AquaTechnex

"Advancing the Science of Lake Management"

Capitol Lake Integrated Aquatic Vegetation Management Plan

July, 2003

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Table of Contents

Executive Summary

The Washington Department of General Administration (GA) has developed this Integrated Aquatic Vegetation Management Plan (IAVMP) for the waters of Capitol Lake. The 260 acre lake is located in Olympia, Washington and is a focal point for the State Capitol Campus and the City of Olympia.

The State of Washington created Capitol Lake in 1951 by damming the head of Budd Inlet. The dam created a lake forming a reflecting pool for the group of state capitol buildings, as envisioned by architects Walter Wilder and Harry White in the 1911 Capitol Campus Plan. Since 1951, GA has had the responsibility for the preservation, maintenance and operations of the 260 acre lake area, including the dam, located along the northwest portion of the State Capitol.

Lake management was intensified in the early 1970's and well into the 1980's with efforts to address sedimentation, water quality and public recreation. During this period, the state dredged the lake twice. Over the last 15 years the lake has not been dredged. Since the last dredging, it's estimated that 525,000 cubic yards of sediment has accumulated in the lake basin. In the mid-1990's, attempts were made to secure permits to aggressively dredge Capitol Lake with the objective to partially reverse and then keep up with the sediment deposits. GA found significant environmental permitting challenges in its attempt to secure these permits.

The need for a more comprehensive management of the lake peaked in 1996 when the state attempted to obtain permits for the construction of Heritage Park. It became clear that a single purpose management strategy was no longer feasible and that the competing demands of fisheries, habitat, water quality, public use, flood management and aesthetics require that all lake activities be comprehensively coordinated. While Capitol Lake is only a small part of the Deschutes River Watershed,, solutions for the lake needed to take into consideration this larger ecosystem and responding to a broad rage of interests.

In 1997, GA established a partnership with state natural resource agencies and local governments that have permitting and or management responsibility over Capitol Lake or its watershed. The nine jurisdictions on the Capitol Lake Adaptive Management Plan (CLAMP) Steering Committee include:

- State Department of General Administration
- State Department of Ecology
- State Department of Natural Resources
- State Department of Fish and Wildlife
- Port of Olympia
- Squaxin Island Tribe
- Thurston County
- City of Olympia
- City of Tumwater

GA serves as the chair of the Committee and provides the staff and associated resources for the committee's operation. The other jurisdictions provide technical staff assistance to the committee. The role of the Committee is to provide guidance to General Administration for the management of the lake.

The steering committee developed the initial Capitol Lake Adaptive Management Plan (1999 - 2001) to ensure that operations, maintenance and capital investments were coordinated so that limited financial resources could be used in an effective and efficient manner. The GA director adopted this plan in June of 1999.

During the 2001-2003 biennium, GA secured new information about the lake and how it could best be managed. The steering committee reviewed several aquatic alternative regarding the management future of Capitol Lake. Ultimately two of these approaches were seriously considered:

1. The removal of the Capitol Lake dam to create a natural saltwater estuary.
2. Dredging the lake to retain a lake environment.

Following a thorough analysis of these two options, it was determined that it would be very difficult to secure the necessary resources and environmental permits to do either alternative, and that both options would be very expensive to implement. Given this information, the committee recommended Capitol Lake continue to be adaptively managed.

In 2002, the committee developed an update to the management plan, to include a 10-year plan for the lake. The Plan focuses on the areas of highest importance and concern. An executive summary of the plan is attached as appendix A.

All lakes go through an aging process called eutrophication. Eutrophication is a succession process involving the flow of nutrients and sediments into the lake from the watershed. Nutrients generally drive excessive levels of aquatic weeds and algae growth that contribute to the natural filling process. Sediments that are eroded upstream from a lake are deposited there naturally as the inflows loose energy and their

ability to transport sediment diminish. Over time, these two processes can lead to the lake transitioning from a deep clear water body to a shallow system that supports abundant aquatic vegetation.

Since the lake was formed about 52 years ago, it has started to experience the impact of this natural process. Sediments transported down the Deschutes River and Percival Creek are being deposited in the lake. There have also been excessive levels of algae and aquatic plant growth in the lake in recent years. Both of these natural processes can detract from the intended purpose of this lake.

One negative impact not envisioned by the designers of Capitol Lake was the potential for infestation by non-native invasive noxious weeds. In September of 2001, Eurasian watermilfoil (*Myriophyllum spicatum*) was discovered in Capitol Lake by a representative of the Thurston County Noxious Weed Board. As a result of this discovery, the Thurston County Department of Water and Waste Management conducted an aquatic survey of the lake in October of 2001 and documented the presence of Eurasian watermilfoil throughout the North and Middle basins of the lake.

Eurasian watermilfoil has been identified by the US Congress Office of Technology Assessment as a "harmful non-indigenous species". It is one of 17 aquatic and wetland weeds on the State of Washington's noxious weed list. The Governor's Salmon Recovery Plan refers to Eurasian Milfoil because of the impact this plant can have on habitat and water quality parameters critical to salmon survival. This invasive plant species spreads rapidly once introduced to a water body and is able to grow up to one foot per week in optimal growing conditions. Eurasian watermilfoil plants can reach the surface of the lake from depths of 20 feet or more and out-compete and replace native beneficial aquatic vegetation, forming a thick mat in the process. Proliferation of this plant is rapid, as already established plants auto fragment each fall, with each fragment potentially rooting in the sediment to form a new plant.

The impacts of Eurasian Milfoil are described in this excerpt from the US Geological Survey's Nonindigenous Aquatic Species web site (http://nas.er.usgs.gov/plants/docs/my_spica.html).

"Eurasian water-milfoil competes aggressively to displace and reduce the diversity of native aquatic plants. It elongates from shoots initiated in the fall, beginning spring growth earlier than other aquatic plants. Tolerant of low water temperatures, it quickly grows to the surface, forming dense canopies that overtop and shade the surrounding vegetation (Madsen et al. 1991). Canopy formation and light reduction, are significant factors in the decline of native plant abundance and diversity observed when Eurasian water-milfoil invades healthy plant communities (Smith and Barko 1990; Madsen 1994). Both eelgrass (Vallisneria americana) and southern naiad (Najas guadalupensis) are known to have been displaced by this nonindigenous species in the Mobile Delta of Alabama (Bates and Smith 1994). Its establishment in Lake George, New York, reduced native plants from 5.5 to 2.2 species per square meter, in just two years (Madsen et al 1991).

Eurasian water-milfoil has less value as a food source for waterfowl than the native plants it replaces (Aiken et al. 1979). And although fish may initially experience a favorable edge effect, the characteristics of Eurasian water-milfoil's overabundant growth negate any short-term benefits it may provide fish in healthy waters. At high densities, its foliage supports a lower abundance and diversity of invertebrates, organisms that serve as fish food (Keast 1984). Dense cover allows high survival rates of young fish, however, larger predator fish lose foraging space and are less efficient at obtaining their prey (Lillie and Budd 1992; Engel 1995). Madsen et al. (1995) found growth and vigor of a warm-water fishery reduced by dense Eurasian water-milfoil cover. The growth and senescence of thick vegetation degrades water quality and depletes dissolved oxygen levels (Honnell 1992; Engel 1995). Typical dense beds restrict swimming, fishing and boating, clog water intakes and result in decaying mats that foul lakeside beaches".

The presence of Eurasian watermilfoil in Capitol Lake will negatively impact several beneficial uses. Due to the potential formation of thick mats in this relatively shallow lake, aesthetics will be diminished, along with decreasing habitat for native aquatic plants and fish. This degradation in water quality will be obvious to both permanent residents in Olympia and Tumwater and visitors to the Capitol Campus.

One of the 14 CLAMP Objectives (identified in appendix A) is "Eliminate the Purple Loosestrife and Eurasian Milfoil noxious weed infestations throughout Capitol Lake". While the CLAMP focuses on overall lake management, the threat posed by noxious weeds requires action to prevent the negative impacts these plants have on lakes and adjacent wetlands. GA has developed and adopted a plan for the management of Purple Loosestrife in the wetlands adjacent to the lake. This Integrated Aquatic Vegetation Management Plan (IAVMP) is intended to focus control efforts on Eurasian Milfoil to meet the stated goals of the CLAMP.

The Integrated Aquatic Vegetation Management Plan

Integrated aquatic plant management planning is a process that helps citizens develop a comprehensive control program that meets the needs of all interested parties and the aquatic resource. The Department of Ecology's (DOE) planning process has a number of steps that GA must complete to develop a meaningful plan. During the past year, GA has taken an active role in the management of Eurasian Milfoil. The agency understands the threat this weed poses to the intended beneficial uses of Capitol Lake. Part of this process is the development of this plan following the guidelines provided by the DOE. A Milfoil Steering Committee has been formed to assist in the development of this plan. The committee has met several times and reviewed Eurasian Milfoil management options. The members of the Steering Committee are representatives from:

- State Department of General Administration
- State Department of Ecology
- State Department of Agriculture

- State Department of Fish and Wildlife
- Thurston County
- City of Olympia
- City of Tumwater
- Squaxin Island Tribe

The Milfoil Steering Committee has determined that the CLAMP goal of elimination of Eurasian Milfoil needs to be implemented. There is not consensus among the Milfoil Steering Committee members regarding the best approach to accomplish this goal. After reviewing all of the milfoil management options, the Plan concentrates attention on the potential use of two different herbicides – fluridone and 2,4-D granular . Some members of the committee expressed the position that a herbicide should be used as "a last resort." However, given the number of milfoil plants in the lake the available methods of removal are quite limited. Never-the-less, the Plan identifies a number of milfoil management options. GA will seek public input on these and any other possible approach that could apply to Capitol Lake. After the public process is completed and comments reviewed, the General Administration Department will determine the direction that it will proceed. Since milfoil can be continuously introduced into the lake, the committee members also recognize that keeping milfoil out of the lake, once it is eradicated, will require annual special attention by the GA Department.

Quick Guide to the location of DOE Requirements for an IAVMP in this Draft IAVMP (note that this is a draft document. If this information remains to be collected an * is displayed in the Page Number section.

