOCHEMISTS
W175 N11163 Stonewood Drive
Suite 234
Germantown, WI 53022-4799
(800) 558-5106

Trade Name & Synonyms: AB NAVIGATE
Chemical Name & Synonyms: 2,4-D: 2,4-DICHLOROPHENOXYACETIC ACID, BUTOXYETHYL ESTER
Generic Description: AQUATIC HERBICIDE
Formula: $C_{12}H_{18}Cl_2O_4$
D.O.T. Proper Shipping Name: Not Regulated
U.N. or N.A. Identification #: Not Regulated
D.O.T. Hazard Class: Not Applicable
D.O.T. Emergency Response Guide: Not Assigned

Hazardous Mat'ls ID System Values (HMIS):	Health -1	Flammability -1	Reactivity -0	Personal Protection -F
Nat'l Fire Protection Assn. (NFPA 704M):	Health -1	Flammability -1	Reactivity -0	Specific Hazard: None

SECTION II - HAZARDOUS INGREDIENTS

Hazardous Component(s)	CAS#	PEL	TLV
2,4-Dichlorophenoxyacetate Acid, Butoxyethyl Ester	1929-73-3	10 mg/m^3	10 mg/m^3
Crystalline Silica	14808-60-7	0.1 mg/m^3	0.1 mg/^{3}

Ingredients listed in this section have been determined to be hazardous as defined in 29 CFR 1910.1200. Materials determined to be health hazards are listed if they comprise 1% or more of the composition. Materials identified as carcinogens are listed if they comprise 0.1% or more of the composition. Information on proprietary materials is available as provided in 29 CFR 1910.1200 (i) (1).

SECTION III - PHYSICAL DATA

Boiling Point (F):	NOT KNOWN	Specific Gravity (water = 1):	NOT KNOWN
Vapor Pressure (mm Hg):	NOT KNOWN	% Volatile (by Volume):	NOT DETERMINED
Vapor Density (air = 1):	NOT KNOWN	Evaporation Rate:(Ether = 1)	< 1
Melting Point (F):	NOT KNOWN		
Solubility in Water:	INSOLUBLE		

Appearance & Odor: GRAY/TAN GRANULES WITH MILD PHENOLIC ODOR.

SECTION IV - FIRE & EXPLOSION DATA

Flash Point (F): NOT FLAMMABLE Method:
Extinguishing Media: CO_2, WATER, DRY CHEMICAL OR FOAM TO FIGHT FIRES IN WHICH THIS PRODUCT IS INVOLVED.
Special Fire Fighting Procedures: WEAR APPROVED SELF-CONTAINED BREATHING APPARATUS. DIKE TO PREVENT CONTAMINATION OF WATER SOURCES.
Unusual Fire & Explosion Hazards: THERMAL DECOMPOSITION PRODUCTS INCLUDE OXIDES OF CARBON, SULFUR DIOXIDES AND HYDROCHLORIC ACID.

SECTION V - REACTIVITY DATA

Stability - _____Unstable __X__Stable
Conditions to Avoid: NONE KNOWN
Incompatibility (Materials to Avoid): ACIDS, BASES, OXIDIZERS.
Hazardous Decomposition Products: THERMAL DECOMPOSITION PRODUCTS INCLUDE OXIDES OF CARBON, SULFUR DIOXIDES AND HYDROCHLORIC ACID.
Hazardous Polymerization: _____Will Occur __X__Will Not Occur
Conditions to Avoid: NONE

AB NAVIGATE

SECTION VI - HEALTH HAZARD DATA

Acute Health Hazards: $LD_{50(Rat)}$ >2000 mg/Kg

Chronic Health Hazards: THIS PRODUCT CONTAINS CLAY. IARC HAS CLASSIFIED CRYSTALLINE SILICA (A COMPONENT OF CLAY) AS A PROBABLE HUMAN CARCINOGEN. PROLONGED CONTACT MAY CAUSE LIVER DAMAGE, KIDNEY DAMAGE, CHRONIC MUSCLE DAMAGE.

Signs & Symptoms of Exposure: EYE CONTACT MAY CAUSE TEARING AND REDNESS. MAY CAUSE SLIGHT SKIN IRRITATION. INHALATION OF DUST MAY CAUSE IRRITATION TO RESPIRATORY TRACT. INGESTION MAY CAUSE NAUSEA, VOMITING, ABDOMINAL PAIN, MUSCLE WEAKNESS MYOTONIA, AND A FALL IN BLOOD PRESSURE.

Medical Conditions Generally Aggravated by Exposure: MAY AGGRAVATE EXISTING CHRONIC RESPIRATORY PROBLEMS SUCH AS ASTHMA, EMPHYSEMA, OR BRONCHITIS; CONTACT MAY IRRITATE SKIN DISEASE.

Chemical Listed as Carcinogen or Potential Carcinogen by:

National Toxicology Program:	Yes:	No:	✓
I.A.R.C. Monographs:	Yes:	No:	✓
O.S.H.A.	Yes:	No:	✓

Emergency & First Aid Procedures: FOR PRINCIPLE ROUTE OF ENTRY, SEE APPROPRIATE EMERGENCY PROCEDURES BELOW.
NEVER GIVE ANYTHING BY MOUTH TO AN UNCONSCIOUS PERSON.

Route of Entry:
- Inhalation: REMOVE TO FRESH AIR, CONTACT A PHYSICIAN IF NECESSARY.
- Eyes: FLUSH WITH FRESH WATER FOR AT LEAST 15 MINUTES. CALL A PHYSICIAN.
- Skin: WASH SKIN WITH PLENTY OF SOAP AND WATER. WASH CLOTHES THOROUGHLY BEFORE REUSE.
- Ingestion: DRINK 2-3 GLASSES OF MILK OR WATER, INDUCE VOMITING. CALL A PHYSICIAN.

SECTION VII - SPILL OR LEAK PROCEDURES

Steps to be Taken in Case Material is Released or Spilled: SWEEP UP AND PLACE IN APPROVED CONTAINERS.DO NOT FLUSH AREA WITH WATER AS IT CAN CAUSE CONTAMINATION OF SEWER SYSTEM.

Waste Disposal Methods: DISPOSE OF IN ACCORDANCE WITH LOCAL, STATE AND FEDERAL REGULATIONS. 100 LBS. RESULTS IN A REPORTABLE QUANTITY AS SPECIFIED BY D.O.T.

SECTION VIII - SPECIAL PROTECTION AND CONTROL MEASURES

Respiratory Protection (Specify Type): NOT REQUIRED

Ventilation - Local Exhaust: MECHANICAL — Special Exhaust: STAND DOWN WIND WHEN USING.

Mechanical Exhaust: — Other Exhaust:

Protective Equipment - Gloves: PLASTIC OR CHEMICAL RESISTANT

Eye Protection: SAFETY GLASSES OR CHEMICAL GOGGLES

Other Protective Equipment: PROTECTIVE CLOTHING

Work or Hygienic Practices: USE SAFE CHEMICAL HANDLING PROCEDURES SUITABLE FOR THE HAZARDS PRESENTED BY THIS MATERIAL.

SECTION IX - SPECIAL PRECAUTIONS

Precautions to be Taken in Handling and Storage: DO NOT SWALLOW, BREATH DUST, STORE NEAR FOOD, CONTAMINATE WATER FOOD OR FEED, APPLY TO WATERS USED FOR IRRIGATION, AGRICULTURAL SPRAYS, WATERING DAIRY ANIMALS OR DOMESTIC WATER SUPPLIES.

Other Precautions: AVOID DRIFT TO SUSCEPTIBLE PLANTS. AVOID GETTING INTO EYES, ON SKIN OR CLOTHING. **KEEP OUT OF REACH OF CHILDREN**

DJK

Date of Last Revision: 9/30/99

cerexagri

AQUA-KLEEN®

A SELECTIVE HERBICIDE For Controlling Certain Unwanted Aquatic Plants

ACTIVE INGREDIENT:
Butoxyethyl Ester of 2,4-Dichlorophenoxyacetic Acid* 27.6%
OTHER INGREDIENTS: 72.4%
TOTAL 100.0%

*Isomer Specific AOAC Method,
Equivalent to 2,4-Dichlorophenoxyacetic Acid 19.0%

EPA Registration No. 228-378-4581 EPA Establishment No. 228-IL-1

KEEP OUT OF REACH OF CHILDREN

CAUTION

FIRST AID:

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.

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 arms 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.

ENVIRONMENTAL HAZARDS

This product is toxic to fish. Drift or runoff may adversely affect fish and nontarget 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 noncrop 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 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 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 groundwater contamination.

DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling. READ ENTIRE LABEL BEFORE USING THIS PRODUCT. USE STRICTLY IN ACCORDANCE WITH LABEL PRECAUTIONARY STATEMENTS AND DIRECTIONS.

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 this product 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

This product 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 into 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 this product 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. Weigh 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 this product per minute.

$$\frac{\text{Miles per hour x spreader width x pounds per acre}}{495}$$

Example: To apply 100 pounds of this product 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 this product per minute.

$$\frac{\text{4 mph x 20 feet x 100 lbs./A}}{495}$$

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.

	POUNDS PER ACRE	POUNDS PER 2000 SQ. FT.
SUSCEPTIBLE WEEDS Water milfoil (Myriophyllium spp.) Water stargrass (Heteranthera dubia)	100 to 200	5
SLIGHTLY TO MODERATELY RESISTANT WEEDS Bladderwort (Utricularia spp.) White water lily (Nymphaea spp.) Yellow water lily or (Nuphar spp.) spatterdock* Water shield (Brasenia spp.) Water chestnut (Trapa natans) Coontail* (Ceratophyllum demersum)	150 to 200	7½ to 10

*Repeat treatments may be needed.

STORAGE AND DISPOSAL

STORAGE: Always use original container to store pesticides in a secured warehouse or storage 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 the passenger compartment of any vehicle.

PESTICIDE DISPOSAL: Pesticide wastes are toxic. If container is damaged or if pesticide has leaked, clean up all spilled material. Improper disposal or excess pesticide, spray mixtures 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: 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 burned, stay away from smoke.

EMERGENCY TELEPHONE NUMBERS:

CHEMTREC: (800) 424-9300

MEDICAL: (303) 623-5716

Rocky Mountain Poison Control Center

WARRANTY AND DISCLAIMER

Cerexagri, Inc. warrants that this material conforms to the chemical description on the label and is reasonably fit for the purposes referred to in the Directions for Use, subject to the risks referred to therein. CEREXAGRI MAKES NO OTHER EXPRESS OR IMPLIED WARRANTY OF FITNESS OR MERCHANTABILITY OR ANY OTHER EXPRESS OR IMPLIED WARRANTY. IN NO CASE SHALL CEREXAGRI OR SELLER BE LIABLE FOR CONSEQUENTIAL, SPECIAL OR INDIRECT DAMAGES RESULTING FROM THE USE OR HANDLING OF THIS PRODUCT INCLUDING, BUT NOT LIMITED TO, LOSS OF PROFITS, BUSINESS REPUTATION, OR CUSTOMERS; LABOR COST; OR OTHER EXPENSES INCURRED IN PLANTING OR HARVESTING.

Cerexagri and seller offer this product and the buyer and user accept it subject to the foregoing conditions of sale and warranty which may be varied only by agreement in writing signed by a duly authorized representative of Cerexagri.

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Cerexagri, Inc. is a wholly-owned subsidiary of ATOFINA Chemicals, Inc.

cerexagri

Aqua-Kleen Aquatic Herbicide

Material Safety Data Sheet

Cerexagri, Inc.

1 PRODUCT AND COMPANY IDENTIFICATION

Agrichemicals Group
Cerexagri, Inc.
630 Freedom Business Center, Suite 402
King of Prussia, PA 19406

EMERGENCY PHONE NUMBERS:
Chemtrec: (800) 424-9300 (24hrs) or (703) 527-3887
Medical: Rocky Mountain Poison Control Center
(866) 767-5089 (24Hrs)

Information Telephone Numbers	Phone Number	Available Hrs
R&D Technical Service	610-878-6100	8:00am to 5:00pm EST
Customer Service	1-800-438-6071	8:00am - 5:00 pm EST

Product Name	Aqua-Kleen Aquatic Herbicide
Product Synonym(s)	
Chemical Family	2,4-Dichlorophenoxyacetic acid, butoxyethyl ester
Chemical Formula	NA
Chemical Name	Acetic acid, (2,4-dichlorophenoxy)-, 2-butoxyethyl ester
EPA Reg Num	228-378-4581
Product Use	Aquatic herbicide for controlling unwanted aquatic plants

2 COMPOSITION / INFORMATION ON INGREDIENTS

Ingredient Name	CAS RegistryNumber	Typical Wt. %	OSHA
2-Butoxyethyl 2,4-dichlorophenoxy acetate	1929-73-3	27.6	Y
Quartz	14808-60-7	<15	Y

The substance(s) marked with a "Y" in the OSHA column, are identified as hazardous chemicals according to the criteria of the OSHA Hazard Communication Standard (29 CFR 1910.1200)

3 HAZARDS IDENTIFICATION

Emergency Overview

Tan granules, solid, phenolic odor.
CAUTION!
KEEP OUT OF REACH OF CHILDREN.
HARMFUL IF SWALLOWED, INHALED OR ABSORBED THROUGH SKIN.
CAUSES EYE IRRITATION.
Avoid contact with eyes, skin and clothing. Handle in accordance with good industrial hygiene and safety practices. These practices include avoiding unnecessary exposure and removal of material from eyes, skin and clothing. Avoid breathing dust. Wash thoroughly after handling.
CANCER HAZARD. CONTAINS CRYSTALLINE SILICA WHICH CAN CAUSE CANCER.
Repeated and prolonged inhalation of respirable particles can cause lung cancer and delayed lung damage (silicosis)

Potential Health Effects

Inhalation and skin contact are expected to be the primary routes of occupational exposure to this material. Based on its composition, it is anticipated to be slightly to moderately toxic if swallowed and slightly toxic if inhaled. Direct contact may be irritating to the eyes and skin. Inhalation may be irritating to the respiratory tract. Repeated and prolonged inhalation of crystalline silica may cause a form of disabling lung disease (commonly known as silicosis). Clinical signs and symptoms of silicosis include cough, shortness of breath, wheezing and impairment of lung function. Impairment of lung function may be progressive. In the usual case of silicosis, there is a slow deterioration of capacity for physical

effort, decreased chest expansion, and an increased susceptibility to tuberculosis and other respiratory infections. This material inhaled in the form of quartz is classified as "carcinogenic to humans" by the International Agency for Research on Cancer (IARC) and respirable forms of this material are listed as substances that "may reasonably be anticipated to be carcinogens" by the National Toxicology Program.

Short term, extremely heavy exposures to dust of this material (particularly small-sized particles) can result in acute silicosis. This disease is rapidly progressive with diffuse pulmonary involvement, which may develop within months of initial exposure. Individuals with acute silicosis may suffer an abrupt onset of violent coughing, labored breathing, and weight loss; death has been known to occur within one to two years.

4 FIRST AID MEASURES

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, Wash with plenty of soap and water. Get medical attention if irritation persists.

IN CASE OF CONTACT, flush the area with plenty of water. Remove material from clothing. Wash clothing before reuse.

IF SWALLOWED,
-Call a poison control center or doctor immediately for treatment advice.
-Have person sip a glass of water if able to swallow.
-Do not induce vomiting unless told to do so by a poison control center or doctor.
-Do not give anything by mouth to an unconscious person.

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

5 FIRE FIGHTING MEASURES

Fire and Explosive Properties

Auto-Ignition Temperature	NA	
Flash Point	NA	Flash Point Method
Flammable Limits- Upper	NA	
Lower	NA	

Extinguishing Media

dry chemical, carbon dioxide, foam, water spray

Fire Fighting Instructions

Fire fighters and others who may be exposed to products of combustion should wear full fire fighting turn out gear (full Bunker Gear) and self-contained breathing apparatus (pressure demand NIOSH approved or equivalent). Fire fighting equipment should be thoroughly decontaminated after use.

Fire and Explosion Hazards

Avoid breathing fumes from fire exposed material. Irritating or toxic vapors

6 ACCIDENTAL RELEASE MEASURES

In Case of Spill or Leak

Contain spill. Sweep or scoop up and remove to suitable container. Flush with water. Prevent spilled product from entering sewers or natural water. Consult a regulatory specialist to determine appropriate state or local reporting requirements, for assistance in waste characterization and/or hazardous waste disposal and other requirements listed in pertinent environmental permits.

7 HANDLING AND STORAGE

Handling

Handle in accordance with good industrial hygiene and safety practices. These practices include avoiding unnecessary exposure and removal of material from eyes, skin and clothing. Avoid breathing dust.

Storage

Store away from food and feed. Do not store in a manner where cross-contamination with pesticides, fertilizers, food or feed could occur. Store in a cool, dry place.

8 EXPOSURE CONTROLS / PERSONAL PROTECTION

Engineering Controls

Investigate engineering techniques to reduce exposures below airborne exposure limits. Provide ventilation if necessary to control exposure levels below airborne exposure limits (see below). If practical, use local mechanical exhaust ventilation at sources of air contamination such as open process equipment.

Eye / Face Protection

Use good industrial practice to avoid eye contact.

Skin Protection

Wear appropriate chemical resistant protective clothing and chemical resistant gloves to prevent skin contact. gloves should be worn when handling this material. Rinse contaminated skin promptly. Wash contaminated clothing and clean protective equipment before reuse. Wash skin thoroughly after handling.

Respiratory Protection

Avoid breathing dust. When airborne exposure limits are exceeded (see below), use NIOSH approved respiratory protection equipment appropriate to the material and/or its components. Consult respirator manufacturer to determine appropriate type equipment for given application. Observe respirator use limitations specified by NIOSH or the manufacturer. For emergency and other conditions where exposure limit may be significantly exceeded, use an approved full face positive-pressure, self-contained breathing apparatus or positive-pressure airline with auxiliary self-contained air supply. Respiratory protection programs must comply with 29 CFR § 1910.134.

Airborne Exposure Guidelines for Ingredients

Exposure Limit		Value
Quartz		
ACGIH TWA	Respirable particle	0.05 mg/m3
2-Butoxyethyl 2,4-dichlorophenoxy acetate		
ACGIH TWA	-For 2,4-D	10 mg/m3
OSHA TWA PEL	-For 2,4-D	10 mg/m3

-Only those components with exposure limits are printed in this section.
-Skin contact limits designated with a "Y" above have skin contact effect. Air sampling alone is insufficient to accurately quantitate exposure. Measures to prevent significant cutaneous absorption may be required.
-ACGIH Sensitizer designator with a value of "Y" above means that exposure to this material may cause allergic reactions.
-WEEL-AIHA Sensitizer designator with a value of "Y" above means that exposure to this material may cause allergic skin reactions.

9 PHYSICAL AND CHEMICAL PROPERTIES

Appearance/Odor	Tan granules, solid, phenolic odor.
pH	NA
Specific Gravity	NA
Vapor Pressure	2.4 X 10-6 mm Hg(for ester)
Vapor Density	NA
Melting Point	NA
Freezing Point	NA
Boiling Point	156-162C@1 mmHg (ester)
Solubility In Water	Insoluble
Molecular Weight	321.2 (ester)

10 STABILITY AND REACTIVITY

Stability

This material is chemically stable under normal and anticipated storage and handling conditions.

Hazardous Polymerization

Does not occur.

Incompatibility

Strong oxiding agents: bases, acids.

Hazardous Decomposition Products

Upon thermal decomposition may produce hydrogen chloride, oxides of sulfur

11 TOXICOLOGICAL INFORMATION

Toxicological Information

Data on this material and/or its components are summarized below.

Single exposure (acute) studies indicate:
Inhalation - Slightly Toxic to Rats (4-hr LC50 4.6 mg/l) 2-Butoxyethyl 2,4-dichlorophenoxy acetate
Birth defects have been observed in the offspring of rats exposed orally during pregnancy.

2,4-Dichlorophenoxyacetic acid
Single exposure (acute) studies indicate that this material is slightly to moderately toxic if swallowed (rat LD50 320-4,050 mg/kg), no more than slightly toxic if absorbed through skin (rabbit LD50 >2,000 mg/kg) and slightly irritating to rabbit eyes and skin. 2,4-Dichlorophenoxyacetic acid
Kidney effects were observed in rats and mice following repeated oral exposure. This material is classified as a Category D carcinogen (unclassifiable as to carcinogenicity) by the U.S. Environmental Protection Agency and chlorophenoxy herbicides are classified as "possibly carcinogenic to humans" (Group 2B) by the International Agency for Research on Cancer (IARC). The IARC listing is based on epidemiological studies suggesting and association between the development of certain types of cancer (soft-tissue sarcoma and non-Hodgkin's lymphoma) and exposure to chlorophenoxy herbicides. Two long-term oral studies in rats produced no evidence of tumors, although kidney effects were observed. No birth defects were observed in the offspring of rabbits exposed orally during pregnancy. Birth defects were observed in the offspring of rats exposed orally during pregnancy, but only at dosages which produced adverse effects on the mothers. Genetic changes were observed in tests using human cells, but not in tests using bacteria or animals. Both positive and negative

11 TOXICOLOGICAL INFORMATION

results were observed in tests using animal cells.

The acid data are considered to be more representative for the granular formulation because the ester is essentially insoluble in water, it releases gradually from the granules and it is hydrolyzed rapidly to the acid. Thus, exposure of aquatic organisms is predominantly to the acid.

Quartz
Chronic inhalation of crystalline silica may cause a progressive pneumoconiosis (silicosis), a form of disabling lung disease (pulmonary fibrosis). Data from animal studies on crystalline forms of silica confirm the capacity of free crystalline silica to induce a fibrinogenic response in lungs. Studies on a variety of laboratory animals (rats, guinea pigs, rabbits, and monkeys) using inhalation as well as intratracheal routes of exposure indicate the ability of crystalline silica to produce silicosis similar to that seen in man. In addition, experiments in animals have confirmed human experience that the presence of crystalline silica in the lung increased susceptibility to tuberculosis and other lung infections. Crystalline silica inhaled in the form of quartz is classified as "carcinogenic to humans" by the International Agency for Research on Cancer (IARC), and respirable forms of crystalline silica are listed as substances that "may reasonably be anticipated to be carcinogens" by the National Toxicology Program. The IARC listing is based on the determination that there is sufficient evidence in humans for the carcinogenicity of inhaled crystalline silica in the form of quartz from occupational exposures. Epidemiology studies cited by IARC give indications of increased risk for lung cancer from inhaled crystalline silica (quartz) resulting from occupational exposure. Studies involving heavy industrial exposure to silica in granite and foundry workers, brick factories and sandblasting produced increased levels of protein and enzymes in urine, which is indicative of kidney damage.

12 ECOLOGICAL INFORMATION

Ecotoxicological Information

Data on this material and/or its components are summarized below.
2,4-Dichlorophenoxyacetic acid
This material is slightly toxic to Daphnia (48-hr EC50 36.4 mg/l). It is practically non-toxic to trout (96-hr LC50 358 mg/l) and bluegill (96-hr LC50 263 mg/l).

2-Butoxyethyl 2,4-dichlorophenoxy acetate
This material is moderately toxic to bleak (96-hr LC50 3.2-3.7 mg/l), Daphnia magna (48-hr EC50 7.2 mg/l) and coho salmon (96-hr LC50 1.5 mg/l). It is highly toxic to bluegill (96-hr LC50 0.61 mg/l), Chinook salmon (96-hr LC50 0.315 mg/l) and pink salmon (96-hr LC50 0.8 mg/l). It is moderately to highly toxic to rainbow trout (96-hr LC50 0.518-2.0 mg/l) and fathead minnow (96-hr LC50 0.95-2.5 mg/l). The oral LC50 for bobwhite quail, Japanese quail, ring-necked pheasant and mallard duck is >5,000 ppm.
Aqua-Kleen
The acid data are considered to be more representative for the granular formulation because the ester is essentially insoluble in water, it releases gradually from the granules and it is hydrolyzed rapidly to the acid. Thus, exposure of aquatic organisms is predominantly to the acid.

Chemical Fate Information

Data on this material and/or its components are summarized below.
Aqua-Kleen
In water, hydrolysis of the ester to the acid occurred with hours of release from granules (nondetectable later than 1 day after application). The typical half-life of the resultant acid ranged from a few days to a few weeks.

13 DISPOSAL CONSIDERATIONS

Waste Disposal

Pesticide wastes are acutely hazardous. Improper disposal of excess pesticide or rinsate is a violation of Federal law. 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. Dispose of solid waste at properly permitted landfills observing all local, state and federal regulations. Contaminated liquids should be concentrated and incinerated at a properly permitted disposal site again observing all local, state and federal regulations.

14 TRANSPORT INFORMATION

DOT Name	NOT REGULATED
DOT Technical Name	Not regulated
DOT Hazard Class	NA
UN Number	NA
DOT Packing Group	PG NA
RQ	NA

15 REGULATORY INFORMATION

Hazard Categories Under Criteria of SARA Title III Rules (40 CFR Part 370)

Immediate (Acute) Health	Y	Fire	N
Delayed (Chronic) Health	Y	Reactive	N
		Sudden Release of Pressure	N

Ingredient Related Regulatory Information:

SARA Reportable Quantities	CERCLA RQ	SARA TPQ
Quartz		
2-Butoxyethyl 2,4-dichlorophenoxy acetate		NE

SARA Title III, Section 313

This product does contain chemical(s) which are defined as toxic chemicals under and subject to the reporting requirements of, Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372. See Section 2

2-Butoxyethyl 2,4-dichlorophenoxy acetate

SARA Title III, Section 302

This product does contain chemical(s), as indicated below, currently on the Extremly Hazardous Substance List, Section 302, SARA Title III. See Section 2 for further details regarding concentrations and registry numbers.

2-Butoxyethyl 2,4-dichlorophenoxy acetate

California Prop 65 - Carcinogen

This product does contain the following chemical(s), as indicated below, currently on the California list of Known Carcinogens.

Quartz

Massachusetts Right to Know

This product does contain the following chemicals(s), as indicated below, currently on the Massachusetts Right to Know Substance List.

2-Butoxyethyl 2,4-dichlorophenoxy acetate
Quartz

New Jersey Right to Know
This product does contain the following chemical(s), as indicated below, currently on the New Jersey Right-to-Know Substances List.
2-Butoxyethyl 2,4-dichlorophenoxy acetate
Quartz

Pennsylvania Environmental Hazard
This product does contain the following chemical(s), as indicated below, currently on the Pennsylvania Environmental Hazard List.
2-Butoxyethyl 2,4-dichlorophenoxy acetate

Pennsylvania Right to Know
This product does contain the following chemical(s), as indicated below, currently on the Pennsylvania Hazardous Substance List.
2-Butoxyethyl 2,4-dichlorophenoxy acetate
Quartz

16 OTHER INFORMATION

Revision Information

Revision Date	09 JUL 2003	Revision Number 8
Supercedes Revision Dated	02-DEC-2002	

Revision Summary
Updated to remove restriction relating to California

Key
NE= Not Established NA= Not Applicable (R) = Registered Trademark

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Cerexagri, Inc. is a wholly owned subsidiary of ATOFINA Chemicals, Inc.

Supplemental Labeling

Dow AgroSciences

Dow AgroSciences LLC 9330 Zionsville Road Indianapolis, IN 46268-1054 USA

DMA* 4 IVM

(EPA Reg. No. 62719-3)

EPA 24(c) Special Local Need Registration SLN WA-020025
(For Distribution and Use Only in the State of Washington)

Control of Eurasian Water Milfoil in Slowly Moving Waters Using Drip Application

For Distribution and Use Only by Applicants Approved under Aquatic Noxious Weed Control National Pollutant Discharge Elimination System Waste Discharge General Permit (NPDES Permit No. WAG-993000) Issued by the Washington State Department of Ecology and Made Available to the Washington State Department of Agriculture. All Applicators Must Secure Coverage Under NPDES Permit No. WAG-993000 with the Washington State Department of Agriculture prior to making any applications.

ATTENTION

- It is a violation of Federal law to use this product in a manner inconsistent with its labeling.
- This labeling must be in the possession of the user at the time of application.
- Read the label affixed to the container for DMA* 4 herbicide before applying. Carefully follow all precautionary statements and applicable use directions.
- Use of DMA 4 according to this supplemental labeling is subject to all use precautions and limitations imposed by the labels affixed to product containers and this supplemental labeling.

Directions for Use

DMA* 4 IVM herbicide is labeled for aquatic weed control in the following use sites: ponds, lakes, reservoirs, marshes, bayous, drainage ditches, canals, rivers and streams that are quiescent or slow moving, including programs of the Tennessee Valley Authority. Prior to 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.

The Dow AgroSciences product DMA 4 IVM herbicide, containing 46.3% 2,4-D dimethylamine salt, is registered in the state of Washington and is labeled for use in sub-surface applications to quiescent or slow moving waters at the rate of 2 to 4 parts per million (1.42 to 2.84 gallons per acre-foot). The Washington State Department Of Ecology, via a state-approved integrated aquatic vegetation management plan, proposes to apply DMA 4 IVM herbicide to control infestations of Eurasian Water Milfoil in slowly moving water using a drip system to maintain a minimum concentration of 1 ppm over a period of 48 hours.

Except as described below, all applicable label directions, precautions and restrictions must be followed:

- Application is to be conducted during a period of time when Eurasian Water Milfoil is actively growing and stream flow is expected to remain stable.
- Drip system is to be located a sufficient distance upstream from infested area to allow for mixing of the herbicide with the stream flow prior to entering infested area. Alternatively, the herbicide mixture may be introduced through multiple openings across the width of the stream in order to achieve uniform distribution of the herbicide in the flowing water.

Drip system is to be located and operated in a manner that ensures the drip application will be delivered uniformly over the duration of the treatment and equipment is reasonably secure from tampering.
Maximum application rate must not exceed 0.71 gallons of DMA 4 IVM per acre-foot of water (1.0 ppm) and duration of drip application must not exceed 48 hours.

Measurement of Stream Flow: Accurate measurement of stream flow in treatment area and calculation of estimated treatment volume in **acre-feet** is to be determined prior to application.

Objective: To maintain 1.0 ppm of 2,4-D active ingredient for 48 hours in Milfoil infested area

Rate Calculation: Calibrate application equipment to uniformly deliver 0.71 gallons (1.0 ppm) of DMA 4 IVM per acre foot of water volume.