Item Required in IAVMP	Page No. (s)
Develop a Problem Statement	**11**
Define Management Goals	**12-14**
Describe Past Management Efforts-no milfoil control to date	**n/a**
Watershed Characteristics	**15-16**
Location and Size of Watershed	**16, Apx. B**
Land use activities (rural, single family, residential etc)	**17**
Stream and wetland locations	**17**
Nonpoint nutrient source locations, actual or potential	**15-17**
Waterbody characteristics	**17-24**
Location, size, depth and shape	**17-18**
Water sources and flushing rate	**18-19**
Water Quality-evaluate historical water quality data	**19**
Aquatic plants and algae	**25-26**
Shoreline use	**19**
Fisheries	**19-21**
Wetland Areas	**17-18**
Wildlife	**21-22**
List Beneficial and Recreational Uses	**22-23**
Identify present water body uses	**22-23**
Conservancy areas	**22-23**
Water skiing areas	**22-23**
Boating and Boat access areas	**22-23**
Swimming Areas	**22-23**
Fishing areas	**22-23**
Develop a waterbody "use" map of zones showing priority uses for activities as well as other natural habitat areas for fish, waterfowl and other wildlife	**24**
Map Aquatic Plants	**25-26,Apx. B**
Approximate location and species of aquatic plants	**25-26,Apx. B**
Location of Wetlands	**17-18, 25-26, Apx. B**
Location of threatened and endangered species of plants or animals	**22**

Sediment type	17-18
Water body depth and contour lines	17-18, Apx. B
Characterize Aquatic Plants	25-26,Apx. B
Identify species, growth habit and coverage	25-26,Apx. B
Recognize the problems and benefits of aquatic plants	25-26,Apx. B
Identify the life cycle and any "weak" link of the target plant species	*
Identify and discuss aquatic plant control alternatives, their effectiveness, environmental impacts, human health risks, costs and their applicability to waterbodies included in the plan	29-48
No Action	29-30
Environmental Manipulation	30-35
Mechanical Controls	38-40
Biological control methods	40-42
Chemical control methods	42-47
New Technologies	41-43
Identify the plant problems in specific locations by assessing the control levels in each of the areas identified on the Use Map	47-49
No Control	47-49
Low Level of Control	47-49
High Intensity of Control	47-49
Choose the best combination of options of site-specific levels of control using this criteria	47-58
Identify proposed control methods, areas where they will be applied, Timing of the action and targeted degree of control	47-58
Assess the duration of the control and it's compatibility with the site	47-58
Determine the capitol costs and operation and maintenance costs	47-58
Determine the degree of control to the site, including evaluating whether the control strategy is appropriate to the site	47-58
Evaluate the compatibility of the weed control strategy with fisheries, waterfowl, wildlife and the ecology of the waterbody	47-58
Evaluate whether the strategy has a balanced approach between waterbody enhancement and environmental protection	47-58
Determine if the strategy causes minimal human health risks	47-58
Public Involvement	3-4, 27-28,apd. A
Identify Interested Parties	3-4, 27-28
Conduct Public Meetings during the following times	3-4, 27-28
At the formative stages	3-4, 27-28
When alternatives have been developed	3-4, 27-28

After selecting an alternative but before implementation	3-4, 27-28
During implementation as necessary	*
During evaluation and surveillance phases as necessary	*
Obtain and document support or acceptance from interested parties	**Ongoing**
Develop an Action Strategy which implements the Integrated Aquatic Vegetation Management Plan	54-58
Develop costs and budget to implement the plan, identify planning costs, capital costs and operation and maintenance costs	49-51, 55-57
Review the costs, permit requirements, environmental issues, environmental impacts and acceptability to the lake residents and the general public	49-51, 55-57
Develop a short term action plan that is possible to accomplish considering the costs, permits, degree of control and public acceptance	48-58
Develop a long term action plan that may require more funding than is currently available and may include managing complex permit issues	48-58
Develop a funding strategy	48-58
Short term funding for planning	48-58
Long term funding for capital and operating costs	48-58
Develop an action plan to meet the goals of the IAVMP	48-58
Monitoring and Evaluation of Plan	59
Develop a detailed plan for monitoring and reporting the relative degree of success	59
Describe surveillance strategy	59
Describe long term revenue sources for continual management	**Initially, work will be funded by GA and an Ecology Grant, over time, GA will provide for the management of the lake**

Problem Statement

Understanding the problem is the first step in any planning process. The CLAMP Steering Committee has as one of its 14 lake management objectives the goal of eliminating Eurasian Milfoil from Capitol Lake. Using that criteria, the following problems statement has been developed for Capitol Lake:

It is clear that Eurasian Milfoil, a harmful, nonindigenous species, poses a significant threat to water users and the aquatic environment where it occurs. Eurasian Milfoil has been found in Capitol Lake and is rapidly expanding. The Capitol Lake Adaptive Management Plan has been developed to provide management guidance for the next ten years (2003-2013). The goals of that plan are to improve water quality, fish and wildlife habitat, and public recreation opportunities while managing flood control, sediment deposit and adjacent infrastructure. Eurasian Milfoil will have a negative impact on water quality, fish and wildlife habitat and recreation. Excessive amounts of this weed could also impact flood control functions of the lake and will have an effect on the deposition of sediments. Eurasian Milfoil will have a negative impact on all of the CLAMP's stated objectives. The CLAMP's objective of eliminating Eurasian Milfoil from Capitol Lake is our priority.

This problem statement is presented in this draft IAVMP for the use of the Milfoil Committee during the public involvement process. It is subject to change or modification based on input that is received from the public or other interested stakeholders. The final IAVMP will include a problem statement that will take into account any additional legitimate comment or concerns expressed during that process.

Aquatic Plant Management Goals

There are five basic strategies that an aquatic plant manager can select when dealing with an invasive aquatic species. They are:

1. Prevention
2. Eradication
3. Suppression
4. Maintenance
5. No Action

It is critical that GA determines which of these options are most appropriate for the situation they face. The various tools that manager's have to combat invasive aquatic weeds fall into categories of cultural, physical, biological, mechanical and chemical treatments. Managers cannot effectively select and deploy these various tools until they understand what their management goals are. For example, if the managers goal is to eliminate Eurasian Milfoil from a lake system, aquatic plant harvesting systems are not appropriate because they will not produce that desired effect. If the managers goal is to maintain open water at a beach or other high use area, then aquatic plant harvesting operations may have a fit. The five basic strategies are as follows.

Prevention is a strategy that attempts to identify a threat to a water body like Capitol Lake and stop the pest before it arrives in the lake. This work involves public education, constant monitoring and rapid action if pioneering colonies are detected when introduced. Eurasian Milfoil has reached Capitol Lake and has expanded widely in that system. The levels of milfoil present means that prevention is not an available option for Capitol Lake at this point. If the plant is successfully removed or suppressed in the lake, prevention will play an important role in the future. The active infestation of Eurasian Milfoil in Capitol Lake poses a threat to other neighboring water bodies however. This weed spread primarily on boat trailers from lake to lake. Plant fragments can travel on a boat trailer or motor that moves from an infested site like Capitol Lake to an un-infested water body. Prevention measures should be taken to halt the movement of this weed from Capitol Lake to other bodies of water to protect them. GA has restricted access to Capitol Lake to boats with motors.

Eradication is another strategy that can be used to protect the environment from an invasive aquatic weed like Eurasian Milfoil. Eradication strategies have been developed for Eurasian milfoil. However, long-term eradication of milfoil within any water body is problematic since the plant can be reintroduced from nearby infested lakes. Follow-up surveys and physical removal are critical to maintain low levels of the plant within the water body. There have been a number of successful short-term

eradication projects that have been funded and performed under the DOE's Freshwater Aquatic Weed Program and the Corps of Engineers Aquatic Plant Management Program. There have also been long term success stories in Washington State where this weed has not yet re-appeared. Capitol Lake is an appropriate candidate for the application of these technologies.

Suppression is a weed control strategy that considers the area to be managed and selects the correct mix of tools to reduce and maintain the population of the invasive weed at the lowest level possible. Suppression strategies are also well developed. Aquatic herbicides and grass carp are both examples of suppression control techniques. The DOE collected data from Loon Lake in Eastern Washington and Kress Lake in Western Washington where aquatic herbicides have been used to treat areas impacted by Eurasian watermilfoil (Hamel, personal communication). In the Loon Lake study, DOE found that the use of 2,4-D aquatic herbicide significantly reduced the Eurasian watermilfoil in the treatment plots and had no significant impact on native aquatic plants. Kress Lake was treated with Aquathol and there was an increase in species diversity after treatment and a decrease in milfoil. There have also been examples of biocontrol agents like triploid grass carp providing suppression of milfoil. However, generally grass carp will consume native aquatic plants before they start feeding on Eurasian watermilfoil. DOE does not recommend grass carp for milfoil control except under special circumstances.
Suppression is a weed control strategy that has potential for Capitol Lake. Capitol Lake is small enough that suppression strategies are economically feasible.

Maintenance control of aquatic weeds is another option managers have. Generally, maintenance control is performed in large lake systems where the cost of eradication or suppression strategies are beyond the economic feasibility of those funding the programs. This technique involves the use of control tools (herbicides, harvesters, other mechanical techniques, and biocontrol if appropriate) to maintain weed-free conditions in high-use areas. This technique is currently used in many lakes throughout the Country to manage Eurasian watermilfoil. Aquatic herbicides are often used to clear high use areas of this noxious weed. Aquatic plant harvesting programs are also effectively used to maintain open water in infested lakes. Maintenance control could be considered for Capitol Lake.

No action is the last option that managers have. The CLAMP objective is to eliminate Eurasian Milfoil from Capitol Lake. The no action alternative will not meet the stated objective of the CLAMP and should not be considered,

Given these alternatives and the stated objective of the CLAMP to eliminate Eurasian Milfoil from Capitol Lake, eradication strategies should be employed as the first step in the long term management of this weed. The technologies presented in this plan have the potential to accomplish this objective both in the short and the long term.

Suppression strategies should be used if any milfoil survives the eradication efforts. Maintenance techniques should not be employed unless a decision is made that eradication technologies will not be used in the lake. Maintenance strategies assume large populations of this weed present and this is contrary to the CLAMP's stated objective.

Watershed and Lake Characteristics

Lake and watershed characteristics can have an influence on the capacity of a water body to develop aquatic weed and algae problems. When that is the case, it is important to include consideration of these factors in the planning process. For example, if the major problem in a lake is excessive algae then nutrient inputs to the lake can be something that if modified could reduce the problem. Algae are single celled organisms that must get the nutrients they need from the water column. Reducing the amounts of nutrients available in the water column will have an impact on the ability of the lake to support excessive growth of these problem species. In these cases, looking at the watershed and determining where the sources of the nutrients are and halting their movement to the lake can over time have an impact on the problem.

It should also be noted that Eurasian Milfoil can develop into a major problem regardless of water quality. For example, this noxious weed is rapidly expanding in Lake Tahoe, one of the more pristine lakes in the United States. Managing or reducing nutrient inputs to Capitol Lake from the watershed is something that would be beneficial with respect to the overall health of the lake. It is not probable that there would be any effect from such an action in the short or mid term on the Eurasian Milfoil populations from such an action however.

Prior to 1951, the area occupied by Capitol Lake was a tidal estuary. The character of the estuary was different than present conditions, with brackish marsh vegetation being influenced by both the salt-water tidal action of Puget Sound and freshwater flow of the Deschutes River. The lake was formed to serve as a reflecting pool for the Capitol Building and was first envisioned by architects Wilder and White in their conceptual design for the Capitol Campus in 1911. The State Legislature authorized construction of the lake in the 1930's and funding was authorized to build the tide gate and dam along 5th avenue in 1947. The lake project was completed in 1951.

The perceived benefits of forming the lake included:

- A Capitol Campus reflecting pool and improved aesthetics
- Public access and recreational uses such as swimming, boating, and fishing
- Limited flood control for the City of Olympia during high tides and for less intense floods
- New fish rearing facilities located in Percival Cove
- Elimination of tide flats and associated odors

There were also some negative impacts with lake formation, including:

- Intermittent fish passage problems at the tide gate
- Excessive aquatic plant growth

loam and sandy loam. Potential natural vegetation is western hemlock, western red cedar, Douglas fir and big leaf maple.

The predominant land use in the watershed is Forest (60 percent of land) according to WA DOE documents. Other land use categories are Urban (13 percent), Water (10 percent), Agriculture (6 percent), Rangeland (4 percent) and other (7 percent). There is a map published by DOE GIS Technical Services that shows the coverage and location of these various land use types for the watershed attached in Appendix B.

Stream and Wetland locations are described in the Waterbody section below.