Example of Rate Calculation:

- Assuming a flow rate of 3.4 cubic ft per second, the total flow in 48 hours = 3.4 cu ft/sec X 3600 sec/hr X 48 hr = 587520 cu ft. 587,520. cu ft / 43560 cu ft/acre = 13.5 acre ft.
- 13.5 acre ft X 0.71 gallons of DMA 4 IVM per acre ft = 9.585 gallons of DMA 4 IVM
- 9.59 gal / 48 hr = 0.2 gal/hr = 25.6 oz/hr = 0.43 oz/min

Note: Product may be diluted 50% or more with water if a larger volume of herbicide mixture is needed for accurate calibration of injection equipment.

Environmental Hazards: This product is toxic to aquatic invertebrates. Drift or runoff may adversely affect aquatic invertebrates and non-target plants.

Restrictions:

- Do not apply within 1,500 feet of an active potable or irrigation water intake.
- **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 or other than non-crop areas or those crops or plants labeled for direct application of 2,4-D; or (2) mixing spray 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).

SLN Expiration: This label for DMA 4 IVM expires and must not be distributed or used in accordance with this SLN registration after December 31, 2003.

*Trademark of Dow AgroSciences LLC

Revisions: Addition of restrictions required by EPA.

D06-141-002
Accepted: 09/03/2002
Replaces D06-141-001

Specimen Label

Herbicide

Aquatic Sites: For control of emersed, submersed and floating aquatic plants in aquatic sites such as ponds, lakes, reservoirs, non-irrigation canals and ditches which have little or no continuous outflow, marshes and wetlands, including broadleaf and woody vegetation on banks and shores within or adjacent to these and other aquatic sites.

Active Ingredient:	
triclopyr: 3,5,6-trichloro-2-pyridinyloxyacetic acid, triethylamine salt	44.4%
Inert Ingredients	55.6%
Total	100.0%

Acid equivalent: triclopyr - 31.8% - 3 lb/gal

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 or absorbed through skin • Prolonged or frequently repeated skin contact may cause allergic reaction in some individuals

Do not get in eyes or on skin or clothing.

Personal Protective Equipment (PPE)

Applicators and other handlers must wear:

- Long-sleeved shirt and long pants
- Shoes plus socks• Protective eyewear
- Chemical resistant gloves (≥ 14 mils) such as butyl rubber, natural rubber, neoprene rubber or nitrile rubber

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 and wash PPE separately from other laundry.

FIRST AID	
In the 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 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 for treatment advice. • Have person sip a glass of water if able to swallow. • Do not induce vomiting unless told to do so by a poison control center or doctor. • Do not give anything by mouth to a unconscious person.

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

Note to Applicator: Allergic skin reaction is not expected from exposure to spray mixtures of Renovate 3 herbicide when used as directed.

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

Refer to inside of label booklet for additional precautionary information including Personal Protective Equipment (PPE), User Safety Recommendations and Directions for Use including Storage and Disposal.

Notice: Read the entire label. Use only according to label directions. **Before using this product, read Warranty Disclaimer, Inherent Risks of Use, and Limitation of Remedies at end of label booklet. If terms are unacceptable, return at once unopened.**

In case of emergency endangering health or the environment involving this product, call **INFOTRAC at 1-800-535-5053**. If you wish to obtain additional product information, visit our web site at www.sepro.com.

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

EPA Reg. No. 62719-37-67690 EPA Est. No. 464-MI-1
FPL 012203 SPC - 381116

*Trademark of Dow AgroSciences LLC manufactured for: **SePRO Corporation** Carmel, IN 46032, U.S.A.

Renovate 3 Herbicide

Engineering Controls

When handlers use closed systems, enclosed cabs, or aircraft in a manner that meets the requirements listed in the WPS (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.

Environmental Hazards

Under certain conditions, treatment of aquatic weeds can result in oxygen depletion or loss due to decomposition of dead plants, which may contribute to fish suffocation. This loss can cause fish suffocation. Therefore, to minimize this hazard, do not treat more than one-third to one-half of the water area in a single operation and wait at least 10 to 14 days between treatments. Begin treatment along the shore and proceed outwards in bands to allow fish to move into untreated areas. Consult with the State agency for fish and game before applying to public water to determine if a permit is needed.

Physical or Chemical Hazards

Combustible. Do not use or store the product near heat or open flame.

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
- Shoes plus socks
- Protective eyewear
- Chemical-resistant gloves (≥ 14 mils) such as butyl rubber, natural rubber, neoprene rubber or nitrile rubber

NON-AGRICULTURAL USE REQUIREMENTS

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

Entry Restrictions for Non-WPS Uses: For applications to non-cropland areas, do not allow entry into areas until sprays have dried, unless applicator and other handler PPE is worn.

STORAGE AND DISPOSAL

Do not contaminate water, food, or feed by storage and disposal. Open dumping is prohibited.
Pesticide Storage: Store above 28° F or agitate before use.

Pesticide Disposal: Wastes resulting from the use of this product may be disposed of on site or at an approved waste disposal facility.

Container Disposal for Refillable Containers: Seal all openings which have been opened during use. Return the empty container to a collection site designated by SePRO Corporation. If the container has been damaged and cannot be returned according to the recommended procedures, contact SePRO Corporation at 1-800-419-7779 to obtain proper handling instructions.

Container Disposal (Metal): Do not reuse container. 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): Do not reuse container. Triple rinse (or equivalent). Then offer for recycling or reconditioning, or 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: Consult federal, state, or local disposal authorities for approved alternative procedures.

General Information

For Aquatic and Wetland Sites

Renovate[1] 3 herbicide is recommended for control of emersed, submersed and floating aquatic plants in aquatic sites such as ponds, lakes, reservoirs, non-irrigation canals, and ditches which have little or no continuous outflow, marshes and wetlands, including broadleaf and woody vegetation on banks and shores within or adjacent to these and other aquatic sites.

Obtain Required Permits: Consult with appropriate state or local water authorities before applying this product to public waters. State or local public agencies may require permits.

General Use Precautions and Restrictions

In Arizona: The state of Arizona has not approved Renovate® 3 for use on plants grown for commercial production, specifically forests grown for commercial timber production, or on designated grazing areas.

When applying this product in tank mix combination, follow all applicable use directions, precautions and limitations on each manufacturer's label.

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

Irrigation: Do not use treated water for irrigation for 120 days following application. As an alternative to waiting 120 days, treated water may be used for irrigation once the triclopyr level in the intake water is determined to be non-detectable by laboratory analysis (immunoassay). There is no restriction on use of water from the treatment area to irrigate established grasses.

Do not apply Renovate 3 directly to, or otherwise permit it to come into direct contact with grapes, tobacco, vegetable crops, flowers, or other desirable broadleaf plants, and do not permit spray mists containing it to drift into them.

- **Do not** apply to salt water bays or estuaries.
- **Do not** apply directly to un-impounded rivers or streams.
- **Do not** apply on ditches or canals used to transport irrigation water. It is permissible to treat non-irrigation ditch banks.
- **Do not** apply where runoff water may flow onto agricultural land as injury to crops may result.
- When making applications to control unwanted plants on banks or shorelines of moving water sites, minimize overspray to open water.
- The use of a mistblower is not recommended.

Grazing and Haying Restrictions
Except for lactating dairy animals, there are no grazing restrictions following application of this product.

- **Grazing Lactating Dairy Animals:** Do not allow lactating dairy animals to graze treated areas until the next growing season following application of this product.
- **Do not** harvest hay for 14 days after application.
- Grazed areas of non-cropland and forestry sites may be spot treated if they comprise no more than 10% of the total grazable area.

Slaughter Restrictions: During the season of application, withdraw livestock from grazing treated grass at least 3 days before slaughter.

Avoiding Injurious Spray Drift

Applications should be made only when there is little or no hazard from spray drift. Very small quantities of spray, which may not be visible, may seriously injure susceptible plants. Do not spray when wind is blowing toward susceptible crops or ornamental plants near enough to be injured. It is suggested that a continuous smoke column at or near the spray site or a smoke generator on the spray equipment be used to detect air movement, lapse conditions, or temperature inversions (stable air). If the smoke layers or indicates a potential of hazardous spray drift, do not spray.

Aerial Application: For aerial application near susceptible crops, apply through a Microfoil† or Thru-Valve boom†, or use a drift control additive labeled for aquatic use. Other drift reducing systems or thickened sprays prepared by using high viscosity inverting systems may be used if they are made as drift-free as mixtures containing thickening agents labeled for use in aquatics or applications made with the Microfoil or Thru-Valve boom. Keep spray pressures low enough to provide coarse spray droplets. Spray boom should be no longer than 3/4 of the rotor length. Do not use a thickening agent with the Microfoil or Thru-Valve booms, or other systems that cannot accommodate thick sprays. Spray only when the wind velocity is low (follow state regulations). Avoid application during air inversions. If a spray thickening agent is used, follow all use recommendations and precautions on the product label.

†Reference within this label to a particular piece of equipment produced by or available from other parties is provided without consideration for use by the reader at its discretion and subject to the reader's independent circumstances, evaluation, and expertise. Such reference by SePRO Corporation is not intended as an endorsement of such equipment, shall not constitute a warranty (express or implied) of such equipment, and is not intended to imply that other equipment is not available and equally suitable. Any discussion of methods of use of such equipment does not imply that the reader should use the equipment other than is advised in directions available from the equipment's manufacturer. The reader is responsible for exercising its own judgment and expertise, or consulting with sources other than SePRO Corporation, in selecting and determining how to use its equipment.

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:

1. The distance of the outer most operating nozzles on the boom must not exceed 3/4 the length of the rotor.
2. Nozzles must always point backward parallel with the air stream and never be pointed downwards more than 45 degrees.

Where states have more stringent regulations, they should be observed.

The applicator should be familiar with and take into account the information covered in the following Aerial Drift Reduction Advisory. [This information is advisory in nature and does not supersede mandatory label requirements.]

Aerial Drift Reduction Advisory

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

Controlling Droplet Size:
- **Volume** - Use high flow rate nozzles to apply the highest practical spray volume. Nozzles with higher rated flows produce larger droplets.
- **Pressure** - Do not exceed the nozzle manufacturer's recommended pressures. For many nozzle types lower pressure produces larger droplets. When higher flow rates are needed, use higher flow rate nozzles instead of increasing pressure.
- **Number of Nozzles** - Use the minimum number of nozzles that provide uniform coverage.
- **Nozzle Orientation** - Orienting nozzles so that the spray is released parallel to the airstream produces larger droplets than other orientations and is the recommended practice. Significant deflection from horizontal will reduce droplet size and increase drift potential.
- **Nozzle Type** - Use a nozzle type that is designed for the intended application. With most nozzle types, narrower spray angles produce larger droplets. Consider using low-drift nozzles. Solid stream nozzles oriented straight back produce the largest droplets and the lowest drift.

Boom Length: 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 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 spray drift.

Temperature and Humidity: When making applications in low relative humidity, set up equipment to produce larger droplets to compensate for evaporation. Droplet evaporation is most severe when conditions are both hot and dry.

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

Sensitive Areas: The pesticide should only be applied when the potential for drift to adjacent sensitive areas (e.g., residential areas, known habitat for threatened or endangered species, non-target crops) is minimal (e.g., when wind is blowing away from the sensitive areas).

Ground Equipment: To aid in reducing spray drift, Renovate 3 should be used in thickened (high viscosity) spray mixtures using a labeled drift control additive, high viscosity invert system, or equivalent as directed by the manufacturer. With ground equipment, spray drift can be reduced by keeping the spray boom as low as possible; by applying 20 gallons or more of spray per acre; by keeping the operating spray pressures at the lower end of the manufacturer's recommended pressures for the specific nozzle type used (low pressure nozzles are available from spray equipment manufacturers); and by spraying when wind velocity is low (follow state regulations). In hand-gun applications, select the minimum spray pressure that will provide adequate plant coverage (without forming a mist). Do not apply with nozzles that produce a fine-droplet spray.

High Volume Leaf-Stem Treatment: To minimize spray drift, do not use pressure exceeding 50 psi at the spray nozzle and keep sprays no higher than brush tops. A labeled thickening agent may be used to reduce drift.

Plants Controlled by Renovate 3

Woody Plant Species

alder	cascara	maples
arrowwood	ceanothus	mulberry
ash	cherry	oaks
aspen	Chinese Tallow	poison ivy
bear clover (bearmat)	chinquapin	poison oak
beech	choke cherry	poplar
birch	cottonwood	salt-bush (*Baccharis* spp.)
blackberry	crataegus (hawthorn)	sweetgum
blackgum	locust	waxmyrtle
Brazilian pepper	Maleleuca (seedlings)	willow

Annual and Perennial Broadleaf Weeds

burdock	ligodium	tropical sodaapple
Canada thistle	plantain	vetch
curly dock	smartweed	wild lettuce
elephant ear	tansy ragwort	

Aquatic Weeds

alligatorweed	milfoil species	purple loosestrife
American lotus	nuphar (spatterdock)	waterhyacinth
American frogbit	parrotfeather*	waterlily
Aquatic sodaapple	pickerelweed	waterprimose
Eurasian watermilfoil	pennywort	

*Retreatment may be needed to achieve desired level of control.

Application Methods

Floating and Emerged Weeds

For control of waterhyacinth, alligatorweed (see specific directions below), and other susceptible emerged and floating herbaceous weeds and woody plants, apply 1 1/2 to 6 lb ae triclopyr (2 to 8 quarts of Renovate 3) per acre as a foliar application using surface or aerial equipment. Use higher rates in the rate range when plants are mature, when the weed mass is dense, or for difficult ot control species. Repeat as necessary to control regrowth and plants missed in the previous operation, but do not exceed a total of 6 lb ae triclopyr (8 quarts of Renovate 3) per acre per annual growing season.

Use of a non-ionic surfactant in the spray mixture is recommended to improve control. Follow all directions and use precautions on the aquatic surfactant label.

Apply when plants are actively growing.

Surface Application

Use a spray boom, handgun or other similar suitable equipment mounted on a boat or vehicle. Thorough wetting of foliage is essential for maximum effectiveness. Use 20 to 200 gallons per acre of spray mixture. Special precautions such as the use of low spray pressure, large droplet producing nozzles or addition of a labeled thickening agent may minimize spray drift in areas near sensitive crops.

Aerial Application
Apply with a helicopter using a Microfoil or Thru-Valve boom, or a drift control additive in the spray solution. Apply in a minimum of 10 gallons of total spray mix per acre. Do not apply when weather conditions favor drift to sensitive areas. See label section on aerial application directions and precautions.

Waterhyacinth (*Eichhornia crassipes*)
Apply Renovate 3 at 1 1/2 to 6 lb ae triclpyr (2 to 8 quarts of Renovate 3) per acre to control waterhyacinth. Apply when plants are actively growing. Use the higher rate in the rate range when the weed mass is dense. It is important to thoroughly wet all foliage with the spray mixture. Use of a non-ionic surfactant in the spray mixture is recommended. A repeat treatment may be needed to control regrowth or plants missed in the previous treatment.

Alligatorweed (*Alternanthera philoxeroides*)
Apply Renovate 3 at 2 to 6 lb ae triclopyr (3 to 8 quarts of Renovate 3) per acre to control alligatorweed. It is important to thoroughly wet all foliage with the spray mixture. For best results, it is recommended that an approved non-ionic aquatic surfactant be added to the spray mixture. Alligatorweed growing outside the margins of a body of water can be controlled with this treatment. However, alligatorweed growing in water will only be partially controlled. Top growth above the water will be controlled, but the plant will likely regrow from tissue below the water surface.

Precautions for Potable Water Intakes - Lakes, Reservoirs, Ponds:
For applications of Renovate 3 to control floating and emerged weeds in lakes, reservoirs or ponds that contain a functioning potable water intake for human consumption, see chart below to determine the minimum setback distances of the application from the functioning potable water intakes.

Renovate 3 Application Rate (quart/acre)

	Setback Distance (ft)			
Area Treated (acres)	2 qt/acre	4 qt/acre	6 qt/acre	8 qt/acre
< 4	0	200	400	500
> 4 - 8	0	200	700	900
> 8 - 16	0	200	700	1000
> 16	0	200	900	1300

Note: Existing potable water intakes which are no longer in use, such as those replaced by potable water wells or connections to a municipal water system, are not considered to be functioning potable water intakes. These setback restrictions do not apply to terrestrial applications made adjacent to potable water intakes.

To apply Renovate 3 around and within the distances noted above from a functioning potable water intake, the intake must be turned off until the triclopyr level in the intake water is determined to be 0.4 parts per million (ppm) or less by laboratory analysis or immunoassay.

- **Recreational Use of Water in Treatment Area:** There are no restrictions on use of water in the treatment area for recreational purposes, including swimming and fishing.

- **Livestock Use of Water from Treatment Area:** There are no restrictions on livestock consumption of water from the treatment area.

Submerged Weeds

For control of Eurasian watermilfoil (*Myriophyllum spicatum*) and other susceptible submerged weeds in ponds, lakes, reservoirs, and in non-irrigation canals or ditches that have little or no continuous outflow, apply Renovate 3 as either a surface or subsurface application. Rates should be selected according to the rate chart below to provide a triclopyr concentration of 0.75 to 2.5 ppm ae in treated water. Higher rates in the rate range are recommended in areas of greater water exchange. These areas may require a repeat application. However, total application of Renovate 3 must not exceed an application rate of 2.5 ppm triclopyr for the treatment area per annual growing season.

Apply in spring or early summer when Eurasian watermilfoil or other submersed weeds are actively growing.

Areas near susceptible crops or other desirable broadleaf plants may be treated by subsurface injection applied by boat to avoid spray drift.

Subsurface Application
Apply desired amount of Renovate 3 per acre directly into the water through boat-mounted distribution systems.

Surface Application
Apply the desired amount of Renovate 3 as either a concentrate or a spray mixture in water. However, use a minimum spray volume of 5 gallons per acre. Do not apply when weather conditions favor drift to sensitive areas.

Concentration of Triclopyr Acid in Water (ppm ae)

	Gallons of Renovate 3 per surface acre at specified depth				
Water Depth (feet)	0.75 ppm	1.0 ppm	1.5 ppm	2.0 ppm	2.5 ppm
1	0.7	0.9	1.4	1.8	2.3
2	1.4	1.8	3.3	3.6	4.6
3	2.1	2.9	4.1	5.4	6.8
4	2.7	3.6	5.4	7.2	9.1
5	3.4	4.5	6.8	9.0	11.3
6	4.1	5.4	8.1	10.9	13.6
7	4.8	6.3	9.5	12.7	15.8
8	5.5	7.2	10.9	14.5	18.1
9	6.1	8.1	12.2	16.3	20.4
10	6.8	9.0	13.6	18.1	22.6
15	10.2	13.6	20.4	27.2	33.9
20	13.6	18.1	27.2	36.2	45.3

Precautions for Potable Water Intakes - Lakes, Reservoirs, Ponds:
For applications of Renovate 3 to control submerged weeds in lakes, reservoirs or ponds that contain a functioning potable water intake for human consumption, see the chart below to determine the minimum setback distances of the application from the functioning potable water intakes.

Concentration of Triclopyr Acid in Water (ppm ae)					
	Required setback distance (ft) from potable water intake				
Area Treated (acres)	0.75 ppm	1.0 ppm	1.5 ppm	2.0 ppm	2.5 ppm
< 4	300	400	600	800	1000
> 4 - 8	420	560	840	1120	1400
> 8 - 16	600	800	1200	1600	2000
> 16 - 32	780	1040	1560	2080	2600
32 acres, calculate a setback using the formula for the appropriate rate	Setback (ft) = (800* ln (acres) – 160)/3.33	Setback (ft) = (800* ln (acres) – 160)/2.50	Setback (ft) = (800* ln (acres) – 160)/1.67	Setback (ft) = (800* ln (acres) – 160)/1.25	Setback (ft) = (800* ln (acres) – 160)

Example Calculation 1: to apply 2.5 ppm Renovate 3 to 50 acres:

Setback in feet = (800 x ln (50 acres) – 160

= (800 x 3.912) – 160

= 2970 feet

Example Calculation 2: to apply 0.75 ppm Renovate 3 to 50 acres:

$$\text{Setback in feet} = \frac{(800 \times \ln(50 \text{ acres}) - 160}{3.33}$$

$$= \frac{(800 \times 3.912) - 160}{3.33}$$

= 892 feet

Note: Existing potable water intakes which are no longer in use, such as those replaced by potable water wells or connections to a municipal water system, are not considered to be functioning potable water intakes. These setback restrictions do not apply to terrestrial applications made adjacent to potable water intakes.

To apply Renovate 3 around and within the distances noted above from a functioning potable water intake, the intake must be turned off until the triclopyr level in the intake water is determined to be 0.4 parts per million (ppm) or less by laboratory analysis or immunoassay.

- **Recreational Use of Water in Treatment Area:** There are no restrictions on use of water in the treatment area for recreational purposes, including swimming and fishing.

- **Livestock Use of Water from Treatment Area:** There are no restrictions on livestock consumption of water from the treatment area.

Wetland Sites

Wetlands include flood plains, deltas, marshes, swamps, bogs, and transitional areas between upland and lowland sites. Wetlands may occur within forests, wildlife habitat restoration and management areas and similar sites as well as areas adjacent to or surrounding domestic water supply reservoirs, lakes and ponds.

For control of woody plants and broadleaf weeds in these sites, follow use directions and application methods on this label for terrestrial sites associated with wetland areas.

Use Precautions
Minimize overspray to open water when treating target vegetation in and around non-flowing, quiescent or transient water. When making applications to control unwanted plants on banks or shorelines of flowing water, minimize overspray to open water. **Note:** Consult local public water control authorities before appling this product in and around public water. Permits may be required to treat such areas.

Purple Loosestrife (Lythrum salicaria)

Purple loosestrife can be controlled with foliar applications of Renovate 3. For broadcast applications, a minimum of 4 1/2 to 6 lb ae triclopyr (6 to 8 quarts of Renovate 3) per acre is recommended. Apply Renovate 3 when purple loosestrife is at the bud to mid-flowering stage of growth. Follow-up applications for control of regrowth should be made the following year in order to achieve increased control of this weed species. For all applications, a non-ionic surfactant labeled for aquatics should be added to the spray mixture. Follow all directions and use precautions on the label of the surfactant. Thorough wetting of the foliage and stems is necessary to achieve satisfactory control. A minimum spray volume of 50 gallons per acre is recommended for ground broadcast applications.

If using a backpack sprayer, a spray mixture containing 1% to 1.5% Renovate 3 or 5 to 7.6 fl oz of Renovate 3 per 4 gallons of water should be used. All purple loosestrife plants should be thoroughly wetted.

Aerial application by helicopter may be needed when treating restoration sites that are inaccessible, remote, difficult to traverse, isolated, or otherwise unsuited to ground aplication, or in circumstances where invasive exotic weeds dominate native plant populations over extensive areas and efforts to restore native plant diversity are being conducted. By air, apply in a minimum spray volume of 30 gallons per acre using Thru-Valve or Microfoil boom only.

- **Recreational Use of Water in Treatment Area:** There are no restrictions on use of water in the treatment area for recreational purposes, including swimming and fishing.

- **Livestock Use of Water from Treatment Area:** There are no restrictions on livestock consumption of water from the treatment area.

Terrestrial Sites Associated with Wetland Areas

- Apply no more than 2 lb ae triclopyr (2/3 gallon of Renovate 3) per acre per growing season on range and pasture sites, including rights-of-way, fence rows or any area where grazing or harvesting is allowed.

- On forestry sites, Renovate 3 may be used at rates up to 6 lb ae of triclopyr (2 gallons of Renovate 3) per acre per year.

Use Renovate 3 at rates of 3/4 to 6 lb ae triclopyr (1/4 to 2 gallons of Renovate 3) per acre to control broadleaf weeds and woody plants. In all cases use the amount specified in enough water to give uniform and complete coverage of the plants to be controlled. Use only water suitable for spraying. Use of a labeled non-ionic surfactant is recommended for all foliar applications. When using surfactants, follow the use directions and precautions listed on

the surfactant manufacturer's label. Use the higher recommended concentrations of surfactant in the spray mixture when applying lower spray volumes per acre. The recommended order of addition to the spray tank is water, spray thickening agent (if used), additional herbicide (if used), and Renovate 3. A labeled aquatic surfactant should be added to the spray tank last or as recommended on the product label. If combined with emulsifiable concentrate herbicides, moderate continuous adequate agitation is required.

Before using any recommended tank mixtures, read the directions and all use precautions on both labels.

For best results, applications should be made when woody plants and weeds are actively growing. When hard to control species such as ash, blackgum, choke cherry, maples, or oaks are prevalent and during applications made in late summer when the plants are mature and during drought conditions, use the higher rates of Renovate 3.

When using Renovate 3 in combination with a 2,4-D herbicide approved for aquatic use, such as DMA 4 IVM, generally the higher rates should be used for satisfactory brush control.

Use the higher dosage rates when brush approaches an average of 15 feet in height or when the brush covers more than 60% of the area to be treated. If lower rates are used on hard to control species, resprouting may occur the year following treatment.

High Volume Foliage Treatment
For control of woody plants, use Renovate 3 at the rate of 3 to 6 lb ae triclopyr (1 to 2 gallons of Renovate 3) per 100 gallons of spray solution, or Renovate 3 at 3/4 to 3 lb ae triclopyr (1 to 4 quarts of Renovate 3) may be tank mixed with 1/4 to 1/2 gallons of 2,4-D 3.8 lb amine, like DMA 4 IVM, diluted to make 100 gallons of spray solution. Apply at a volume of 100 to 400 gallons of total spray per acre depending on size and density of woody plants. Coverage should be thorough to wet all leaves, stems, and root collars. (See General Use Precautions and Restrictions.) Do not exceed the maximum allowable use rate of 6 lb ae of triclopyr (2 gallons of Renovate 3) per acre per growing season.

Low Volume Foliage Treatment
To control susceptible woody plants, apply up to 15 lb ae triclopyr (5 gallons of Renovate 3) in 10 to 100 gallons of finished spray. The spray concentration of Renovate 3 and total spray volume per acre may be adjusted according to the size and density of target woody plants and kind of spray equipment used. With low volume sprays, use sufficient spray volume to obtain uniform coverage of target plants including the surfaces of all foliage, stems, and root collars (see General Use Precautions and Restrictions). For best results, a labeled aquatic surfactant should be added to all spray mixtures. Match equipment and delivery rate of spray nozzles to height and density of woody plants. When treating tall, dense brush, a truck mounted spray gun with spray tips that deliver up to 2 gallons per minute at 40 to 60 psi may be required. Backpack or other types of specialized spray equipment with spray tips that deliver less than 1 gallon of spray per minute may be appropriate for short, low to moderate density brush.

Cut Surface Treatments (Woody Plants)
To control unwanted trees and other listed woody plants, apply Renovate 3, either undiluted or diluted in a 1 to 1 ratio with water as directed below.

With Tree Injector Method
Applications should be made by injecting 1/2 milliliter of undiluted Renovate 3 or 1 milliliter of the diluted solution through the bark at intervals of 3 to 4 inches between centers of the injector wound. The injections should completely surround the tree at any convenient height. **Note: No Worker Protection Standard worker entry restrictions or worker notification requirements apply when this product is injected directly into plants.**

With Hack and Squirt Method
Make cuts with a hatchet or similar equipment at intervals of 3 to 4 inches between centers at a convenient height around the tree trunk. Spray 1/2 milliliter of undiluted Renovate 3 or 1 milliliter of the diluted solution into each cut.

With Frill or Girdle Method
Make a single girdle through the bark completely around the tree at a convenient height. Wet the cut surface with undiluted or diluted solution.

Both of the above methods may be used successfully at any season except during periods of heavy sap flow of certain species—for example, maples.

Stump Treatment
Spray or paint the cut surfaces of freshly cut stumps and stubs with undiluted Renovate 3. The cambium area next to the bark is the most vital area to wet.

Terms and Conditions of Use

If terms of the following Warranty Disclaimer, Inherent Risks of Use, and Limitation of Remedies are not acceptable, return unopened package at once to the seller for a full refund of purchase price paid. Otherwise, use by the buyer or any other user constitutes acceptance of the terms under Warranty Disclaimer, Inherent Risks of Use and Limitations of Remedies.

Warranty Disclaimer

SePRO Corporation warrants that the 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. SEPRO CORPORATION MAKES NO OTHER EXPRESS OR IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR ANY OTHER EXPRESS OR IMPLIED WARRANTY.

Inherent Risks of Use

It is impossible to eliminate all risks associated with use of this product. Plant 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 or application, or other factors, all of which are beyond the control of SePRO Corporation as the seller. All such risks shall be assumed by buyer.

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 SePRO Corporation's 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.

SePRO Corporation shall not be liable for losses or damages resulting from handling or use of this product unless SePRO Corporation is promptly notified of such losses or damages in writing. In no case shall SePRO Corporation be liable for consequential or incidental damages or losses.

The terms of the Warranty Disclaimer above and this Limitation of Remedies can not be varied by any written or verbal statements or agreements. No employee or sales agent of SePRO Corporation or the seller is authorized to vary or exceed the terms of the Warranty Disclaimer or Limitations of Remedies in any manner.

Form No. A-00-RG-01(03)

Material Safety Data Sheet

SePRO

Transportation and Medical Emergency Phone: 1-800-535-5053 (INFOTRAC)
General Phone: 317-580-8282

EPA Reg. Number: 62719-37-67690
Effective Date: 01/22/03

Renovate† 3 Herbicide

SePRO Corporation Carmel, IN 46032

1. PRODUCT AND COMPANY IDENTIFICATION

PRODUCT: Renovate† 3 Herbicide

COMPANY IDENTIFICATION:
SePRO Corporation
11550 North Meridian Street, Suite 600
Carmel, IN 46032
www.sepro.com

2. COMPOSITION / INFORMATION ON INGREDIENTS

Triclopyr ((3,5,6-trichloro-2-pyridinyl)oxy)acetic acid), triethylamine salt	CAS # 057213-69-1	44.4%
Inert Ingredients, Total, Including		55.6%
Ethanol	CAS # 000064-17-5	
Triethylamine (N,N-Diethylethanamine)	CAS # 000121-44-8	
Ethylenediaminetetraacetic Acid (EDTA)	CAS # 000060-00-4	

This document is prepared pursuant to the OSHA Hazard Communication Standard (29 CFR 1910.1200). In addition, other substances not 'Hazardous' per this OSHA Standard may be listed. Where proprietary ingredient shows, the identity may be made available as provided in this standard.