Water quality information for the Deschutes River and Capitol Lake watershed is available from DOE and Thurston County sources. DOE records show that the Deschutes River and some other streams in the watershed occasionally experience problems with water quality. Problems include high temperatures and fecal coliform. DOE's Surface Water Quality 303d list notes problem areas within WRIA 13. The Deschutes River is listed on the 303d list for fecal coliform, high water temperatures, pH and large woody debris. Additional information specific to Capitol Lake is included in the discussion of the water body.

The Waterbody

Capitol Lake is located in northern Thurston County within the cities of Olympia and Tumwater. Capitol Lake is at the mouth of the Deschutes River and has shoreline of 5.3 miles and a drainage area of 185 square miles. This 260 acre man-made lake consists of three basins labeled North, South and Middle.

The North Basin is round in shape. This area is adjacent to downtown Olympia and the developed areas of Heritage Park. The outlet from Capitol Lake into the southern Puget Sound is located at the north end of this basin. Water flows into the northern basin under a railroad trestle that crosses the lake along the southern shoreline of the basin from the middle lake basin. The most current contour map found of this system is contained in the DOE Lakes Reconnaissance Volumes published some time ago. The DOE contour map of the lake produced in 1973 shows this basin to have an average depth of approximately 12 feet with a maximum depth of 15 feet. It is probable that this area has filled since then. The Thurston County GeoData Center has produced detailed wetland maps for the County including the area around Capitol Lake. They have mapped a narrow (20-30 foot) band of wetlands along the southwest shoreline extending from the railroad trestle to the mid point of the west shoreline. They have also mapped a very narrow band of wetlands along the north shoreline east from the outlet to the midpoint of the east shore. This area is now part of Heritage Park and there is a wall constructed along this area.

The middle basin is long and narrow, oriented from north to south. The basin is bounded on the north by the railroad trestle and on the south by the Interstate 5 Bridge. The DOE contour map of the plan produced in 1973 shows this basin to have an average depth of 5 feet with a maximum depth of 10 feet. Observations by Aquatechnex staff on the water in the summer of 2002 are that the average depth is closer to 3 feet in this basin. This is due to the deposition of silt from the Deschutes River over time. The Thurston County GeoData Center has produced detailed wetland maps for the County including the areas around Capitol Lake. The majority of the western and eastern shoreline of this basin have a narrow band of wetland plants present. This band extends from 5 to 10 feet into the lake. In the southeast corner of this basin there is a constructed wetland complex that includes a number of shallow ponds. This area was used at one point as a dredge spoils disposal site and the wetlands were created as a mitigation measure. There are a number of trails through this system for the public.

The southern basin is located south of the Interstate 5 bridge. This area is where the Deschutes River discharges into Capitol Lake. The water body is very shallow outside of the channel created by the river flow to the middle basin. This area serves as the delta for the Deschutes River. There are numerous islands created by the deposition of sediments as the river enters the lake and channels cut through those islands. The shoreline and the islands in this basin are wetlands and densely covered with cattails and other wetland species.

There are two major water inputs to Capitol Lake. The first of these is the Deschutes River. The USGS maintains a stream gauge that measure flow throughout the basin. The gauge located at E Street Bridge in Tumwater is the closest flow measuring point to the lake. The USGS indicates that this gauge measures the drainage from 162 square miles upstream from the site. Information available from that site provides daily readings for the most recent water year reported (October 2000 through September 2001) and historical data for the water years from 1945 through 2001. During the most recent water year the minimum average monthly flows were recorded in August (69 cubic feet per second or cfs) and the maximum average monthly flows were recorded in April (283 cfs). This information is presented in Appendix B. The flow rates will be discussed again in the context of herbicide treatments later in this plan.

Percival Creek is the other inlet to Capitol Lake. Today, the creek enters the lake in the middle basin. Prior to the impoundment of the lake, the creek discharged into the estuary and this area historically was prime shellfish harvesting grounds for Native Americans. Stream flow data for this system is not available from regional or local government sources. An internet search found an expenditure item in the Tumwater City budget to install a stream gauge in 2002. It is not known if this system is up and running. There is data available for the summer 1996-1997 water years (Davis, et al) that indicates the discharge from Capitol Lake at the outlet was 197 cfs. Checking USGS records for the E Street Stream Gauge for this same time period, the flows are

approximately 161 cfs. This information can be used to estimate flows from Percival Creek and other sources as approximately 36 cfs.

The flushing rate for the lake can be estimated by looking at the flow through the system and the water volume that is stored in the lake. This rate is highly variable from year to year and from season to season. There is further discussion of this topic as it pertains to treatment options later in the plan.

Water Quality

The water quality in Capitol Lake is considered by the DOE to be impaired. The US EPA through the Clean Water Act (CWA) requires states to investigate the water quality in surface waters within the state. When lakes or rivers do not meet standards adopted for a number of water quality parameters, the CWA requires the state to list those waters as impaired under section 303d of the Act. Portion of Capitol Lake are listed by DOE on the Washington 303d List. Capitol Lake is listed because phosphorus levels in the lake exceed water quality standards the department has published.

Shoreline Use

The Thurston County Shoreline Comprehensive Plan designates the entire shoreline of Capitol Lake as "Conservancy". A major portion of the shoreline of the north basin is developed as part of Heritage Park and managed by GA. The western shore of the Middle Basin along the Deschutes Parkway is undeveloped with extensive walking and jogging trails. In the southwest corner of the middle basin shoreline is a wetland interpretative center and additional walkways. The eastern shoreline of the middle basin is maintained in a natural state. There are homes located along this shore, but they are on top of a bluff overlooking the lake. The face of the bluff is undeveloped. The majority of the shoreline in the south basin is undeveloped as well. The City of Tumwater does maintain a park and public boat ramp on the western shore of this basin, but the edges of the park are separated from the water by natural buffers in most cases.

Fisheries and Salmon issues

The Deschutes River is the principle drainage in WRIA 13. The river begins in the foothill slopes of the Cascades approximately 12 miles southwest of Eatonville, Washington. Moving away from the relatively steep, forested slopes, the river flows generally northwest across a broad prairie type valley floor. The majority of the lower river system contains considerable excellent quality pool-riffle streambed interspersed with occasional rapids sections. The majority of the lower river areas is highly suitable for use by both anadromous and resident fishes. At Tumwater, the Deschutes River flows over a series of falls. These barriers were laddered by the Department of Fisheries

in 1954, opening up the upper river to anadromous fish. (WA Department of Fisheries, Salmon Inventory and Stream Usage, Puget Sound, 1972)

Three species of Pacific Salmon, chinook, coho and chum, currently utilize Deschutes basin drainages. All of these fish can pass from the Puget Sound into Capitol Lake through a fish ladder at the dam. From there they move upstream through the fish ladder at Tumwater Falls. They then disperse throughout the watershed and spawn. Historically, Tumwater Falls provided a barrier to fish migration.

Of these three species, only the Puget Sound Chinook Salmon have been listed by the National Marine Fisheries Service as "Threatened" under the Federal Endangered Species Act (ESA). The following paragraph provides a description of this listing.

Evolutionary Significant Unit (ESU)* STATUS AND DESCRIPTION: Listed as a threatened species on March 24, 1999. The ESU includes all naturally spawned populations of chinook salmon from from rivers and streams flowing into Puget Sound including the Straits of Juan De Fuca from the Elwha River, eastward, including rivers and streams flowing into Hood Canal, South Sound, North Sound and the Strait of Georgia in Washington.

As Tumwater Falls was a barrier to fish passage, there is not a historical naturally spawning population of Chinook Salmon using the watershed. The Fisheries Department (now the DFW) initiated a program of releasing fall chinook salmon fingerlings into the Deschutes River estuary in 1964. Since the falls at the river mouth blocked migration into the river, returning adult chinook were trapped and trucked above the falls to spawn naturally. Capitol Lake, now occupying the former intertidal estuarial basin was created in 1950 and in 1954 a series of vertical baffle fishways was completed affording free access for mature adult salmon to the upper river. The return of chinook and coho to this river system originated entirely from plants made above the falls. Present production is maintained at a high level through intensive stocking of Capitol Lake. (WA Department of Fisheries, Salmon Inventory and Stream Usage, Puget Sound, 1972). (Note: The Fisheries Department was independent from the Department of Fish and Wildlife at this time. The Inventory Report is from 1972, but is useful because it provides a historical context to salmon usage well before the population declines of recent years).

In the Deschutes Basin, Chinook utilize mainly the Deschutes River. These fish are principally fall run chinook. Spawners are known to use river sections throughout the accessible length of the river with major spawning occurring between Tumwater and Vail, a distance of 25 miles. Of the Deschutes tributaries, only Percival Creek is known to support significant number of spawning chinook. Juvenile chinook rear in the accessible length of the river and extensive rearing takes place in Capitol Lake (WA

Department of Fisheries, Salmon Inventory and Stream Usage, Puget Sound, 1972). Juvenile out migration occurs between March and June of each year.

Eurasian Milfoil if left unchecked could have a major impact on these populations. This weed will choke the majority of the surface acres of the lake in the near future if left untreated. During the summer months, Milfoil mats will degrade two important water quality parameters critical to salmon. Thick milfoil beds will absorb sunlight and convert it to heat energy (Honnell 1992; Engel 1995). This effect can raise water temperatures well beyond those considered safe for salmon. Dissolved oxygen levels are also depressed within milfoil beds. Salmon require cool water and high levels of dissolved oxygen. It is probable that the presence of Eurasian Milfoil in the lake will contribute to the degradation of these two water quality parameters well beyond state standards established to protect these species (Honnell 1992; Engel 1995). Upstream migration of chinook salmon could be affected. This occurs from July through October. The first three months of this period would occur when the standing crop of milfoil was at its peak. The density of the plant beds themselves could pose an obstacle to passage. As most juvenile chinook will clear the system by June, the milfoil plants in the lake would have a minor impact on water quality conditions when they are present. Milfoil beds normally reach the lake surface and become problematic in late June in Washington State. While coho salmon are not listed under the ESA, they also utilize this lake as important rearing habitat during the first year of their life. The milfoil would be expected to severely degrade water quality conditions important to this species during a time when they would be present in the lake.

Selective removal of Eurasian Milfoil is necessary to protect salmon utilizing the Deschutes River system.

Wildlife

Capitol Lake supports a wide range of wildlife. The Black Hills Audubon Society lists the lake as one of the premier bird watching areas in the region. They note that in the vicinity of Tumwater Falls Park species such as the American Dipper, Common Merganser and Belted Kingfisher are common. There is generally also a variety of warblers and migrant passerine present in the trees and shrubs adjacent to the lake. First year Thayer's gulls, geese and ducks are also present in this area of the lake. Near the Capitol Lake Interpretative Center they note that in the early spring and fall, Bonaparte's gulls can be observed feeding on the lake. Fall and winter brings a congregation of waterfowl including American Widgeon, Coot and Bufflehead. The ponds in the interpretive center adjacent to the lake generally contain a variety of dabbling ducks including mallards, Northern Pintail, Green wing Teal and Gadwall. In the northern portion of the lake (middle and north basins) Cormorants, Hooded Mergansers, Common Mergansers, Belted Kingfishers and Wood Ducks are common. Great Blue Heron and Black Crowned Night Herons can be observed in the wetlands

and the mouth of Percival Creek. Bald Eagles and Osprey are often observed overhead. The fall and winter months see populations of Bufflehead, Barrow's Goldeneye, Common Loons and Coots dotting the lake surface. There is an abundance of waterfowl present at most times during the winter months.