3. HAZARDOUS IDENTIFICATIONS

EMERGENCY OVERVIEW

Hazardous Chemical. Light purple-pink liquid, ammonia-like odor. May cause severe eye irritation with corneal injury, which may result in permanent impairment of vision, even blindness. Prolonged or repeated exposure may cause skin irritation, even a burn. LD_{50} for skin absorption in rabbits is >5000 mg/kg; oral LD_{50} for male rats is 2574 mg/kg and 1847 mg/kg for female rats. Toxic and irritating gases may be formed during fire conditions.

EMERGENCY PHONE NUMBER: 1-800-992-5994

POTENTIAL HEALTH EFFECTS: This section includes possible adverse effects, which could occur if this material is not handled in the recommended manner.

EYE: May cause severe irritation with corneal injury, which may result in permanent impairment of vision, even blindness. Vapors of amines may cause swelling of the cornea resulting in visual disturbances such as blurred, smoky or halo vision. When tested on animals, dilutions of this material were less irritating to eyes than the undiluted product.

SKIN: Prolonged or repeated exposure may cause skin irritation, even a burn. When tested on animals, dilutions of this material were less irritating to skin than the undiluted product. Prolonged or frequently repeated skin contact may cause allergic skin reactions in some individuals. With the dilute mix, no allergic skin reaction is expected. A single prolonged exposure is not likely to result in the material being absorbed through the skin in harmful amounts. The LD_{50} for skin absorption in rabbits is >5000 mg/kg.

INGESTION: Single dose oral toxicity is low. The oral LD_{50} was 2574 mg/kg for male rats and 1847 mg/kg for female rats. Small amounts swallowed incidental to normal handling operations are not likely to cause injury; however, swallowing larger amounts may cause injury. Ingestion may cause gastrointestinal irritation or ulceration.

INHALATION: A single brief (minutes) inhalation exposure is not likely to cause adverse effects.

SYSTEMIC (OTHER TARGET ORGAN) EFFECTS: Excessive exposure may cause liver or kidney effects.

CANCER INFORMATION: Triclopyr did not cause cancer in laboratory animal studies. This material contains ethanol. Epidemiology studies provide evidence that drinking of alcoholic beverages (containing ethanol) is associated with cancer, and IARC has classified alcoholic beverages as carcinogenic to humans.

TERATOLOGY (BIRTH DEFECTS): For triclopyr, birth defects are unlikely. Even exposures having an adverse effect on the mother should have no effect on the fetus. Ethanol has been shown to cause birth defects and toxicity to the fetus in laboratory animal tests. It has also been shown to cause human fetotoxicity and/or birth defects when ingested during pregnancy.

REPRODUCTIVE EFFECTS: For triclopyr, in laboratory animal studies, effects on reproduction have been seen only at doses that produced significant toxicity to the parent animals. Ingestion of large amounts of ethanol has been shown to interfere with fertility in human males.

†Renovate is a registered trademark of Dow AgroSciences LLC manufactured for SePRO Corporation.

SePRO

Renovate† 3 Herbicide

4. FIRST AID

EYE: Wash immediately and continuously with flowing water for at least 30 minutes. Remove contact lenses after the first 5 minutes and continue washing. Obtain prompt medical consultation, preferably from an ophthalmologist.

SKIN: Wash skin with plenty of water.

INGESTION: Do not induce vomiting. Give one cup (8 ounces or 240 ml) of water or milk if available and transport to a medical facility. Do not give anything by mouth to an unconscious person.

INHALATION: No emergency medical treatment necessary.

NOTE TO PHYSICIAN: Due to irritant properties, swallowing may result in burns/ulceration of mouth, stomach and lower GI tract with subsequent stricture. Aspiration of vomitus may cause lung injury. Suggest endotracheal/ esophageal control if lavage is done. If burn is present treat as any thermal burn, after decontamination. Exposure to amine vapors may cause minor transient edema of the corneal epithelium (glaucopsia) with blurred vision, blue haze, and halos around bright objects. Effects disappear in a few hours and temporarily reduce ability to drive vehicles. No specific antidote. Treatment of exposure should be directed at the control of symptoms and the clinical condition of the patient.

5. FIRE FIGHTING MEASURES

FLASH POINT: 110° F (43° C)
METHOD USED: TCC
FLAMMABLE LIMITS: LFL: Not determined
UFL: Not determined

EXTINGUISHING MEDIA: Alcohol foam and CO_2.

FIRE AND EXPLOSION HAZARDS: Toxic, irritating vapors may be formed or given off if product is involved in fire. Although product is water-based, it has a flash point due to the presence of small amounts of ethanol and triethylamine.

FIRE-FIGHTING EQUIPMENT: Use positive-pressure, self-contained breathing apparatus and full protective clothing.

6. ACCIDENTAL RELEASE MEASURES

ACTION TO TAKE FOR SPILLS/LEAKS: Contain small spills and absorb with an inert material such as clay or dry sand. Report large spills to InfoTrac at 1-800-535-5053.

7. HANDLING AND STORAGE

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE: HANDLING: Keep out of reach of children. Causes irreversible eye damage. Harmful if inhaled or absorbed through skin. Prolonged or frequently repeated skin contact may cause allergic skin reaction in some individuals. Avoid contact with eyes, skin, clothing, breathing vapor, or spray mist. Users should wash hands before eating, drinking, chewing gum, using tobacco, or using the toilet.

STORAGE: Store above 28°F or agitate before use. Store in original container. See product label for handling/storage precautions relative to the end use of this product.

8. EXPOSURE CONTROL/PERSONAL PROTECTION

These precautions are suggested for conditions where the potential for exposure exists. Emergency conditions may require additional precautions.

EXPOSURE GUIDELINE(S):
Ethanol (ethyl alcohol): ACGIH TLV and OSHA PEL are 1000 ppm. ACGIH classification is A4.
3,5,6-Trichloro-2-pyridyloxyacetic acid (Triclopyr), triethylamine salt: SePRO Corporation Industrial Hygiene Guideline is 2 mg/M^3 as acid equivalent; Skin.
Triethylamine: ACGIH TLV is 1 ppm TWA, 3 ppm STEL, Skin. OSHA PEL is 10 ppm TWA, 15 ppm STEL.

PELs are in accord with those recommended by OSHA, as in the 1989 revision of PELs.

A "skin" notation following the exposure guideline refers to the potential for dermal absorption of the material. It is intended to alert the reader that inhalation may not be the only route of exposure and that measures to minimize dermal exposures should be considered.

ENGINEERING CONTROLS: Provide general and/or local exhaust ventilation to control airborne levels below the exposure guidelines.

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SePRO Corporation Carmel, IN 46032

RECOMMENDATIONS FOR MANUFACTURING, COMMERCIAL BLENDING, AND PACKAGING WORKERS:

RESPIRATORY PROTECTION: Atmospheric levels should be maintained below the exposure guideline. When respiratory protection is required for certain operations, use a NIOSH approved air-purifying respirator.

SKIN PROTECTION: When prolonged or frequently repeated contact could occur, use protective clothing impervious to this material. Selection of specific items such as faceshield, gloves, boots, apron or full-body suit will depend on operation.

EYE PROTECTION: Use chemical goggles. Eye wash fountain should be located in immediate work area. If vapor exposure causes eye discomfort, use a NIOSH approved full-face respirator.

APPLICATORS AND ALL OTHER HANDLERS: Refer to the product label for personal protective clothing and equipment.

9. PHYSICAL AND CHEMICAL PROPERTIES

BOILING POINT: Not determined
VAPOR PRESSURE: Not determined
VAPOR DENSITY: Not applicable
SOLUBILITY IN WATER: Miscible
SPECIFIC GRAVITY: 1.135 (68/68°F)
APPEARANCE: Light purple/pink liquid
ODOR: Ammonia-like odor

10. STABILITY AND REACTIVITY

STABILITY: (CONDITIONS TO AVOID) Avoid sources of ignition if temperature is near or above flash point.

INCOMPATIBILITY: (SPECIFIC MATERIALS TO AVOID) Any oxidizing agent. Consult manufacturer for specific cases.

HAZARDOUS DECOMPOSITION PRODUCTS: Nitrogen oxides and hydrogen chloride may be formed under fire conditions.

HAZARDOUS POLYMERIZATION: Not known to occur.

11. TOXICOLOGICAL INFORMATION

MUTAGENICITY: For triclopyr and ethanol: in-vitro mutagenicity studies were negative. For triclopyr: animal mutagenicity studies were negative. For ethanol: animal mutagenicity studies were negative in some cases and positive in other cases.

12. ECOLOGICAL INFORMATION

ENVIRONMENTAL FATE:
MOVEMENT & PARTITIONING: Based largely or completely on information for triclopyr. Bioconcentration potential is low (BCF < 100 or Log Pow < 3).

DEGRADATION & PERSISTENCE: Biodegradation under aerobic static laboratory conditions is high (BOD20 or BOD28/ThOD > 40%). 20-Day biochemical oxygen demand (BOD20) is 0.30 p/p. Theoretical oxygen demand (ThOD) is calculated to be 0.75 p/p.

ECOTOXICOLOGY: Material is slightly toxic to aquatic organisms on an acute basis (LC_{50}/EC_{50} is between 10 and 100 mg/L in most sensitive species).
Acute EC_{50} for shell deposition inhibition in Eastern oyster (*Crassostrea virginica*) is 56-87 mg/L.
Acute LC_{50} for rainbow trout (*Oncorhynchus mykiss*) is 400 mg/L.
Acute LC_{50} for channel catfish (*Ictalurus punctatus*) is 446 mg/L.
Acute LC_{50} for pink shrimp (*Penaeus duorarum*) is 895 mg/L.
Growth inhibition EC_{50} for green alga (*Selenastrum capricornutum*) is 45 mg/L.

13. DISPOSAL CONSIDERATIONS

DISPOSAL METHOD: Do not contaminate food, feed, or water by storage or disposal. Excess wastes are toxic. Improper disposal or excess wastes are a violation of federal law. If wastes resulting from the use of this product cannot be disposed of according to label instructions, dispose of these wastes at an approved facility. Contact your state pesticide or environmental control agency, or the hazardous waste representative at the nearest EPA regional office for guidance.

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14. TRANSPORT INFORMATION

For DOT regulatory information, if required, consult transportation regulations, product-shipping papers, or contact your SePRO Corporation representative.

15. REGULATORY INFORMATION

NOTICE: The information herein is presented in good faith and believed to be accurate as of the effective date shown above. However, no warranty, express or implied, is given. Regulatory requirements are subject to change and may differ from one location to another; it is the buyer's responsibility to ensure that its activities comply with federal, state or provincial, and local laws. The following specific information is made for the purpose of complying with numerous federal, state or provincial, and local laws and regulations.

U.S. REGULATIONS

SARA 313 INFORMATION: This product contains the following substances subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372:

CHEMICAL NAME	CAS NUMBER	CONCENTRATION
N,N-Diethylethanamine	000121-44-8	3%

SARA HAZARD CATEGORY: This product has been reviewed according to the EPA "Hazard Categories" promulgated under Sections 311 and 312 of the Superfund Amendment and Reauthorization Act of 1986 (SARA Title III) and is considered, under applicable definitions, to meet the following categories:

An immediate health hazard
A delayed health hazard
A fire hazard

TOXIC SUBSTANCES CONTROL ACT (TSCA): All ingredients are on the TSCA inventory or are not required to be listed on the TSCA inventory.

STATE RIGHT-TO-KNOW: The following product components are cited on certain state lists as mentioned. Non-listed components may be shown in the composition section of the MSDS.

CHEMICAL NAME	CAS NUMBER	LIST
Ethylenediamine Tetraacetic Acid	000060-00-4	NJ3 PA1 PA3
Ethanol	000064-17-5	NJ1 NJ3 PA1
N,N-Diethylethanamine	000121-44-8	NJ1 NJ3 PA1 PA3

NJ1 = New Jersey Special Health Hazard Substance (present at > or = to 0.1%).
PA1 = Pennsylvania Hazardous Substance (present at > or = to 1.0%).
PA3 = Pennsylvania Environmental Hazardous Substance (present at > or = to 1.0%).

OSHA HAZARD COMMUNICATION STANDARD:
This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) RATINGS:

CATEGORY	RATING
Health	3
Flammability	2
Reactivity	0

COMPREHENSIVE ENVIRONMENTAL RESPONSE COMPENSATION AND LIABILITY ACT (CERCLA, or SUPERFUND): This product contains the following substance(s) listed as "Hazardous Substances" under CERCLA which may require reporting of releases:

Chemical Name	CAS Number	RQ	% in Product
Triethylamine	000121-44-8	5000	3%
Ethylenediaminetetra-acetic Acid (ETDA)	000060-00-4	5000	2.3%

RCRA Categorization Hazardous Code:
Triethylamine = U404

16. OTHER INFORMATION

MSDS STATUS: New 01/22/03

The information herein is given in good faith, but no warranty, express or implied, is made. Consult SePRO Corporation for further Information.

Appendix F: Species controlled with Navigate® and AquaKleen®

Table 2: Species Controlled with Aqua-Kleen® and Navigate®, Effectiveness of Control and Registration Status for Control of Listed Species

Species Controlled	Effectiveness of Control or Labeled Use	
	Aqua-Kleen®	Navigate®
Potamogeton spp. Pondweed	No Efficacy Claimed[7]	No Efficacy Claimed
Ceratophyllum spp. Coontail	Labeled Use Fair Control[2]	Labeled Use Fair Control[2]
Hydrilla verticillata Hydrilla	No Efficacy Claimed	No Efficacy Claimed
Myriophyllum spicatum Eurasian watermilfoil	Labeled Use Excellent Control[2]	Labeled Use Excellent Control[2]
Myriophyllum spp. Milfoil	Labeled Use Excellent Control[1]	Labeled Use Excellent Control[1]
Myriophyllum hetrophyllum Variable leaf milfoil	Labeled Use Excellent Control[1]	Labeled Use Excellent Control[1]
Brasenia spp. Watershield	Labeled Use Excellent Control[2]	Labeled Use Excellent Control[2]
Uricularia spp. Bladderwort	Labeled Use Fair Control[6] Good Control[3]	Labeled Use Fair Control[6] Good Control[3]
Heteranthera spp. Water stargrass	Labeled Use	Labeled Use
Sparganium spp. Bur reed	No Efficacy Claimed	No Efficacy Claimed
Hygrophila polysperma Hygrophila	No Efficacy Claimed	No Efficacy Claimed
Lythrum salicaria Purple loosestrife	No Efficacy Claimed	No Efficacy Claimed
Egeria densa Brazilian elodea	No Efficacy Claimed	No Efficacy Claimed
Myriophyllum aquaticum Parrotsfeather	Labeled Use Excellent Control[1,2]	Labeled Use Excellent Control[1,2]
Cabomba caroliniana Fanwort	Fair Control[4] No Efficacy Claimed	Fair Control[4] No Efficacy claimed
Tamarix ramosissima Saltcedar	No Efficacy Claimed	No Efficacy Claimed
Amorpha fruitcosa Indigobush	No Efficacy Claimed	No Efficacy Claimed
Polygonum sacalinense Giant knotweed	No Efficacy Claimed	No Efficacy Claimed
Polygonum cuspidatum Japanese knotweed	No Efficacy Claimed	No Efficacy Claimed

Table 2: Species Controlled, Effectiveness of Control and Registration Status for Control of Listed Species (Continued)

Species Controlled	Effectiveness of Control or Labeled Use	
	Aqua-Kleen®	Navigate®
Lysimachia vulgaris Garden loosestrife	No Efficacy Claimed	No Efficacy Claimed
Phalaris arundinacea Reed canarygrass	No Efficacy Claimed	No Efficacy Claimed Labeled Use
Typha Spp. Cattail	Labeled Use Fair Control[5] Good Control[4]	Fair Control[5] Good Control[4]
Elodea canadensis American waterweed	No Efficacy Claimed	No Efficacy Claimed
Nuphar spp. Spadderdock	Labeled Use Fair Control[5] Excellent Control[2]	Labeled Use Fair Control[5] Excellent Control[2]
Nymphaea spp. Fragrant water lilies	Labeled Use Good Control[3] Excellent Control[2]	Labeled Use Good Control[3] Excellent Control[2]
Hydrilla	No Efficacy Claimed	No Efficacy Claimed
Spartina Smooth cordgrass	No Efficacy Claimed	No Efficacy Claimed
Phragmites australis. Common reed	No Efficacy Claimed	No Efficacy Claimed
Trapa natans Water chestnut	Labeled Use Good Control[4]	Labeled Use Good Control[4]
Algae species	No Efficacy Claimed	No Efficacy Claimed

1 (Robinette, 1998-1999)
2 (Westerdahl et al., 1988)
3 (Robinette, 1998-1999)
4 (Westerdahl et al., 1988)
5 (Robinette, 1998-1999)
6 (Westerdahl et al., 1988)
7 No Efficacy Claimed = The indicated formulation has not been shown to control this species. Not listed as a controlled species on the label.

Appendix G: Herbicide Residential and Business Notification

Herbicide Application
Residential and Business Notice

The Waters of Newman Lake will be treated with aquatic herbicide(s) **on or near October 20th** (weather permitting, if weather is a factor the treatment will proceed on the next day when practical).

Attached is a map of the area(s) to receive treatment.

On the day of treatment, notices will be posted at your shoreline if you are in the affected area. They will also be posted at all boat launches within 1.5 miles of the treatment area.

The herbicide that will be used on **or near October 20th** will be **AquaKleen or Dow IVM** (active ingredient 2,4-D). Both are US EPA and Washington Department of Ecology approved aquatic herbicides.

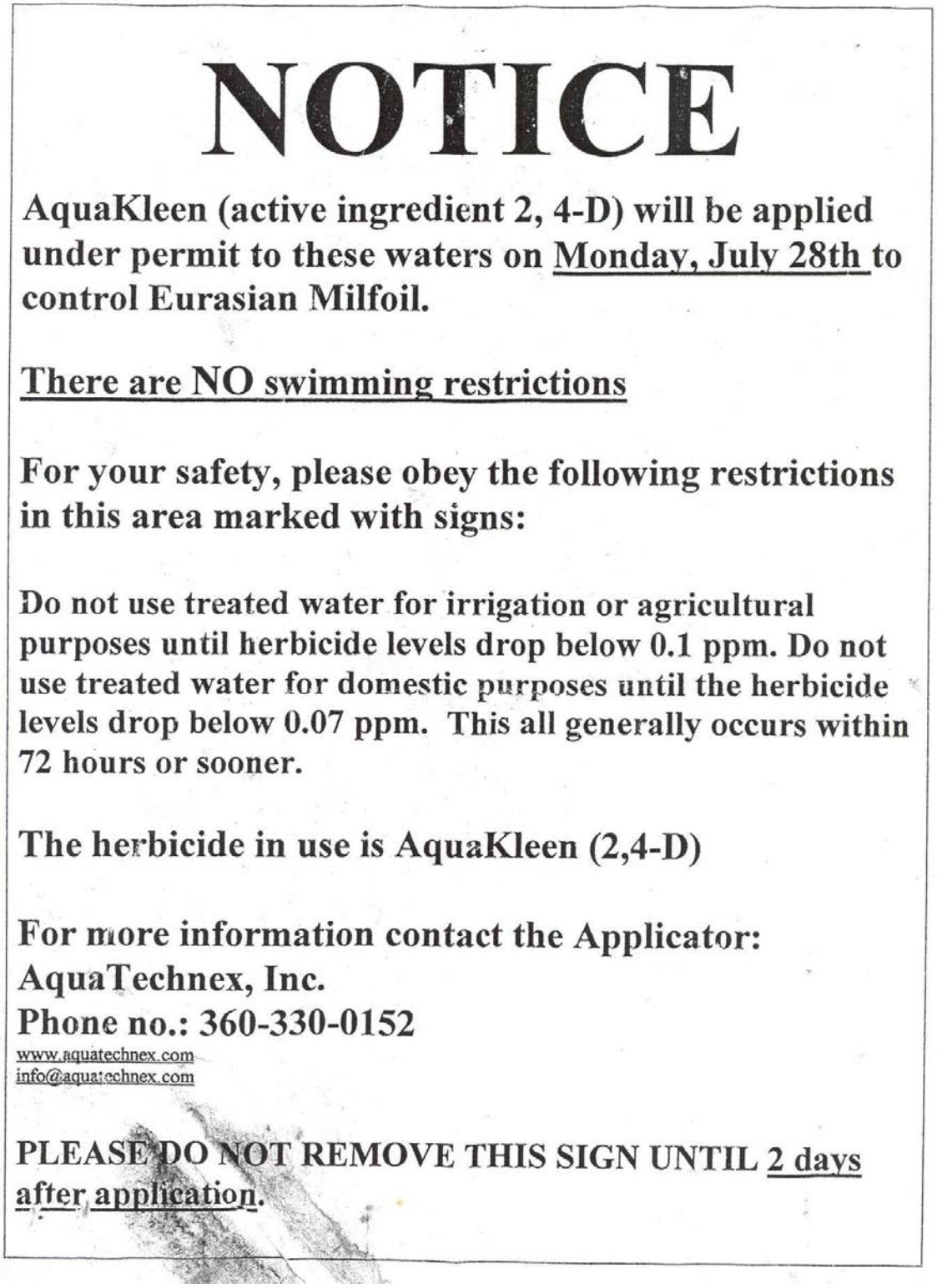
Please obey the following use restrictions within the marked treatment areas: Do not use treated water for irrigation or agricultural purposes until herbicide levels drop below 0.1 ppm . Do not use treated water for domestic purposes until the herbicide levels drop below 0.07 ppm. This generally occurs within 72 hours or sooner.

Herbicides to be used, their water restrictions, and the dates and locations of treatment(s) scheduled for the remainder of the season are: Do not use treated water for irrigation or agricultural purposes until herbicide levels drop below 0.1 ppm . Do not use treated water for domestic purposes until the herbicide levels drop below 0.07 ppm. This generally occurs within 72 hours or sooner. Additional treatments may be made, as necessary, every two weeks after the initial treatment within the treatment area(s) until the permit expires. Shoreline notices will be posted prior to any additional needed treatments.

For more information contact Aquatechnex at 360-330-0152 or terry@aquatechnex.com or go to www.aquatechnex.com.

This herbicide treatment is regulated under a permit issued by the Department of Ecology Water quality Program and administered by the Washington Department of Agriculture. These herbicides have been approved for this purpose by EPA and the State Department of Agriculture.

Appendix H: Posting for Direct Aquatic Application



NOTICE

AquaKleen (active ingredient 2, 4-D) will be applied under permit to these waters on Monday, July 28th to control Eurasian Milfoil.

There are NO swimming restrictions

For your safety, please obey the following restrictions in this area marked with signs:

Do not use treated water for irrigation or agricultural purposes until herbicide levels drop below 0.1 ppm. Do not use treated water for domestic purposes until the herbicide levels drop below 0.07 ppm. This all generally occurs within 72 hours or sooner.

The herbicide in use is AquaKleen (2,4-D)

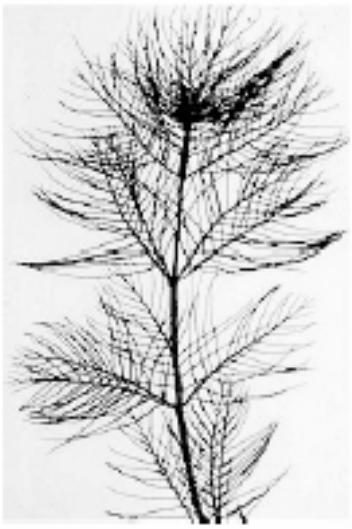
For more information contact the Applicator:
AquaTechnex, Inc.
Phone no.: 360-330-0152
www.aquatechnex.com
info@aquatechnex.com

PLEASE DO NOT REMOVE THIS SIGN UNTIL 2 days after application.

Appendix I : Newman Lake Newsletter Article, Spring 2003

EURASIAN MILFOIL IN NEWMAN LAKE

Late last fall, we discovered a very young infestation of Eurasian Water Milfoil (Myriophyllum spicatum) at the South end of Newman Lake around the outlet gate area. As disappointing as it was to find, it was probably inevitable that at some point we would get it. It spreads easily from even small plant fragments brought in by boats. Many lakes and rivers in Northeast Washington and Idaho panhandle have been fighting Eurasian Milfoil for years, including Liberty Lake, Loon Lake, Long Lake, Diamond Lake, Pend Oreille River, Little Spokane river and others. Fortunately we have caught it an early stage of growth and the area infested is relatively small, only about 20 acres. Management and control is much easier especially if we act soon and keep on top of it.



Problem: E. Milfoil is a submersed aquatic plant that has becom a problem in many of Washington's lakes and rivers. This invasive nonnative species is fast growing, spreading by plant fragments and root systems. It can eventually produce dense mats that interfere with navigation and recreational activities such as boating, swimming fishing, and water-skiing. It also adversely impacts aquatic ecosystems by forming dense fast growing canopies that often shade out native vegetation and provide poor habitat for waterfowl, fish, and other wildlife. With its fast thick growth it can also significantly increase the decomposing biomass at the end of the growing season and therefore increase the internal loading of nutrients to the water and decreasing water quality. Because of this the Newman Lake Flood Control Zone District (NLFCZD) is trying to act quickly to implement a control plan.

Management: Effective management requires a long-term commitment. It involves frequent surveying, implementation of control actions up to 2 or 3 times per year, and education. Plans now include surveying the entire lakeshore by boat and/or foot again in late spring as we did last fall with follow up 2-3 times during the growing season. Control options include diver hand pulling, chemical herbicides, bottom barriers, and mechanical harvesting among others. The most effective in Newman Lake at this time seems to be treatment with 2,4D, a selective herbicide proven very effective against milfoil with out impacting native aquatic vegetation. Then following up with diver hand pulling which is most effective with small nfestations and isolated plants. This is based on advice from Department of Ecology and Dr. Barry Moore (who has had extensive experience controlling milfoil at Liberty Lake). Bottom barriers are difficult to anchor for very long and also block native vegetation, which can help control milfoil spread. Mechanical harvesting in early infestations of Milfoil usually does more harm than good as it spreads plant fragments. The District will be preparing a management plan in the next couple of months to review these options and impacts in more detail. We plan to start surveying and implementing controls in late spring (late May or June). If you would like to participate in this process please see the public meeting information at the end of this article.

Education and Identification: We can use your help in preventing and identifying any further spread of this noxious aquatic weed. Please remove any plant fragments from your boat before launching in Newman Lake. Be especially careful around props and intakes where they snag and hide easily. Also keep your eyes open for any new infestations in your area. Eurasian water milfoil is a

Milfoil (cont.)

submersed perennial plant with finely dissected feather-like leaves. The leaves are arranged in whorls of 4 around the stem at each node. Each Eurasian water milfoil leaf generally has 12 or more leaflet pairs. See photos below. Until you've seen a few, it can be easy to confuse this with other native plants. If you think you may have spotted a milfoil plant, contact me (see contact info below) and I'll come out and take a look.

Cost: Since we've caught it early, control costs will hopefully stay manageable. Fortunately the Newman Lake Flood Control Zone District has received a $50,000 grant from Dept. of Ecology to manage Eurasian Water Milfoil growth over the next 3 years. We are required to provide only a 12.5% ($7,143) match from our District funds.

Public Meeting: The NLFCZD would like to get your input and also respond to any questions or concerns you might have on these plans. We will be holding a public meeting to discuss our plans and alternatives and answer your questions at the April Newman Lake Watershed Committee meeting. It will be held on Wednesday, April 23rd at 6:30 pm at the Tri-community Grange hall. Please come! If you cannot attend but would like to receive a copy of the plan and/or notify me of your concerns please contact me as noted below.

To learn more: If your interested in learning more about aquatic weeds and Eurasian Milfoil, the best place to start is the Department of Ecology's web site for Lakes and aquatic plants at http://www.ecy.wa.gov/programs/wq/links/plants.html.

NLFCZD Contact: Marianne Barrentine, Spokane County Division of Engineering and Roads, 1026 W Broadway, Spokane WA 99260, phone 509-477-7443, fax 509-477-7478, email: mbarrentine@spokanecounty.org.

Appendix J: 2003 Draft Preliminary Milfoil Management Plan

DRAFT

Newman Lake Flood Control Zone District

PRELIMINARY AQUATIC VEGETATION MANAGEMENT PLAN

For Control Of Eurasian Watermilfoil In Newman Lake

Background: In September 2002, we discovered a very young infestation of Eurasian Watermilfoil (*Myriophyllum spicatum*) at the South end of Newman Lake around the outlet gate area (see attached location map). As disappointing as it was to find, it was probably inevitable that at some point we would get it. It spreads easily from even small plant fragments brought in by boats. Many lakes and rivers in Northeast Washington and Idaho panhandle (as well as all over the US) have been fighting Eurasian Milfoil for years, including Liberty Lake, Loon Lake, Long Lake, Diamond Lake, Pend Oreille River, Little Spokane river and others. Fortunately we have caught it an early stage of growth and is relatively small thin stand. The area infested is only about 20 acres area and if plants all pushed together probably cover an area less than 2 acres. Management and control is much easier especially if we act soon and keep on top of it.

Why is this a Problem: Eurasian Watermilfoil (Milfoil) is a submersed aquatic plant that has become a problem in many of Washington's lakes and rivers. This invasive non-native species is fast growing, and easily spreads by plant fragments and root systems. Because it is not native it seems to have no natural enemies to control its growth. Potential negative impacts include:

1. **Recreational Use of the Lake**: Milfoil can eventually produce dense mats that interfere with navigation and recreational activities such as boating, swimming, fishing, and water-skiing. Although so far in Newman Lake we have only seen the milfoil growing in about 3 feet of water, it can grow at depths of up to 30 feet and reach the surface when growing in depths of up to 15 feet. For a shallow lake like Newman this could be significant portion of the lake though visibility may limit its spread.
2. **Aquatic Habitat**: Milfoil also adversely impacts aquatic ecosystems by forming dense fast growing canopies that often shade out native vegetation. It's mono-specific stands provide poor habitat and food for waterfowl, fish, and other wildlife.
3. **Water Quality:** With its fast thick growth Milfoil can also significantly increase the decomposing biomass at the end of the growing season and therefore increase the internal loading of nutrients to the water and decreasing water quality. Since Newman Lake already has an excess nutrient problem, this could be special concern.