There are species of concern that utilize Capitol Lake and its shorelines and wetlands. The Thurston County GeoData Center produces maps based on the Washington Department of Fish and Wildlife Priority Habitat and Species Locations and Areas. This information was accessed through this system (note that the web access to this information is limited to protect these resources, Andrew Kinney with that department provided site specific maps for Capitol Lake and the vicinity). The entire shoreline of the middle and south basins of the lake are designated as priority habitat for mink species. The mouth of Percival Creek in Percival Cove is designated as priority habitat for the Green Heron. There are two locations in the middle basin's eastern shore that are designated as priority habitat for Bald Eagle, these are assumed to be nesting sites.

As noted in the executive summary, Eurasian Milfoil infestations alter habitat and water quality where allowed to thrive. Left unchecked it is probable that the infestation in Capitol Lake will have a detrimental impact on many of these species.

Beneficial Uses

In addition to the environmental concerns noted above, there are a number of other beneficial uses that are recognized for Capitol Lake. The Capitol Lake Adaptive Management Plan has the following goals for the next ten years:

Objectives for managing Capitol Lake Basin for the next 10 years *(2003-2013)*

1. Adaptively manage the Capitol Lake Basin.
2. Complete an estuary feasibility study to determine a long -range management decision.
3. Restore earthquake-damaged state infrastructure within the basin.
4. Complete the development of Heritage Park.
5. Expand and enhance public use of state-owned lands and adjacent public spaces within the Capitol Lake region.
6. Develop and implement a flood hazard management strategy to protect lands adjacent to Capitol Lake.
7. Rehabilitate the fish ladder in the Capitol Lake dam to provide year-round fish passage into and out of Capitol Lake.
8. Relocate Percival Cove fish-rearing operation and rehabilitate Percival Cove for other uses.
9. Improve lake edges to be fish-, wildlife - and people -friendly.
10. Maintain Capitol Lake with fewer than 100 resident Canada geese.

11. Improve the water quality in Capitol Lake to meet state standards.
12. Eliminate Purple Loosestrife, Eurasian Milfoil noxious weed infestations throughout Capitol Lake.
13. Develop and implement a comprehensive sediment management strategy for the Capitol Lake basin.
14. Communicate with the community, legislators and the State Capitol Committee on a routine basis regarding Capitol Lake.

This plan highlights a number of beneficial uses that the stakeholders want to protect and enhance.

Goal Number 4 is "Complete the development of Heritage Park" and Goal Number 5 is "expand and enhance public use of state owned lands and adjacent public paces within the Capitol Lake Region". Heritage Park is a focal point of the Capitol Campus. Much of the park development has focused on improving sight lines from the Capitol across the lake. The park is envisioned to attract people to the shoreline and to create opportunities for water based recreation. Eurasian Milfoil will have a negative impact on these beneficial uses. During the summer months, the dense mats of aquatic vegetation will make water based recreation difficult. The mats will detract from the view and reflective design of the park. Dense plant mats will also impact boaters using the lake. In the mid summer and into the fall, the floating plant debris that windrows against the Park seawall will create an eyesore and cause odor problems that will impact park users.

Another beneficial use outlined in the plan is Goal Number 6, "Develop and implement a flood hazard management strategy to protect lands
adjacent to Capitol Lake". Dense colonies of Eurasian Milfoil will have an impact on the State's ability to implement this goal. Aquatic weed beds have an influence on deposition of sediments transported by water. It is probable that this would increase the rate of silt deposition in Capitol Lake. Macrophytes reduce flow velocities within their beds in rivers and streams as well as
in marine environments (Madsen, et al, 2001). Likewise, wave energy and current velocity are reduced within beds in the littoral zone of lakes and coastal areas (Madsen, et al, 2001). This reduction in waves and currents increases sediment deposition within the plant beds (Madsen, et al, 2001). Dense aquatic weed beds also take up space that normally would be storage capacity in a lake or reservoir. If allowed to expand, the presence of this weed would reduce the volume of water that could be stored in the lake during certain periods of the year. This impact would be during the period where plant biomass was the greatest in the lake, summer through fall.

Waterbody Use Map

Generally, the water body use map is created during the public process for the lake. The public meetings have not yet been held. The Capitol Lake Adaptive Management Plan however does outline the preferred option uses in the lake. That document has gone through the public process and beneficial uses have been agreed to by the CLAMP. This information is presented in great detail in that document and highlighted above in the beneficial uses section.

Eurasian Milfoil is widespread in the lake and expanding. It will impact most of the beneficial uses of this system. The CLAMP specifically addresses Eurasian Milfoil and expresses as a goal its elimination from the system. The waterbody use map highlights these uses.

Aquatic Plant Characterization

Aquatic vegetation has been mapped a number of times during the past two years as part of an effort to understand the Eurasian Milfoil problem. The first efforts were undertaken by Thurston County on discovery of the milfoil in the fall of 2001. In the summer of 2001, Aquatechnex conducted a number of mapping events to help define control alternatives.

A mapping effort was undertaken early in the summer of 2002. This survey was conducted by a mapping team equipped with Differential Global Positioning System (GPS) receivers. The entire lake (including Percival Cove) was covered using boat transects and GPS equipment was used to record the location and density of Eurasian Milfoil. This survey was conducted prior to the State dewatering the lake basin for construction work on the Deschutes Parkway. The lake was lowered during the summer of 2002 to accommodate re-construction of the Deschutes River Parkway from July through August 15th.

Additional survey efforts were undertaken later in the summer after the lake levels were brought back to normal elevations. A map of the aquatic plant communities focusing on Eurasian Milfoil is presented in appendix C. This map highlights the location and density of the milfoil communities.

In the North Basin, the areas not denoted as milfoil areas contained a mix of other exotic and native aquatic plants. The second most prolific plant found was *Potamogeton crispus* or Curly Leaf Pondweed. This plant is considered by the Federal Government as an invasive exotic species and can cause the same types of problems that Eurasian Milfoil does in infested waters. Washington State Noxious Weed Board has added this plant to the monitor list. The monitor listing does not require landowners to control the weed, but means that the state is evaluating the potential impact that plant may have on resources. There was also a general understory of *Elodea canadensis* and pondweeds present.

The middle and southern basin showed areas of Eurasian Milfoil as well. Both the Eurasian Milfoil and the native aquatic plants in this basin were impacted by the summer drawdown of the lake for construction. The lake bottom was completely exposed for a number of weeks in the summer and this had an impact on aquatic vegetation that would normally be present. This also has an impact along the shorelines of the north basin.

It should be noted that the aquatic plant communities in the lake were influenced by the summer drawdown to some degree during the summer of 2002 when this work was undertaken. The Eurasian Milfoil present in the lake at the end of the summer was

extensive. As this plant spreads within a lake by auto-fragmentation in the fall, it is assumed that the levels in the lake in 2003 will expand from conditions that are mapped. Additional mapping efforts during 2003 should focus on mapping the expansion of the Eurasian Milfoil and note any changes in the native aquatic plant communities.

Public Involvement

Capitol Lake is a bit different from the vast majority of the lakes that go through the IAVMP planning process. Most lakes in Washington State where plans have been developed and/or implemented have shorelines that are well developed as residential or summer home property. In these cases there are a number of lakefront property owners that have a direct interest in the management of invasive species. Most of these lakes have a lake association made up of property owners that advocate for the positions of the community on various subjects related to their water bodies. There is no lake association around Capitol Lake because the majority of the shoreline is owned by the State of Washington and managed by GA. As the majority property owners, GA serves in the role that traditionally would be taken by the lake association in this planning process. GA staff have been fully involved in the discussions regarding Eurasian Milfoil and control options that might be implemented on the lake.

GA has put together a Milfoil Steering Committee. This committee is made up of GA staff and representatives of the Department of Ecology, Department of Fish and Wildlife, Department of Agriculture, Thurston County Water and Waste Management, Thurston County Noxious Weed Board, the City of Olympia, the City of Tumwater and the Squaxin Island Tribe. The committee has met several times since the initial detection of Eurasian Milfoil in the lake.

In the spring of 2002, control options were outlined for the committee and a path of action to manage Eurasian Milfoil during the summer drawdown was selected as a preferred option. This option depended on the ability of the contractor to work effectively on the exposed lake bottom. This drawdown was undertaken to repair earthquake damage on the Deschutes Parkway along the west side of the lake. The goal at this stage was to try and attempt all non-chemical methods of control. This goal could not be met because the milfoil was more extensive than first thought and the lake sediments did not firm up enough to allow access to the drawn down areas.

The committee met again at the end of the summer and determined that control methods utilizing aquatic herbicides should not go forward until a more complete public process was completed. GA intends to move forward with the public process using this draft IAVMP as a basis for discussion and presentation to the public.

The draft IAVMP was completed in April of 2003 and made available to interested parties with a request for comments. GA also developed a web page (http://www.ga.wa.gov/CLAMP/Milfoil.htm) that provides information to the public. This page provides an overview of the problem. It also provides a number of additional resources for the public to obtain additional information on this invasive weed and

control options. The public can also download the Draft IAVMP for review and comment and fill out an online questionnaire.

On May 15th, 2003, GA hosted an open house to provide additional information to the public and solicit comments and opinion from the public. A number of agencies and groups set up display tables and had representatives available to talk to members of the public in attendance. The Washington Departments of Agriculture, Ecology, General Administration, Health and the State Noxious Weed Board all provided information related to the Capitol Lake IAVMP. Dr. Mark Sytsma, the director for the Oregon Center for Lakes and Reservoirs at Portland State University provided information on the impacts of Eurasian Milfoil. The Long Lake (Thurston County) Association was represented by Kathey Wycoff, she provided information on management of Eurasian Milfoil in Long Lake. Terry McNabb with Aquatechnex also was available to discuss the plan.

After approximately one hour of discussion with the representatives of these organizations, GA solicited comments from the public. GA provided a recorder that transcribed input from members of the public individually. GA also provided an opportunity for the members of the public present to address the group. A number of speakers took part in both activities and the transcripts of their comments are provided in the appendix.

GA also tabulated the results of the Milfoil Questionnaire. This document was made available to members of the public and through the web site.

Generally, those present at the public meeting were opposed to the use of herbicides to manage Eurasian Milfoil at Capitol Lake.

In addition to the public input received at the May 15th open house, the Capitol Lake Adaptive Management Plan committee addressed the issue of herbicide treatment of the lake at their May meeting. It was determined during that session that GA should conduct one more review of the "Salt Water" option. GA has established a working group of the various agencies to look at the benefits and impacts of that option and will delay implementation of this plan until that review had been completed.

Examination of Aquatic Plant Management Alternatives

A variety of methods and devices exist for the management of noxious aquatic plants. These management options are applicable to most aquatic systems and are designed to protect the beneficial uses of a water body. This section will review the control options available, examine the advantages and disadvantages of each option, and address the cost and applicability of each option to Capitol Lake. The objective in reviewing these options is to provide a reference for the Capitol Lake Adaptive Management Committee (CLAMP) members and lake residents as they continue to evaluate the best management alternative(s) for their system. Recommended management options for Capitol Lake will be addressed in the next section.

NO ACTION ALTERNATIVE

Aquatic plant management typically involves conducting manual, mechanical or chemical controls in the water body to correct the problem. However, it is important to consider possible consequences to the water body if **no action** is taken against problem aquatic plants. The choice of no action may have serious impacts on the aquatic ecosystem, recreational uses of the water body, aesthetics and/or property value. These impacts are particularly important when dealing with non-native invasive species and the impacts they will eventually have on a system.

It is important to consider the potential for noxious plants such as Eurasian watermilfoil to alter the aquatic environment and impact aquatic organisms. Water quality parameters should be periodically monitored in an effort to track changes in the water body. Parameters such as dissolved oxygen, temperature, pH and water clarity (due to sediment re-suspension or excessive algae blooms) are key to understanding the impacts of noxious weeds. Dense weed beds can impact the safety and enjoyment of boaters on the lake, decrease the habitat and food availability for fish and wildlife, and decrease the likelihood of swimming in Capitol Lake in the future. In addition to safety and environmental issues, excessive invasive weeds could negatively affect general aesthetics and decrease both residential and commercial property values around the lake.

Advantages

- Allows special habitats to be unaltered or impacted by human activities

Disadvantages

- Can result in excessive plant growth with negative impacts to environment
- Impact the use and safety of water body for recreational activities
- Degrade aesthetics and property value

- In the case of non-natives, can rapidly alter beneficial habitats and have serious impacts on both environment and recreational use

Cost

- This could result is some beach cleanup costs. Milfoil mats will wash up and rot along the shorelines.

Applicability

- CLAMP committee members have agreed that without immediate attention, Eurasian milfoil could eventually grow throughout Capitol Lake and have decided to implement control in 2003, with the eventual goal of eradication. Therefore, this option is not applicable.

WATER QUALITY AND NUTRIENT MANAGEMENT

Watershed management

Lakes are significantly impacted by the external activities occurring in the surrounding watershed. The surface and subsurface water within a watershed is eventually diverted to the lowest point in the system, a stream or lake. Thus, the land use activities play an important role in what materials or nutrients enter a lake system.

The increase of impervious surfaces, such as cement and asphalt, development of the landscape, and the removal of vegetation increases the amount of surface water runoff and degrades the quality of water entering a lake. The loading of organic material, especially nutrients, accelerates the aging process in lakes. Other specific introductions include leaking septic systems, storm water discharges, and runoff of fertilizers from lawns and/or gardens. The results are an accelerated eutrophication of the lake, showcased by excessive increases in nutrients and sediments, aquatic plants, and algae blooms.

Measures used to implement watershed control

- Minimize the degree of vegetation removal in watershed (i.e. riparian trees and shrubs)
- Limit or eliminate fertilizer use in lawn and gardens surrounding the lake and its tributaries
- Practice beneficial landscape and lakescaping along waterfront (limits nutrient runoff and erosion)
- Monitor and inspect storm water and septic systems (understand what is being discharged into the lake)
- Conduct routine monitoring of water quality parameters
- Express concerns to local governments/regulators about any negative watershed impacts (non-point nutrient sources) which are out of your immediate control

Applicability

- Although watershed management would be helpful in maintaining/restoring Capitol Lake water quality, it will not address the already present and growing population of Eurasian watermilfoil. In addition, Eurasian Milfoil is known to thrive in pristine waters. There are expanding populations of this noxious weed in Lake Tahoe on the California/Nevada border and in Lake Chelan. While the reduction of nutrient inputs would benefit Capitol Lake, it is probable that this would not control the Eurasian Milfoil in the system. CLAMP committee members have agreed that without immediate attention, Eurasian watermilfoil could eventually grow throughout Capitol Lake and have decided to implement the goal of eradication. Therefore, this option is not applicable to the control and eradication of milfoil in Capitol Lake.

Dredging

Dredging of the lake sediments can provide both a nutrient and plant control option in both lakes and ponds. Storm water drainage, surface runoff, stream sediment inputs and erosion can all contribute to the build-up of sediments in lakes. These sediments represent a pool of nutrients, which can stimulate algae growth as well as aquatic weeds. In addition, aquatic plants require light to photosynthesize. As light rapidly becomes absorbed by water, deeper portions of a lake will not support aquatic plant life. Increasing the deep areas of a lake can limit the littoral areas that would support aquatic plant growth. In a shallow water body like Capitol Lake, the establishment of significant macrophyte populations can result in accelerated accumulation of sediments and filling of the lake.

Dredging operations can be conducted using mechanical dredging equipment including both shore operations and floating barge systems. Periodic maintenance of those areas experiencing excessive sediment inflow can reduce the negative impacts on the lake ecosystem and minimize the growth of aquatic weeds.

Advantages

- Effective in removing existing plants and nutrient rich sediments
- Increases the depth of the system and reduces the areas available for plant growth
- Site specific management
- Can lead to cooler water for fish

Disadvantages

- Problems with equipment access and location for disposal
- Increase turbidity and short-term impacts of water quality
- May remove beneficial habitat
- May spread non-indigenous aquatic plants to other areas
- Environmental permits may be withheld

Cost
- Operation costs are typically expensive and labor intensive

Applicability
- Sediment management in Capitol Lake is an issue separate from the Eurasian watermilfoil problem and is addressed in the Capitol Lake: A Vision for the Next Ten Years 2002 – 2012 in Objective 13. Efforts to determine the feasibility of sediment removal are ongoing and dredging is not an option for the summer of 2002. Therefore, using dredging to remove both sediment *and* Eurasian watermilfoil is not an option for Capitol Lake for the summer of 2003.

Aeration

Artificial circulation of the water column involves pumping compressed air through a tubing system and bottom diffuser system. The air is injected into air supply tubes and is forced through either a porous membrane or air stone, which creates millions of small air bubbles. The aeration of the lake provides excellent circulation from the lake sediments to the surface and prevents the stratification of the water column. Aeration can help to reduce the release of nutrients from the sediment, minimize excessive algae blooms, increase dissolved oxygen, and enhance the breakdown of organic material.

The success and need for this management options depends on multiple factors for each site. Prior to considering the implementation of this management tool one should investigate; the source of nutrient loading, the type of algae blooms that persist in the system and the current water quality conditions in the water body.

Advantages
- Improved water quality conditions (dissolved oxygen, water clarity, reduced algae blooms)
- Improves conditions needed for aerobic bacteria which breakdown organic material in the system
- Reduces release of nutrients and odorous gases in lakes that stratify
- Excellent tool to implement in a integrated management program

Disadvantages
- Potentially expensive and complex system design in larger water bodies

- May not be effective in reducing algae blooms in lakes with excessive external loading of nutrients
- May create turbidity in extremely shallow systems
- May create changes in primary productivity and food web interactions

Cost
- Installation costs are typically expensive and labor intensive
- Once installed there are minimal operating and maintenance costs

Applicability
Because aeration is primarily used to indirectly control an overabundance of algae, use of this control option is not applicable for Eurasian watermilfoil in Capitol Lake. This type of system could be considered to help improve water quality in the north basin as part of the park improvement project.

Aluminum Sulfate

An effective means to reduce nuisance algal blooms is to precipitate and inactivate total phosphorous. This is accomplished by applying aluminum sulfate to the water column. Introducing aluminum sulfate causes phosphorous to bind to it and creates a precipitate that blankets the sediments. The precipitate prevents the release of phosphorous from the sediments and thus reduces the level of phosphorous available for plant and algae growth.

The pH and alkalinity of the water body determines the level of aluminum sulfate needed to precipitate and inactivate the phosphorous in the water column. The removal is most effective in a pH range of six to eight. Extensive water quality monitoring is required to assure that the safety of the aquatic environment is maintained during the application. A buffering agent, sodium carbonate or sodium aluminate, needs to be readily available to inject into the water column if pH levels drop below the safety thresholds. A National Pollutant Discharge Elimination Systems Permit (NPDES) from the DOE is required prior to application of aluminum sulfate.

Advantages
- Rapidly removes algae and or suspended sediments, improves water clarity
- Reduces the level of algae blooms by trapping phosphorous in the sediment
- Potential to provide long-term control of internal loading of phosphorous
- May reduce the need for introducing algaecides and performing intensive algae control practices

Disadvantages
- Is typically limited to isolated systems with little or no discharge

- Requires permit and extensive water quality monitoring pre and post treatment
- Potentially toxic to aquatic life if water becomes too acidic (pH $\leq$ 6.0)
- Improved water clarity may allow expansion of macrophyte growth
- Eurasian Milfoil can expand in nutrient-poor waters and this tool potentially creates a nutrient-poor environment

Cost
The costs of an aluminum sulfate treatment for Capitol Lake would be in excess of $500,000.00

Applicability
Because aluminum sulfate is primarily used to indirectly control an overabundance of algae by reducing phosphorus levels in the water column, use of this control option is not applicable for Eurasian watermilfoil in Capitol Lake.

Salt Water Back-flushing

Capitol Lake was created by impounding the Deschutes River mouth at the point it entered the salt waters of Puget Sound. There is a tide gate and dam that maintains the lake level. By manipulating this control structure, GA has the ability to allow salt water to flush back into the lake. Salt water is toxic to freshwater organisms including many aquatic plants. If aquatic plant life can be subjected to salt water for prolonged periods, control may be achieved. GA has used this technique in past years to manage nuisance aquatic vegetation. This practice was halted in the mid 1990's because of concerns expressed by the Department of Ecology.

Advantages
- can provide aquatic weed control at minimal cost

Disadvantages
- Eurasian Milfoil is tolerant of some levels of salinity. Salt water, of sufficient concentrations, would have to be maintained in Capitol Lake long enough to kill the plant's root crowns. This action would substantially impact native aquatic freshwater plants. Salt water was last used in 1997 prior to the discovery of Eurasian Milfoil.
- Salt water is toxic to all freshwater organisms. The initial lowering of the lake would flush fresh water fish to the Sound causing mortality, the salt water backflow would kill remaining freshwater organisms. Coho salmon smolts remain in freshwater systems for up to one year, Capitol Lake is used extensively by this species as rearing habitat. Salt water flushing would have a toxic effect on these fish and the food organisms in the lake they rely on

- Resource agencies such as the Department of Ecology have expressed reservations and could take action to prevent the impact flushing would have on the ecosystem

Cost
The costs for this action would be minimal, GA staff time to manage the water exchange.

Applicability
The CLAMP committee requested that this option receive further consideration during their May 2003 meeting. GA has established a committee to determine the applicability of this option for Capitol Lake.

MANUAL CONTROL METHODS

Hand-pulling

Removal of rooted/submerged vegetation via digging is an intensive management option. This method involves digging out the entire plant with a hand-held gardening tool, collecting the plant and roots in a storage bag and disposing plant material on shore. In water depth greater than about three feet, the use of SCUBA divers is typically needed in order to effectively manage a location.

The effectiveness of plant removal depends on sediment type, visibility, plant type, and thoroughness in removing the entire plant. Based upon these variables, the level of plant control will vary from thirty days to multi-year control.

Advantages
- Immediate clearing of the water column
- Highly selective technique, in that individual plants are removed
- Can be implemented in sensitive area where disruption must be kept to a minimum
- Effective in aggressive control of sparse or small infestations in the lake, around docks or in swim areas (advantageous in invasive plant control programs, i.e. Eurasian milfoil)

Disadvantages
- Technique is time consuming and labor intensive
- Visibility may become obscured by the disturbance of sediments during harvesting, thus delays in plant removal
- Control may only be short-term or seasonal; based on location and surrounding infestations

Cost

- Labor intensive and relatively expensive (both machinery and diver costs). These operations generally cost $160.00 per hour of operation.

Applicability

This technique is applicable to Capitol Lake in that it could be used in conjunction with other control techniques, especially post treatment with an aquatic herbicide. Hand removal of single Eurasian Milfoil plants or small patches of this weed could be accomplished in Capitol Lake. The water clarity in the system will play a large role in the effectiveness of this technique. This is not a viable technique to remove large areas of milfoil.