Goals of Control Program: Because of these potentially serious impacts of Milfoil in Newman Lake, the Newman Lake Flood Control Zone District (NLFCZD) is trying to act quickly to implement a control plan. Eradication is rarely successful. Our goal at this time is to:

6. Contain milfoil to the existing infested areas outlet area and hopefully reduce the plants in this area.

7. Minimize any negative environmental impacts of the control methods
8. Minimize costs of control to the State and the Newman Lake Homeowner.

Management: Based on the experience of other lakes, effective and affordable control requires a long-term commitment and early action. It involves frequent surveying to determine milfoil locations, implementation of control actions up to 2 or 3 times per year, and education to prevent continued re-infestation.

Survey: Plans now include surveying the entire lakeshore by boat and/or foot in late May as we did last fall. We will be locating and mapping plans and infested areas with GPS. Identification before infestations have spread will reduce control costs. We will monitor trouble some areas routinely with full follow up surveys in spring and fall.

Control options: Various methods have been used with varying degrees of success in other lakes and water bodies. A summary of these options is below

Diver hand pulling: During hand pulling, milfoil plants are manually removed from the lake bottom, with care taken to remove the entire root crown and to not create fragments. In deeper water, divers are usually needed to reach the plants. Cost effective in small areas of light infestation and /or early or follow-up control.

Chemical herbicides: Of those permitted and effective against milfoil 2,4D is the most selective for milfoil, easiest to use in a limited area (granular application) and also most cost effective and least environmental impact. Complete decomposition of 2,4D in water is usually about 3 weeks (but can be as short as 1 week).

Bottom barriers Bottom barriers are semi-permanent materials that are laid over the top of milfoil beds and are analogous to using landscape fabric to suppress the growth of weeds in yards. They are difficult to anchor for very long and also block native vegetation, which can help control milfoil spread. Can be considered in the future for small limited areas around docks.

Mechanical harvesting: Harvesting is a way to mechanically remove milfoil in order to provide open areas of water for recreational activities and navigation. Harvesting immediately removes surfacing milfoil mats, but since the cut plants grow back (sometimes within weeks), the same area may need to be harvested twice or more per growing season. Using in early infestations of Milfoil this method usually does more harm than good as it spreads plant fragments.

No Action: This is always an option but not recommend as potential severe impacts and high future costs.

Recommendations: The most effective in Newman Lake *at this time* seems to be treatment with 2,4D, a selective herbicide proven very effective against milfoil with out impacting native aquatic vegetation. Then following up with diver hand pulling which is most effective with small infestations and isolated plants. This is based on advice from Department of Ecology and Br. Barry Moore (who has had extensive experience controlling milfoil at Liberty Lake).

Herbicide Application Procedures/Schedule: We are tentatively looking at scheduling the first 2,4D treatment for late June this year. We will be contracting with a State licensed applicator who will obtain permits under

State Dept. Of Agriculture's NPDES permit. All residences and businesses within ¼ mile will be notified 10-21 days prior to application. All permit and label conditions will be followed including notification to and restrictions of irrigation and drinking water users with in or near treatment area. If necessary we will be providing water supplies at no cost during the restricted period to those with impacted intakes and with no alternative supply. We will also be performing follow-up testing of herbicide levels to determine when herbicide levels have dissipated.

Education and Identification: We can use your help in preventing and identifying any further spread of this noxious aquatic weed.

1. **Please remove any plant fragments from your boat before launching in Newman Lake.** Be especially careful around props and intakes where they snag and hide easily.
2. **Volunteer** to help us with our weekend education efforts at the public boat launch.
3. **Monitor your beach**: Keep your eyes open for any new infestations in your area. Eurasian watermilfoil is a submersed perennial plant with finely dissected feather-like leaves. The leaves are arranged in whorls of 4 around the stem at each node. Each Eurasian water milfoil leaf generally has 12 or more leaflet pairs. Until you've seen a few, it can be easy to confuse this with other native plants. If you think you may have spotted a milfoil plant, contact me (see contact info below) and I'll come out and take a look. Do not try to remove the plants yourself! If not careful you can spread more with improper removal.

Cost: Since we've caught it early, control costs will hopefully stay manageable. 2,4D treatments can cost $400-$600/acre of treated area. Surveying and hand pulling efforts currently cost Liberty Lake about $3,000 annually. Fortunately the Newman Lake Flood Control Zone District has received a $50,000 grant from Dept. of Ecology to manage Eurasian Water Milfoil growth over the next 3 years. We are required to provide only a 12.5% ($7,143) match from our District funds this will be in the form of staff time and volunteer time. At least for now we see only a small roughly $2,000/year impact to the annual District Budget or on the order of 1-2% increase in District assessments ($5-10/ year for an average homeowner paying $500/year assessment).

To Learn More: If your interested in learning more about aquatic weeds and Eurasian Milfoil, the best place to start is the Department of Ecology's web site for Lakes and aquatic plants at http://www.ecy.wa.gov/programs/wq/links/plants.html.

NLFCZD Contact: Marianne Barrentine, Spokane County Division of Engineering and Roads, 1026 W Broadway, Spokane WA 99260, phone 509-477-7443, fax 509-477-7478, email: mbarrentine@spokanecounty.org.

Appendix K : Newman Lake Water Rights List

From Water Rights Tracking System Report, Washington State Department of Ecology, 5/26/2005

File #	Cert #	Person	Stat	Doc	Purpose	Qi	UOM	TRS
S3-164128CL		CHURCHILL WILLIAM H	A	Claim L	DG		CFS	26.0N 45.0E 10
S3-160275CL		OTIS PHILIP	A	Claim S	IR,DG		CFS	26.0N 45.0E 03
S3-160629CL		INGHAM JOSEPH W JR	A	Claim L	DG		CFS	26.0N 45.0E 03
S3-161250CL		ROBEY GEORGE E SR	A	Claim L	IR,DG		CFS	26.0N 45.0E 03
S3-157959CL		HELLNER ALLEN E	A	Claim S	DG		CFS	26.0N 45.0E 03
S3-156264CL		WILLIAMS D D	A	Claim L	DG		CFS	26.0N 45.0E 10
S3-155373CL		WALTER MARY M	A	Claim L	IR,DG		CFS	26.0N 45.0E 10
S3-155375CL		WALTER MARY M	A	Claim L	DG		CFS	26.0N 45.0E 10
S3-155943CL		TORTORELLI SAM R	A	Claim L	IR,DG		CFS	26.0N 45.0E 03
S3-155944CL		TORTORELLI SAM R	A	Claim L	IR,DG		CFS	26.0N 45.0E 10
S3-153213CL		WARNER ROBERT J	A	Claim L	DG		CFS	27.0N 45.0E 34
S3-152400CL		WALTER MARY	A	Claim L	No ID		CFS	26.0N 45.0E 10
S3-149282CL		GARDNER JOHN R	A	Claim S	DG		CFS	26.0N 45.0E 03
S3-147234CL		BOYKIN IRENE V	A	Claim S	IR,DG		CFS	26.0N 45.0E 03
S3-146113CL		MC CLELLAND TOM L	A	Claim S	DG		CFS	26.0N 45.0E 10
S3-139757CL		KUHNS JAMES F	A	Claim L	DG		CFS	26.0N 45.0E 03
S3-138242CL		CHASE JAMES S	A	Claim L	DG		CFS	26.0N 45.0E 10
S3-136500CL		OLSEN ROBERT F	A	Claim L	IR,DG		CFS	26.0N 45.0E 03
S3-136501CL		OLSEN MARTHA M	A	Claim L	IR,DG		CFS	26.0N 45.0E 03
S3-135039CL		INGHAM JOSEPH W JR	A	Claim L	DG		CFS	26.0N 45.0E 03
S3-134273CL		WILLIAM EDWIN E	A	Claim L	DG		CFS	26.0N 45.0E 04
S3-132962CL		MORRISON LILLIAN B	A	Claim S	DG		CFS	26.0N 45.0E 03
S3-130810CL		ERICSON JUNE R	A	Claim L	DG		CFS	26.0N 45.0E 03
S3-124392CL		PHILLIPSON JOHN L	A	Claim L	DG		CFS	26.0N 45.0E 10
S3-122453CL		ZEUTSCHEL ALAN H	A	Claim L	DG		CFS	26.0N 45.0E 03
S3-121575CL		STOUGH JEAN R	A	Claim L	DG		CFS	26.0N 45.0E 03
S3-117883CL		HUBBELL GERALD L	A	Claim L	IR		CFS	26.0N 45.0E 03
S3-116395CL		BROOKS GILBERT L	A	Claim L	IR,DG		CFS	26.0N 45.0E 10
S3-116485CL		SHILL ROBERT M	A	Claim L	DG		CFS	26.0N 45.0E 10
S3-113105CL		HANCOX DAISEY D	A	Claim L	DG		CFS	26.0N 45.0E 03
S3-113159CL		SEMB JOHN	A	Claim L	DG		CFS	26.0N 45.0E 04
S3-113262CL		STEELE JOHN E	A	Claim L	DG		CFS	26.0N 45.0E 03
S3-111385CL		NICKELL S	A	Claim L	DG		CFS	26.0N 45.0E 10
S3-107639CL		ENGLESBY GEORGIA M	A	Claim S	DG		CFS	26.0N 45.0E 10
S3-107657CL		SMITH B RUSSELL	A	Claim S	IR,DG		CFS	26.0N 45.0E 03
S3-105443CL		CARNEY JANE E	A	Claim S	DG		CFS	26.0N 45.0E 03
S3-099510CL		MORRISON GLENN	A	Claim S	IR,DG		CFS	26.0N 45.0E 10
S3-099685CL		DAVIS ORVIN L	A	Claim S	DG		CFS	26.0N 45.0E 10
S3-099711CL		DAVIS ORVIN L	A	Claim S	DG		CFS	26.0N 45.0E 10
S3-098495CL		LUTHER CHESTER F	A	Claim L	DG		CFS	26.0N 45.0E 03
S3-098932CL		HALVERSON DONALD D	A	Claim L	IR		CFS	26.0N 45.0E 03
S3-098933CL		HALVERSON DONALD D	A	Claim L	DG		CFS	26.0N 45.0E 03
S3-097103CL		KORUS GIDEON	A	Claim L	DG		CFS	26.0N 45.0E 04
S3-092493CL		PETERSON ARTHUR W	A	Claim S	DG		CFS	26.0N 45.0E 03
S3-092730CL		GUENZEL KARL F	A	Claim S	DG		CFS	26.0N 45.0E 10
S3-092792CL		PORTA A P	A	Claim S	DG		CFS	26.0N 45.0E 02
S3-088927CL		WILLIAMS NORMAN MRS.	A	Claim S	DG		CFS	26.0N 45.0E 10
S3-084554CL		PHIPPS JR. HARVE H.	A	Claim S	DG		CFS	26.0N 45.0E 03
S3-083008CL		ORTH JR. GEORGE E.	A	Claim S	DG		CFS	26.0N 45.0E 03

S3-082017CL		DAY DARRELL L.	A	Claim S	DG		CFS	26.0N 45.0E 02
S3-080846CL		GOTTSCHALK LEONARD	A	Claim L	DG		CFS	26.0N 45.0E 03
S3-079091CL		GEYER ROBERT O.	A	Claim L	DG		CFS	26.0N 45.0E 03
S3-079517CL		HARPEL JR. WILLIAM B.	A	Claim L	DG		CFS	26.0N 45.0E 03
S3-077839CL		OSBORNE ALLEN R.	A	Claim S	DG		CFS	26.0N 45.0E 03
S3-077017CL		GUENZEL CARL F.	A	Claim S	DG		CFS	26.0N 45.0E 10
S3-075579CL		SCHROEDER ERVIN B	A	Claim S	DG		CFS	26.0N 45.0E 10
S3-074522CL		HENNESSEY CHARLES E JR	A	Claim L	ST,DG		CFS	26.0N 45.0E 10
S3-072455CL		LITTLE MORRIS B.	A	Claim S	No ID		CFS	26.0N 45.0E 03
S3-072842CL		MUFFETT R. P.	A	Claim S	DG		CFS	26.0N 45.0E 03
S3-068108CL		O'DONNELL BRIAN E.	A	Claim L	DG		CFS	26.0N 45.0E 02
S3-063471CL		JONES GWILYM A.	A	Claim L	DG		CFS	26.0N 45.0E 04
S3-064316CL		CRAVENS HUGH C.	A	Claim S	DG		CFS	26.0N 45.0E 10
S3-064494CL		MCKAY RICHARD	A	Claim S	DG		CFS	26.0N 45.0E 03
S3-062937CL		CHEROKEE ADDITION	A	Claim S	DG		CFS	26.0N 45.0E 11
S3-055702CL		NAASZ DENNIS W.	A	Claim L	DG		CFS	26.0N 45.0E 04
S3-054997CL		KLUNDT DARRELL W.	A	Claim S	DG		CFS	26.0N 45.0E 03
S3-050673CL		GREEN WARNER	A	Claim S	DG		CFS	26.0N 45.0E 04
S3-047428CL		MCDOWELL BOYD H.	A	Claim S	DG		CFS	26.0N 45.0E 10
S3-046497CL		SWANSON BYRON L.	A	Claim L	DG		CFS	26.0N 45.0E 10
S3-046937CL		KENNEY PATRICK L.	A	Claim L	DG		CFS	26.0N 45.0E 03
S3-044643CL		DENNIE HAROLD R.	A	Claim S	DG		CFS	26.0N 45.0E 03
S3-044878CL		JANSEN LEONARD F.	A	Claim S	DG		CFS	26.0N 45.0E 03
S3-043381CL		BUNNELL FRANCES C.	A	Claim S	DG		CFS	26.0N 45.0E 03
S3-043042CL		MCCRACKEN LESTER C.	A	Claim S	DG		CFS	26.0N 45.0E 03
S3-041660CL		THOMPSON DONALD H.	A	Claim S	DG		CFS	26.0N 45.0E 03
S3-041943CL		CARBON CARL JR.	A	Claim L	DG		CFS	26.0N 45.0E 10
S3-042003CL		SCHAEFER LESTER R.	A	Claim L	DG		CFS	26.0N 45.0E 10
S3-040275CL		SHIELDS JEAN R.	A	Claim S	DG		CFS	26.0N 45.0E 03
S3-040689CL		MONNEY PAUL B.	A	Claim S	DG		CFS	26.0N 45.0E 03
S3-033953CL		BARRETT FORD S.	A	Claim L	DG		CFS	26.0N 45.0E 03
S3-034776CL		HOBBS CORLEY	A	Claim S	DG		CFS	26.0N 45.0E 03
S3-033466CL		PETERSON EDWIN J.	A	Claim S	DG		CFS	27.0N 45.0E 34
S3-033496CL		TRAPP MARVIN A.	A	Claim S	DG		CFS	26.0N 45.0E 10
S3-033562CL		PRINCE JOHN E	A	Claim S	DG		CFS	26.0N 45.0E 03
S3-033918CL		MATSCH FRED A.	A	Claim S	DG		CFS	26.0N 45.0E 03
S3-032333CL		ST. PHILIP'S VILLA INC.	A	Claim S	DG		CFS	26.0N 45.0E 03
S3-015924CL		PATTEN H. LESLIE	A	Claim L	DG		CFS	26.0N 45.0E 03
S3-016092CL		CODDINGTON ROBERT W.	A	Claim L	DG		CFS	26.0N 45.0E 03
S3-016910CL		AINSWORTH RUFUS S.	A	Claim L	DG		CFS	26.0N 45.0E 10
S3-013452CL		JACKSON LOREN E.	A	Claim L	DG		CFS	26.0N 45.0E 03
S3-008471CL		HEYLMAN WARREN C.	A	Claim L	IR		CFS	26.0N 45.0E 04
S3-004634CL		FRITZ WILBERT	A	Claim L	DG		CFS	26.0N 45.0E 10
S3-001866CL		AMDAHL KARL E.	A	Claim L	DG		CFS	26.0N 45.0E 03
S3-*11782CWRIS	5853	CLARK BRUCE	A	Cert	IR	1	CFS	26.0N 45.0E 04
S3-20275CWRIS		WHIPPLE R CECIL	A	Cert	DS	0.01	CFS	26.0N 45.0E 03
S3-20325CWRIS		ALLEN/REDFIELD	A	Cert	DM	0.02	CFS	26.0N 45.0E 03
S3-20430CWRIS		PATTEN H LESLIE	A	Cert	DS	0.01	CFS	26.0N 45.0E 03
S3-20794CWRIS		VIGIL JERALD D	A	Cert	DS	0.01	CFS	26.0N 45.0E 02
S3-21029CWRIS		DOBLER MAX L	A	Cert	DS	0.02	CFS	26.0N 45.0E 10
S3-21101CWRIS		FREY BARRY E	A	Cert	DS	0.02	CFS	26.0N 45.0E 10
S3-21368CWRIS		SKINNER EUGENE	A	Cert	DS	0.01	CFS	26.0N 45.0E 03
S3-21565CWRIS		SEVERANCE TOM ET UX	A	Cert	IR	0.02	CFS	26.0N 45.0E 10
S3-21633CWRIS		BIEKER FRANK J	A	Cert	DS	0.01	CFS	26.0N 45.0E 03
S3-21657CWRIS		THOMASON O V ET AL	A	Cert	DS	0.02	CFS	26.0N 45.0E 10
S3-21730CWRIS		HINKLE ALMA M	A	Cert	DS	0.02	CFS	26.0N 45.0E 03
S3-21804CWRIS		SANTORA CEASAR A	A	Cert	DS	0.01	CFS	26.0N 45.0E 10
S3-21874CWRIS		CARBON CARL JR	A	Cert	DS	0.01	CFS	26.0N 45.0E 10
S3-22131CWRIS		OWES ROBT ET UX	A	Cert	DS	0.01	CFS	26.0N 45.0E 03