Hand-Cutting

This technique involves cutting of the plant below the water surface, but roots are not generally removed. Tools used in cutting include scythes, thin cables, rakes or other specialized devices that can be pulled through the weed beds by boat or people. One popular device consists of a two single-sided stainless steel blades forming a "V" shape that are connected to a four-foot handle and tied to a rope.

Advantages

- The techniques results in immediate removal of nuisance submerged plant growth.
- Can be performed throughout the season as needed

Disadvantages

- This techniques is labor intensive and time consuming
- Visibility may become impaired by turbidity generated by cutting
- Does not result in long-term plant control as the root system is not removed; control is typically needed multiple times each season
- Intensive plant containment and removal process
- Potential to spread plant fragments

Cost

- Costs are minimal

Applicability

Due to the potential for Eurasian watermilfoil to spread by fragmentation, this technique is applicable but not recommended for Capitol Lake. This technique would likely result in greater milfoil abundance in Capitol Lake over time. This technique is more suited to individual lake residents who want to clear an area around their docks for a private swimming area.

Bottom Barrier Installation

Barrier material is applied over the lake bottom to prevent plants from growing. The results are weed free areas and re-establishment of the beneficial uses in the lake. A wide variety of barriers have been successfully implemented; sand-gravel, polyethylene, polypropylene, synthetic rubber, burlap, fiberglass screens, woven polyester, and nylon film. Washington State typically allows the use of burlap when covering native plant areas and burlap or synthetic material when covering noxious weed areas. Installation can be conducted at any depth with the assistance of divers and a support vessel. Bottom conditions do not typically impede most barrier installs, but logs and debris are typically cleared from the area. Duration of control is dependent upon type of material used, application techniques, sediment deposition, and permit requirements.

Advantages

- Provides immediate removal of nuisance plant conditions upon placement
- Easily applied to small, confined areas around docks, moorages or beaches
- They are hidden from view (in deeper waters)
- Effective in isolated management practices, especially in milfoil control

Disadvantages

- Limited durability of certain materials
- Restrictions on location of barrier (spawning areas), type of material, type of plants attempting to control and length of time barrier will be allowed in place
- Gas accumulation under barrier
- Periodic maintenance to remove sediment build up and secure placement pins/bags
- May need to remove after two years to allow native vegetation to re-establish

Cost

- Potentially high material cost for synthetic products, costing approximately $0.40 per square foot applied or $17,424.00 per acre covered

Applicability

This is an effective tool in controlling localized populations of submerged weeds such as Eurasian watermilfoil and is applicable to Capitol Lake where small but dense populations of watermilfoil exist. The deposition of sediments will limit the life of this technique in Capitol Lake however.

Permit Requirements

Most manual plant control methods can be conducted following the guidance in the "Aquatic Plants and Fish" pamphlet developed by the WDFW". This pamphlet was developed in recognition of the importance of controlling aquatic noxious and nuisance weeds. The following issues were addressed in development of this pamphlet:

- Expedite the HPA process for projects designed to control early infestations of aquatic noxious weeds (Hydraulic Permit Approval or HPA is the permitting system used by WDFW regulate alterations to the lake bed or shoreline. The objective of this permit is to protect critical habitat)
- Provide guidance in selecting control methods for early and more advanced infestations of aquatic noxious weeds
- Expedite the HPA process for applicants who want to control aquatic beneficial plants using small scale projects only (e.g., around docks and in swimming areas)

MECHANICAL CONTROL METHODS

Mechanical Harvesting

This technique is considered a short-term plant control practice. It is typically implemented to temporarily remove plants interfering with recreational and aesthetic enjoyment of a location on a water body. Harvesting involves cutting plants below the water surface, with or without collection of plant fragments for disposal. Maximum removal of plants is typically achieved by harvesting plants during the summer months when submerged and floating-leafed plants have reached the surface. Conventional single-stage harvesters combine cutting, collecting, storing and transporting cut vegetation in one piece of machinery. Maximum cutting depths of harvesters and cutting machine are typically from 5 to 8 feet.

This technique immediately opens water areas for use, but the duration of control is variable. Factors such as frequency and timing of harvest, water depth, plant size and depth of cut are critical to the success of implementing this option. Harvesting is typically implemented in large, open areas with few surface obstructions.

Harvesting operations also collect significant numbers of small fish and invertebrates. The following excerpt is taken from North American Lake Management Society; LakeLine, v. 20, no.1, pp 22-34. Spring 2000.

"Although many claim that harvesting is environmentally superior to herbicide use, most neglect to consider that harvesting removes large numbers of macro-invertebrates, semi-aquatic vertebrates, forage fishes, young-of-the-year fishes, and even adult game fishes (Engel 1990). The harvester acts as a large, nonselective predator "grazing" in the littoral zone. In addition, harvesting can re-suspend bottom sediments into the water column, releasing nutrients and other accumulated compound".

Advantages

- Limited interference with use of the water body
- Removal of in-lake plant biomass, thus possible nutrient source
- Reduction in sediment accumulation by removing organic matter which normally decays and adds to the bottom sediments

Disadvantages

- Labor intensive; cutting and collection of cut plant material
- Creates plant fragments which have potential to spread and establish in other portions of the lake (especially a concern with exotic species)
- Not selective and can be detrimental to non-target plants and animals
- High capital costs for machine purchase or use by management consultant

Cost

- Costs range from $650.00 to $900.00 per acre

Applicability

Harvesting is an appropriate technology for the management of Eurasian Milfoil once the plant is widely distributed in a lake and the control objective is to maintain open water. Harvesting pioneering colonies of this weed is not a good idea. As Eurasian Milfoil can recover from this type of operation and grow faster than many native plants, this technique can select for Eurasian Milfoil and add to its competitive advantage over beneficial native aquatic plants. Harvesting generally results in some fragmentation of Eurasian Milfoil. Due to the potential for Eurasian watermilfoil to spread by fragmentation, this technique is applicable but not recommended for Capitol Lake. This technique would likely result in greater watermilfoil abundance in Capitol Lake over time.

Diver-Operated Suction Dredging

Diver dredging has been used for the past twenty years as an improvement to hand removal of sparse colonies of submerged plants (primarily Eurasian milfoil). The technique utilizes a small barge or boat carrying portable dredges with suction heads that are operated by SCUBA divers to remove individual rooted plants from the sediment. Divers physically dislodge plants with sharp tools and the plant/sediment slurry is then suctioned up and carried back to the support vessel via hoses operated by the divers. On the support vessel, plant material is sieved out and retained in catch baskets for off-site disposal. The water sediment slurry can be discharged back to the water or piped off-site for upland disposal.

Diver dredging can be highly effective under the appropriate conditions. Removal is dependent upon sediment condition, density of submerged plants and underwater visibility. This method is best implemented when controlling localized infestations of

low plant densities where fragmentation must be minimized. This method can be highly successful in early infestation management of Eurasian watermilfoil or Brazilian elodea, with removal efficiency of 85-97%.

Advantages

- Species-selective and site-specific
- Minimal disturbance of lake sediments
- Fragmentation is minimal, as plant debris is collected and retained
- More efficient in covering large areas than diver hand-harvesting or digging
- Can be conducted in a wide variety of locations (docks, shorelines, swim areas)

Disadvantages

- May not be highly efficient in dense communities
- Possible permit problems with turbidity and plant fragment falling through screens
- Release of nutrients from the sediment and short-term increase in turbidity

Cost

- Labor intensive and relatively expensive (both machinery and diver costs). These operations generally cost $196.00 per hour of operation.

Applicability

This is a viable control option for Capitol Lake, especially when used in conjunction with other control methods. This option may not be cost effective in the short term because of the level of infestation present. Water clarity can play an important role in the effectiveness of this tool. Visibility is often restricted in Capitol Lake due to suspended sediments and algae growth.

Permit Requirements

Mechanical plant control methods can be conducted following the guidance in the "Aquatic Plants and Fish" pamphlet developed by the DFW. This pamphlet was developed in recognition of the importance of controlling aquatic noxious and nuisance weeds

BIOLOGICAL CONTROL METHODS

Triploid (sterile) Grass Carp

Grass carp or white amur are exotic, plant-consuming fish native to large rivers of China and Siberia. These fish are known for their high growth rate and wide range of aquatic plant food preference, thus controlling certain noxious and nuisance plant species under

the right conditions. Grass carp are most appropriately implemented in lake-wide, low-intensity submerged aquatic plant control programs. Stocking rates are dependent on climate, water temperature, type and extent of plant species and other site-specific conditions.

Effectiveness of grass carp in controlling aquatic weeds depends on their feeding preferences and metabolism that vary from region to region. Some plant species appear to be preferred over others, with the most preferred species being varieties of pondweed, coontail, and elodea. Plant control effectiveness is site specific and significant control of vegetation is not apparent until two to four years following introduction.

Only triploid (sterile) fish can be planted and must be imported by Washington Department of Fish and Wildlife from approved suppliers. Inlets and outlet screens must be installed and approved by WDFW biologists prior to stocking.

Advantages

- Potential for long-term reductions in nuisance submerged plant growth
- May result in improved water quality conditions (where dense aquatic weeds were contributing to problems)
- Cost to benefit ratio is relatively low
- Good biological control alternative
- Can be an effective tool to incorporate in a integrated management program

Disadvantage

- As they can be selective in feeding, may not achieve control of all problem plants
- May avoid heavy recreational use areas, thus not providing desired control
- Plant control is not immediate, taking 2-4 years
- Screening and permit conditions may limit the areas where this tool can be implemented (includes restricted use in salmon bearing waters)
- Overstocking can result in complete removal of aquatic vegetation and negatively impact the biological balance in the system
- May experience significant fish loss due to predation (otters and osprey)

Cost

- Cost to benefit ratio is relatively low

Applicability

This is not a viable control option for Capitol Lake for several reasons. The two primary reasons are that grass carp will not completely eradicate Eurasian milfoil and would have long-term detrimental effects on native vegetation, and Capitol Lake cannot be isolated from the Deschutes River or the South Puget Sound (Budd Inlet) due to salmon stocking and migration.

Milfoil Weevils

The milfoil weevil, *Euhrychiopsis lecontei*, has been associated with declines of Eurasian watermilfoil in the United States (e.g. Illinois, Minnesota, Vermont, and Wisconsin). In Washington State, the milfoil weevil is present primarily in eastern Washington and occurs on both Eurasian and northern watermilfoil (*M. sibiricum*), the latter plant being native to the state. Researchers feel that much remains to be learned about this tool before it can be considered operational. For example, at the level of the individual plant, researchers have a good idea how weevil herbivory influences plant growth (Creed, 2000). At the level of plant beds, researchers do not know how long it takes a weevil population to reach a density that will result in significant reductions in milfoil biomass and don't know if differences in lake productivity influence the weevil/milfoil interaction (Creed, 2000). Although the milfoil weevil shows potential as a biological control for Eurasian watermilfoil more work is needed to determine which factors limit weevil densities and what lakes are suitable candidates for weevil treatments in order to implement a cost and control effective program.

Advantages

- Potential for long-term reductions in Eurasian watermilfoil growth
- May result in improved water quality conditions (where dense aquatic weeds were contributing to problems)
- Cost to benefit ratio is relatively low
- Little to no disruption to native plant and animal communities
- Can be an effective tool to incorporate in an integrated management program

Disadvantage

- Only potentially effective in areas heavily populated by Eurasian watermilfoil
- Plant control is not immediate, taking 2-4 years (if at all)
- Will only control Eurasian milfoil and not eradicate it
- Success rate of milfoil weevils in controlling Eurasian milfoil is highly variable

Cost

- Not established

Applicability

This is not a viable control option for Capitol Lake. Milfoil weevils will not eradicate Eurasian watermilfoil from Capitol Lake. There may not be sufficient milfoil present in the lake for weevil populations to survive. The progress of research groups working on this technique should be monitored. If there is a breakthrough that gives us the information we need to utilize this tool operationally, it should be reconsidered.

Permit Requirements

The WDFW requires a game fish planting permit prior to grass carp introduction into a water body. If an outlet screen(s) is required a hydraulic project approval (HPA) permit is also necessary prior to the approval of a stocking permit.

CHEMICAL CONTROL OPTIONS

The State of Washington currently permits the use of six aquatic herbicides and/or algaecides to control aquatic weeds. The products (active ingredient) available are as follows: systemic herbicides fluridone, 2,4-D, glyphosate; contact herbicides endothall, diquat and Hydrothol 191 (endothall). Systemic herbicides are absorbed by the plant and trans-located throughout the leaves, stems, and roots, and are capable of killing the entire plant. In contrast, contact herbicides are not absorbed by the plant and just injure the plant tissues they come into contact with. This leaves the roots alive and capable of producing new tissue shoots later that season or the following year.

The DOE is currently reviewing one additional herbicide for future use in state waters. Renovate (Triclopyr) is a systemic herbicide which is effective in selectively controlling both emergent and submersed aquatic plants. This product has proven to be effective in selectively controlling invasive plants such as Eurasian watermilfoil and purple loosestrife, while having little impact on non-target plants. Renovate received full approval by the EPA in November of 2002 and potentially will available for use in Washington in 2004. Treatments conducted under Experimental Use Permits in Minnesota and Washington resulted in excellent selective control of Eurasian watermilfoil and purple loosestrife.

Fluridone

Fluridone is a slow-acting systemic type herbicide that is registered for use in the management of aquatic plants in freshwater ponds, lakes and reservoirs. It is formulated as both a liquid and granular product. Fluridone is effectively absorbed and trans-located by both plant roots and shoots. Fluridone demonstrates good control of submerged and emergent aquatic plants in water bodies with little or no water movement. Efficacy of plants is highly dependent on exposure time, application rate, and the size of the control area. It is most applicable to conduct whole-lake or isolated bay treatments in order to effectively control the targeted plants. Effects of fluridone injury become noticeable about two weeks following application, with control of target plants often requiring 60-90 days of exposure.

Advantages

- Systemic herbicide, capable of killing roots and shoots of aquatic plants
- Variety of plants are susceptible, based on treatment rates and program design

- No human health effects, swimming permitted immediately following treatments, can be applied in drinking water reservoirs at 20 ppb or less
- Irrigation is the only water use restriction
- Low order of toxicity to aquatic animals and wildlife
- Excellent control of the non-native weeds Brazilian Elodea, Eurasian watermilfoil, Curly leaf pondweed

Disadvantages

- 14 to 30 day restriction period in irrigation waters
- Requires whole lake or large bay treatments
- There can be some short term impacts to native aquatic plants when used at higher rates, but Eurasian Milfoil will replace them as well and recovery of native plant communities is rapid
- Cost can be a limitation for large water bodies

Cost

- The cost per acre is highly variable based on area treated and water depth. There are specific costs outlined for Capitol Lake in the proposed work plan.

Applicability

Fluridone has an application in Capitol Lake. Eurasian Milfoil has expanded lake-wide and this may be the best option for control.

2,4-D

This is a fast-acting systemic and selective herbicide registered by the EPA for freshwater applications. The 2,4-D butoxyethyl ester (BEE) formulation is registered for aquatic use in Washington State as is the amine formulation. Granular 2,4-D BEE, and the liquid amine formations are a post-emergent herbicides that are primarily used to control Eurasian watermilfoil and water stargrass. Other species such as bladderwort, water lilies, water hyacinth, etc. are also deemed to be slightly to moderately susceptible to 2,4-D BEE applications at higher label rates.

Herbicides containing 2,4-D can be effectively used in spot-treatment programs in lakes or ponds. Effectiveness of the treatment is dependent upon the timing of the application and density of the target plant community. Two treatments may be required when targeting dense plant communities or controlling Eurasian watermilfoil populations. This product can be applied under the Noxious Weed National Pollution Discharge Elimination System permit. Following application the targeted plants will begin to show signs of injury in approximately two weeks, followed by plant breakdown and death.

Advantages

- Fast-acting systemic herbicide which is effective in removing selected plants (especially Eurasian watermilfoil) with no impact on native plants at labeled rates
- Application can be conducted in a spot-treatment or isolated area applications
- Treated waters can be used for swimming within 24 hrs
- No fish consumption restrictions

Disadvantages

- Swimming advisory of 24 hours imposed by WADOE

Cost

- Using this herbicide to control Eurasian watermilfoil in Capitol Lake would cost approximately $650.00 per treated acre.

Applicability

This is a viable control option for Capitol Lake, especially used in conjunction with other control options like diver hand removal and/or diver dredging. This technique would be considered for larger patches of Eurasian Milfoil or in cases where water clarity limited other control options such as diver dredging or bottom barrier application.

Endothall (Aquathol and Aquathol K)

Endothall is a contact herbicide that kill or injures plant tissue, but does not translocate and kill the root or tuber system of plants. Both a liquid and granular formulation of endothal is currently registered for use in Washington water bodies. As a contact herbicide, this product is effective in biomass reduction and short-term maintenance of nuisance plant growth. Duration of control is dependent upon target species, contact efficiency, lake conditions, and re-growth form of unaffected root masses.

Advantages

- Fast acting contact herbicide capable of creating injury to plant tissue and providing short-term control
- There is little to no drift impact from proper application of this product, allowing isolated or spot treatments to be effective
- Can be used to kill plants prior to auto-fragmentation in the late summer or fall to minimize dispersal.

Disadvantages

- Only provide temporary reductions in plant growth without affecting the root system

- Non-target plant impacts are difficult to mitigate as this is a fairly broad spectrum herbicide
- Water use restrictions can limit the use of the water body; 3 day fish consumption, 7-14 day irrigation restriction, 35 day domestic use

Cost
- Aquathol applications range from $500.00-600.00 per treated acre.

Applicability
This is a not a viable control option for Capitol Lake, as it only provides short-term control and will not aid in the long-term goal of eradication of Eurasian watermilfoil. It might be considered under certain circumstances where the objective would be to rapidly kill the portions of the plants in the water column to limit dispersal.

Endothall (Hydrothol 191)

This product is a contact herbicide/algaecide that provides control of algae and submerged aquatic plants. DOE allows its use for only the control of filamentous algae.

Advantages
- Effective in controlling persistent or potentially toxic algae blooms
- A possible alternative to copper treatments for filamentous algae control
- Rapidly breaks down in aquatic systems and dissipates from two to thirty five days

Disadvantages
- Application rate are limited to 0.2 ppm which may provide marginal control of some algae species
- Potential acute and chronic impacts on biota if application rates exceed 0.3 ppm
- Water use restrictions may limit the use of this product in certain water bodies: 7 day irrigation and domestic use at a rate of 0.2 ppm
- Only 2 treatments per season will be allowed by the WADOE unless a management plan addresses further concerns with algae and the need for multiple treatments

Applicability
This is a not a viable control option for Capitol Lake, as Endothall is primary used for algae control.

Glyphosate

Glyphosate is a non-selective systemic herbicide used primarily to control emergent and floating leaf nuisance aquatic plants. This product is directly applied to the foliage of

the target plants and is rapidly absorbed and trans-located throughout the plants tissue and roots.

Glyphosate treatments are effective in providing long-term control of water lilies, purple loosestrife, reed canary grass, Japanese knotweed and cattails. Glyphosate is not effective below the water line as it binds tightly to soil particle on contact and becomes unavailable for uptake by submerged plants. Once applied to the leaf surface, injury is noticeable approximately seven days following application, followed by complete breakdown and death.

Advantages

- Capable of killing the entire plant system, thus long term management
- No swimming, fishing or irrigation water restrictions to treated waters or wetlands
- Rapid dissipation from the environment, with a half-life of as little as two weeks
- Very low toxicity to aquatic and upland wildlife

Disadvantages

- A non-selective herbicide may impact non-target plants in certain treatment situations
- Possible drift when applying to wetlands or lily locations
- Restricted use within ¼ mile upstream of a potable water intake

Applicability

This is a not a viable control option for Capitol Lake, as glyphosate would be ineffective on submerged Eurasian watermilfoil plants

Permit Requirements

Prior to 2001, the use of aquatic herbicides in Washington required a short-term modification to State water quality standards permit order from the DOE. In the spring of 2001, a ruling in *Headwaters vs. Talent Irrigation District* issued by the US Ninth Circuit Court of Appeals caused considerable confusion in the aquatic plant management community. This ruling required this irrigation district to obtain a National Pollution Discharge Elimination System (NPDES) permit to apply aquatic herbicides. Many states, including Washington, interpreted this to mean that all aquatic herbicide applications would require this type of permit. The DOE has finalized an NPDES general permit for the control of aquatic weeds found on the state noxious weed list. This permit was issued by DOE to the DOA on May 15th, 2002 and users can obtain coverage under this general permit by submitting a notice of intent to that department.

Integrated Treatment Action Plan

Eurasian Milfoil is identified as the "problem plant" that this plan will target. There are a number of considerations in the development of a workable Integrated Treatment Action Plan for Capitol Lake. They are:

1. The level of Eurasian Milfoil present in the lake is beyond the level that can be economically managed using many of the tools available to aquatic plant managers
2. The Capitol Lake Adaptive Management Plan has a stated objective of "Eliminating the Eurasian Milfoil noxious weed infestations throughout the lake".
3. If left unchecked, the Eurasian Milfoil infestation will expand lake-wide within the next year or so and have a major impact on the aquatic environment and the beneficial uses identified above.

Given these considerations, the control intensity selected is for attempted eradication of this noxious aquatic weed. Eradication has been successful in a number of Washington Lakes in the short term. In other cases, eradication attempts have reduced the populations of milfoil to the point where other options such as diver hand removal is a viable and cost effective option for management.

The Eurasian Milfoil infestation in the lake at the end of 2002 was beyond the cost effective use of a number of control strategies. It is expected that by the summer of 2003, the plant will have further expanded in the lake through its dispersal by auto fragmentation.

Given these considerations, the best short term solution is to deploy one of two aquatic herbicides to target these populations. As this is a draft proposal and public comment has yet to be solicited, two effective options are outlined below for consideration.

MILFOIL IN CAPITOL LAKE – A COMPARISION OF TWO TREATMENT OPTIONS – AND A RECOMMENDATION FOR ACTION

The invasive aquatic weed Eurasian Milfoil was discovered in Capitol Lake in the fall of 2001. This plant is listed by the Federal Government as a "harmful non-indigenous species". Left unchecked, Eurasian Milfoil will rapidly spread throughout the littoral zone of Capitol Lake damaging fish and wildlife habitat, degrading water quality and having a serious impact on recreational and aesthetic uses of the lake. For this reason, Eurasian Milfoil is on the Washington State noxious weed list. The Capitol Lake Adaptive Management Plan has as a goal the removal of this noxious weed from the lake (management objective #12).