S3-22006CWRIS	GUARISCO J F	A	Cert	DS	0.01	CFS	26.0N 45.0E 03
S3-22037CWRIS	DOW PATRICK A	A	Cert	DS	0.01	CFS	26.0N 45.0E 10
S3-22295CWRIS	KRELL JUDITH M	A	Cert	DS	0.01	CFS	26.0N 45.0E 03
S3-22472CWRIS	ERICKSON MILDRED L	A	Cert	DS	0.02	CFS	26.0N 45.0E 04
S3-22419CWRIS	St Joseph Childrens Home	A	Cert	DM	0.02	CFS	26.0N 45.0E 03
S3-22446CWRIS	HOYUM ALTON ET UX	A	Cert	DS	0.02	CFS	26.0N 45.0E 10
S3-22910CWRIS	NAUDITT W E ET UX	A	Cert	DS	0.02	CFS	26.0N 45.0E 03
S3-22931CWRIS	O'DONNELL BRIAN	A	Cert	IR	0.07	CFS	26.0N 45.0E 02
S3-22976CWRIS	MARTIN GERALD H	A	Cert	DS	0.02	CFS	26.0N 45.0E 03
S3-23108CWRIS	DASCHBACH WILLIAM	A	Cert	DS	0.02	CFS	26.0N 45.0E 03
S3-23117CWRIS	MEWHINNEY HOWARD	A	Cert	DS	0.02	CFS	26.0N 45.0E 04
S3-23139CWRIS	JOHNSON ERNEST J	A	Cert	DS	0.02	CFS	26.0N 45.0E 03
S3-23144CWRIS	TAYLOR HAROLD L	A	Cert	DS	0.01	CFS	26.0N 45.0E 03
S3-23165CWRIS	GREEN WARNER	A	Cert	DS	0.02	CFS	26.0N 45.0E 04
S3-23188CWRIS	FROST WILLIAM W	A	Cert	DS	0.02	CFS	26.0N 45.0E 04
S3-23319CWRIS	WILLIAMS NORMAN	A	Cert	DS	0.02	CFS	26.0N 45.0E 10
S3-23295CWRIS	GUENZEL KARL F	A	Cert	DS	0.02	CFS	26.0N 45.0E 10
S3-23297CWRIS	HOWSER VIRGINIA S	A	Cert	DM	0.02	CFS	26.0N 45.0E 03
S3-23311CWRIS	SHIELDS ALBERT C	A	Cert	IR	0.02	CFS	26.0N 45.0E 10
S3-23316CWRIS	BUTLER ALFRED B	A	Cert	DS	0.01	CFS	26.0N 45.0E 03
S3-23325C	Ladyman Brian	A	Cert	DS	0.02	CFS	26.0N 45.0E 10
S3-23341CWRIS	NICKELL/LONGMEIER	A	Cert	DS	0.02	CFS	26.0N 45.0E 10
S3-24121CWRIS	MENGERT NANCY A	A	Cert	DS	0.01	CFS	26.0N 45.0E 03
S3-23357CWRIS	GUENZEL CARL F	A	Cert	DS	0.02	CFS	26.0N 45.0E 10
S3-23362CWRIS	SILVEY RICHARD ET UX	A	Cert	DS	0.02	CFS	26.0N 45.0E 10
S3-23417CWRIS	ELMS JAMES R	A	Cert	DS	0.01	CFS	26.0N 45.0E 03
S3-23424CWRIS	PHILLIPS EARL L	A	Cert	DM	0.04	CFS	26.0N 45.0E 11
S3-23426CWRIS	NILSON JUNE P	A	Cert	DS	0.02	CFS	26.0N 45.0E 03
S3-23434CWRIS	HURST CHARLES I	A	Cert	IR	0.01	CFS	26.0N 45.0E 04
S3-23443CWRIS	JONES EDWIN L	A	Cert	DS	0.02	CFS	26.0N 45.0E 03
S3-23460CWRIS	DRINKARD JOHN D	A	Cert	DS	0.01	CFS	26.0N 45.0E 04
S3-23483CWRIS	HENDERSON J R	A	Cert	DS	0.01	CFS	26.0N 45.0E 10
S3-23532CWRIS	HENDERSON J R	A	Cert	DS	0.01	CFS	26.0N 45.0E 10
S3-23667CWRIS	CARNEY JANE E	A	Cert	DS	0.01	CFS	26.0N 45.0E 03
S3-23922CWRIS	DAVIS ORVIN L ET AL	A	Cert	DS	0.01	CFS	26.0N 45.0E 10
S3-23923CWRIS	DAVIS ORVIN L ET AL	A	Cert	DS	0.01	CFS	26.0N 45.0E 10
S3-23581CWRIS	EWING WANDA M	A	Cert	DM	0.02	CFS	26.0N 45.0E 03
S3-23586CWRIS	HOOPER JOHN	A	Cert	DS	0.02	CFS	26.0N 45.0E 10
S3-23969CWRIS	SMITH B RUSSELL	A	Cert	DS	0.01	CFS	26.0N 45.0E 03
S3-23672CWRIS	HAYDEN FLOYD N SR	A	Cert	DS	0.02	CFS	26.0N 45.0E 10
S3-23705CWRIS	MCMULLIN CLYDE	A	Cert	DM	0.05	CFS	26.0N 45.0E 02
S3-24209CWRIS	STANDIFORD JAMES F	A	Cert	DS	0.01	CFS	26.0N 45.0E 10
S3-23739CWRIS	ERICSON/CASTLE	A	Cert	DM	0.02	CFS	26.0N 45.0E 03
S3-23761CWRIS	MOORE JACK D	A	Cert	DS	0.01	CFS	26.0N 45.0E 04
S3-23770CWRIS	MCKAY RICHARD	A	Cert	DS	0.02	CFS	26.0N 45.0E 03
S3-23782CWRIS	PHILLIPS L P	A	Cert	DS	0.02	CFS	26.0N 45.0E 10
S3-23837CWRIS	HANNANT STANLEY A	A	Cert	IR	0.02	CFS	26.0N 45.0E 09
S3-23842CWRIS	SEYMOUR JOHN ET UX	A	Cert	DS	0.01	CFS	26.0N 45.0E 03
S3-23995CWRIS	STEELE J E & M K	A	Cert	DS	0.01	CFS	26.0N 45.0E 03
S3-24020CWRIS	HARMON RICHARD J	A	Cert	DS	0.01	CFS	26.0N 45.0E 03
S3-24025CWRIS	CUNNINGHAM W ET UX	A	Cert	DS	0.01	CFS	26.0N 45.0E 03
S3-23940CWRIS	MCCLELLAND TOM L	A	Cert	DS	0.01	CFS	26.0N 45.0E 10
S3-23970CWRIS	ENGLESBY GEORGIA M	A	Cert	DS	0.01	CFS	26.0N 45.0E 10
S3-24259CWRIS	MCCARTNEY CHARLES A	A	Cert	DM	0.02	CFS	26.0N 45.0E 03
S3-24268CWRIS	SCOTT CASEY CARL	A	Cert	DS	0.01	CFS	26.0N 45.0E 03
S3-24833CWRIS	JONES ROBERT C JR	A	Cert	DS	0.01	CFS	26.0N 45.0E 03
S3-25237CWRIS	FRIESEN ALLAN R	A	Cert	DS	0.01	CFS	26.0N 45.0E 03
S3-25574CWRIS	KORZYK MICHAEL	A	Cert	DS	0.02	CFS	26.0N 45.0E 03
S3-26032CWRIS	BLOOM CHARLES J	A	Cert	DS	0.02	CFS	26.0N 45.0E 10

S3-26076CWRIS		RAINVILLE R D ET UX	A	Cert	DS	0.02	CFS	26.0N 45.0E 03
S3-26169CWRIS		VANMATRE JAMES C	A	Cert	DS	0.01	CFS	26.0N 45.0E 10
S3-26201CWRIS		HARMON RICHARD J	A	Cert	DS	0.02	CFS	26.0N 45.0E 03
S3-26332CWRIS		BURLEY LORNE ET UX	A	Cert	DS	0.02	CFS	26.0N 45.0E 03
S3-26377CWRIS		PATTEN H L ET UX	A	Cert	DS	0.02	CFS	26.0N 45.0E 03
S3-27606CWRIS		RABE RICHARD D	A	Cert	DS	0.02	CFS	26.0N 45.0E 10
S3-28326CWRIS		PIERCE GEORGE ETAL	A	Cert	DS	0.02	CFS	26.0N 45.0E 03
S3-28393		Twin Cedars Condo Association	A	Cert	FR,DM	0.51	CFS	26.0N 45.0E 04
S3-28462CWRIS		SJOSTROM J T	A	Cert	DS	0.01	CFS	26.0N 45.0E 03
S3-28929CWRIS		POWELL PATRICIA	A	Cert	DM	0.04	CFS	26.0N 45.0E 02
S3-29762		Ferner Rose	A	NewApp	IR,DS	0.02	CFS	26.0N 45.0E 10
S3-30234		Dow Glen	A	NewApp	DS	0.01	CFS	26.0N 45.0E 03
S3-30292		Aldworth William	A	NewApp	DS	0.02	CFS	26.0N 45.0E 03
TOTAL RECORDS:	181							

Appendix L: Affidavit of Publishing Notice

PUBLIC NOTICE

The Newman Lake Flood Control Zone District (NLFCZD) has prepared a Draft Integrated Aquatic Vegetation Management Plan for Newman Lake. The plan is the result of research and community input for a solution to the Eurasian Watermilfoil infestation at Newman Lake. Eurasian Watermilfoil (*Myriophyllum spicatum*) is a non-native invasive aquatic species listed on the state noxious weed list.

Document Available for Review beginning June 17, 2005 at:
Spokane County
Public Works Building
2nd Floor
1026 W. Broadway Ave.
Spokane, WA 99260-0170

And:
Otis Orchards Branch Library
22324 E. Wellesley Ave.
Otis Orchards, WA 99027

Also Available on the web at:
http://www.spokanecounty.org

Time for Review:
From June 17, 2005 through July 1, 2005. comments on the document must be received in writing by 5:00 pm (PST) on July 1, 2005 at the following address:

Newman Lake
Flood Control Zone District
Spokane County
Engineering and Roads
Attn: Marianne Barrentine
1026 W. Broadway Ave.
Spokane, WA 99160-0170
Phone: 509-477-3600
Fax: 509- 477-7443
Email:
mbarrentine@spokanecounty.org

Public Meeting:
This Plan will also be presented and comments taken at the following public meeting:

Annual Summer Meeting of the NLFCZD & Newman Lake Property Owner's Association (NLPOA)
Date/Time:
Saturday, June 18, 2005
at 7:00 PM
Location:
Tri-Community Grange Hall
(Starr Rd., 1 blk, north of Trent Rd., Newman Lake, WA 99025)

SR9696

*Federal Tax ID No. 91-0420030

AFFIDAVIT OF PUBLICATION

STATE OF WASHINGTON
County of Spokane, ss.

Name: Spokane County Engineers **Acct:** 18094

P.O.: **No. Lines:** 71

Total Cost: $ 83.52 **Log No:** SR9696

I, Jill Leong
do solemnly swear that I am the Principal Clerk of the **SPOKESMAN-REVIEW**, a newspaper established and regularly published, once each day in the English language, in and of general circulation in the City of Spokane, Spokane County, Washington; and in the City of Coeur d'Alene, Kootenai County, Idaho; that said newspaper has been so established and regularly published and has had said general circulation continuously for more than six (6) months prior to the 23rd day of July, 1941; that said newspaper is printed in an office maintained at its place of publication in the City of Spokane, Washington; that said newspaper was approved and designated as a legal newspaper by order of the Superior Court of the State of Washington for Spokane County on the 23rd day of July, 1941, and that said order has not been revoked and is in full force and effect; that the notice attached hereto and which is a part of the proof of publication, was published in said newspaper, one time(s), the publication having been made once each time on the following dates:

June 16, 2005

That said notice was published in the regular and entire issue of every number of the paper during the period of time of publication, and that the notice was published in the newspaper proper and not in a supplement.

Jill Leong

Subscribed and sworn to before me at the City of Spokane, this 22 day of June, 2005

Patricia N. Knowles

Notary Public in and for the State of Washington,
residing in Spokane County, Washington

PATRICIA N. KNOWLES
NOTARY PUBLIC
COMMISSION EXPIRES
APRIL 09, 2007
STATE OF WASHINGTON