During the summer of 2002 the following non chemical control alternatives were analyzed for possible use in Capitol Lake. These included:

- The installation of "bottom barriers" --- This approach was determined to not be economically feasible at a cost of $17,500 per acre. To cover the anticipated 100 acres needed would result in an expenditure of $1,750,000.
- Diver operated suction dredge -- $196 per hour. This approach was determined to not be effective due to the lack of under water visibility in the lake and the significant number of plants present within the lake
- Hand pulling --- During the summer of 2002, Capitol Lake was lowered to accommodate reconstruction work on the Deschutes Parkway. During this "draw down" GA proposed to physically remove the milfoil plants that were exposed. However, this program encountered significant obstacles in the form of deep sediment "muck" that made movement on the lake bed quite difficult and dangerous. Furthermore, the Budd Inlet tide fluctuations also did not allow the lake areas to totally dewater. During this "draw down" the bottoms of the south and middle basins of the lake were substantially exposed. The north basin retained substantial amounts of water.

It was during the summer 2002 draw down that GA discovered the full extent of the presence of milfoil in Capitol Lake. Prior to this time, GA thought that it was dealing with an "early infestation." However, milfoil is present in all of the basins of Capitol Lake.

The following proposal presents the costs and benefits of two herbicidal options that are available with respect to controlling milfoil in Capitol Lake – 2,4-D and fluridone.

The use of any aquatic herbicide requires a permit from the DOE. In 2002, DOE issued a general National Pollution Discharge Elimination System (NPDES) permit for the control of noxious aquatic weeds, including Eurasian Milfoil, to the Washington State Department of Agriculture (DOA). DOA will provide coverage to its cooperators under its NPDES permit. Either the sponsor or the applicator can apply for coverage, although the name and license number of the applicator must be listed on the application for coverage. The first step in any herbicide treatment program would involve obtaining coverage under this plan for the lake. The conditions in the permit must be followed by the applicator.

Proposal for the use of 2,4-D for management of Eurasian Milfoil in Capitol Lake

2,4-D is a systemic aquatic herbicide that has proven its effectiveness in the management of Eurasian Milfoil. A systemic herbicide will translocate within the milfoil and control the entire plant including the root system. 2,4-D is also selective. The product impacts plants that are members of the broad leaf family, it has minimal impact on plants that

are members of the grass family. In the aquatic environment, there are very few broad leaf plants. Eurasian Milfoil is one of these, while the native aquatic plants found in Capitol Lake are members of the grass family. As such, it can be used to selectively target the Eurasian Milfoil and have minimal impact on the beneficial native plants present in the lake.

There has been some public concern expressed regarding the use of 2,4-D in Capitol Lake. 2,4-D is a herbicide that has negative health and environmental connotations for some people. Because 2,4-D has been available for nearly 50 years it has been extensively studied. Ecology recently completed a Risk Assessment and Environmental Impact Statement for the use of this product in the aquatic environment. The DOE uses this assessment format to determine if this, and other aquatic herbicides, can be safely used under their NPDES permit program. The Risk Assessment concluded that 2,4-D is safe for its intended use if permit conditions and mitigation measures are followed. It is target specific for Eurasian Milfoil and provides protection of native aquatic plants. It is approved by the federal and state government agencies that are charged with understanding and protecting the environment. However, the EIS also suggests not using the BEE formulation of 2,4-D where salmon are present.

If sufficient contact time can be maintained for at least 24 - 48 hours, 2,4-D should control the vast majority of the Eurasian Milfoil plants found in the lake. However, the initial application of 2,4-D will not eradicate the weed. In the following years there likely will be small areas of milfoil that need additional attention. The worst case scenario would be to have all the milfoil remaining after treatment. However, experience has indicated that we could expect about 90% of the milfoil plant to be destroyed. Following the first year of 2,4-D application the remaining milfoil plants could be addressed with either chemical or manual removal methods.

Notification and restriction requirements related to 2,4-D: There are no fishing or swimming restrictions on the use of treated water established on the EPA label. However, Ecology has a swimming advisory and advises that people not swim in 2,4-D treated water for 24 hours. There is a precaution not to use the treated water for irrigation or human consumption until levels of the herbicide in the treatment area have dropped below the Federal Food & Drug Administration (FDA) tolerances. This normally happens in 24 to 72 hours. Public notification must be delivered to all property owners adjacent to the lake 10 days prior to any treatment. This notification states the type of herbicide being used, the dates of applications and the water use restrictions indicated below. On the days of treatment, signs are posted along the shoreline indicating that the treatment has occurred and the restrictions on water use are stated. Large signs with maps of the treatment area are posted at public boat ramps or access sites. Smaller signs are posted at 100 foot intervals around the lake.

The following table provides estimates of costs for management of milfoil using 2,4-D.

Year	Activity	Budget
2003	Survey and map treatment areas for Eurasian Milfoil in the lake in early summer	$950.00
2003	Treat up to 100 acres of the lake with 2,4-D	$47,500.00
2003	Perform August survey of the lake for Eurasian Milfoil, determine if additional treatment are necessary	$950.00
2003	Treat (if necessary) up to 10 acres of Eurasian Milfoil	$4,750.00
2004	Survey and map remaining Eurasian Milfoil	$950.00
2004	Manual or chemical removal of any surviving Eurasian Milfoil	$18,5000.00
2005	Manual or chemical removal of any surviving Milfoil	$18,500.00
	TOTAL	$92,100

Proposal for the use of Fluridone for management of Eurasian Milfoil in Capitol Lake

Fluridone is an effective aquatic herbicide that is approved by the EPA and the DOE for the control of Eurasian Milfoil. Fluridone has been effectively used to control Eurasian Milfoil in a number of lakes in Western Washington. It is anticipated that it could do the same for Capitol Lake. Whether fluridone will, in fact, work in Capitol Lake is dependent on the chemical maintaining contact time with the milfoil plants over approximately a 6-10 consecutive week period. Thus, herbicide application rates would be made during the months of the lowest Deschutes River flows into Capitol Lake (July and August).

Fluridone is also a systemic herbicide. Fluridone can be used at high rates of application to control most aquatic weeds present in a system, or at lower rates to target sensitive aquatic weeds. Since Eurasian Milfoil is extremely sensitive to fluridone, the application rate maintained in the lake can be lower than one that would affect many other plant species. There is some potential that the herbicide could cause short term injury to some of the native plants in the lake during the application. However, it should be noted that the milfoil we are targeting is replacing these native plants at an alarming rate and their survival is already is jeopardy.

Before a program is implemented, milfoil plants are collected from the lake scheduled to be treated. Tests are performed on these plants to determine the exact dosage of Fluridone that would be required to target the plants in the lake. The lake water volume

and flow into and out of the lake is then calculated and the appropriate amount of Fluridone is applied The product needs to be kept in contact with the milfoil for a period of approximately 6 - 10 weeks. Thus, additional applications of Fluridone are used to maintain the required low levels of herbicide in the lake. The effectiveness of Fluridone in Capitol Lake is dependent on minimal water flows into and out of the lake. If the herbicide is being rapidly pushed through the lake, maintaining contact time could be difficult and require numerous applications.

Prior to each subsequent treatment, water samples are collected from the lake and analyzed to determine how much of the previous dose remains in contact with the plants. This data is used to maintain the required dose and helps determine how much additional Fluridone may be necessary. This approach provides the necessary contact exposure time to insure complete control in the lake.

The results of the Fluridone application could provide between 95 to 100 percent eradication of Eurasian Milfoil if the appropriate contact time can be maintained. Near the end of the treatment cycle tests would be made on the milfoil plants to determine if they have received a lethal does of fluridone. Surveys would be performed in the following years and any plants found could be manually removed. The use of Fluridone has a much higher probability of milfoil control in one season than does the use of 2,4-D. Thus, follow-up treatments in subsequent years should be markedly less.

Notification and restriction requirements related to the use of Fluridone: Ten days prior to treatment, all property owners adjacent to the lake are provided with written notification of the treatment dates, the herbicide to be used and any water use restrictions. On the days of treatment, signs are posted around the lake. Large signs are placed at the public access sites such as boat ramps or beaches. Smaller signs are posted at 100 foot intervals around the lake. The signs will indicate that the lake has been treated under DOE permit and that the public should use precaution irrigating from the lake. The Fluridone label places no restrictions on the use of treated water for swimming, recreation, fishing and use of drinking water supplies at the rates used for milfoil control. There is an irrigation precaution of 14 days.

The following table outlines the projected costs associated with the use of Fluridone

Year	Activity	Budget
2003	Collect and process PlanTEST samples	$3,500.00
2003	Make up to four applications with fluridone aquatic herbicide based on PlanTEST data	$110,500.00
2003	Reserve for additional fluridone aquatic herbicide in case of rain events or flushing occurs. (note: it is probable that this amount will not have to be spent)	$25,000.00
2003	Monitor fluridone levels on four occasions at five	$2,900.00

	sampling sites to determine dose rates for follow up fluridone applications	
2004	Perform a survey to determine survivability of Eurasian Milfoil	$950.00
2004	Map and remove any Eurasian Milfoil found (may not need to remove any, may not have to expend these funds)	$5,000.00
2004	Perform last summer survey for Eurasian Milfoil	$950.00
2004	Map and remove any Eurasian Milfoil found (may not need to remove any, may not need to expend these funds)	$2,500.00
2005	Repeat 2004	$2,500
	TOTAL	$153,800.00

POSSIBLE COURSE OF ACTION

GA established a "milfoil advisory committee" a few months after the weed was discovered in Capitol Lake (Sept. 2001). The committee consists of representatives from Thurston County Government, The City of Olympia, The City of Tumwater, The Department of Ecology (DOE), The Department of Fish and Wildlife (WDFW), the Department of Agriculture (DOA), the Department of General Administration (GA) and the Squaxin Island Tribe. During its Dec. 2002 meeting, this committee recommended that GA explore all other options before using chemicals in the lake to control the milfoil. Furthermore, the majority of the committee members stated that if chemicals are ultimately used – that there be only one application program – to get the weeds under control. Following the initial herbicide program -- any remaining plants discovered in the lake – would be addressed via non-chemical means. As part of the follow-up program, the lake would be monitored, by an aquatic weed specialist, during the spring and summer growing seasons. This aspect is crucial to identifying and destroying milfoil plants before they fragment and multiply.

GA is willing to explore any viable option to address the milfoil infestation in Capitol Lake. However, given the fact that the weeds are in virtually every section of Capitol Lake, the available control-eradication options are limited. Some citizens have suggested that converting the lake to an estuary would resolve the milfoil situation. We do know that milfoil can tolerate brackish water, but it cannot tolerate the salinity levels found in Puget Sound. However, even if Capitol Lake were to ultimately be converted to an estuary – this could be years into the future. We anticipate that major portions of Capitol Lake will be a mass of milfoil during the summer of 2003.

Short Term Strategy

Based on the information available at this time – GA is considering a program to apply the herbicide Fluridone to Capitol Lake during the summer of 2003, to control the milfoil.

The Fluridone application will require the treatment of the entire lake. The chemical could potentially damage aquatic plants outside of the milfoil family. Thus, the application process, related to this product, is critical. As a result, GA would recommend that the application process be overseen by representatives of the Squaxin Island Tribe, the DOE, WDFW and the DOA.

Long Term Management Strategies.

Long Lake in Thurston County is very similar to Capitol Lake in size and depth. This lake was over run with Eurasian watermilfoil in the late 1980's. IN 1991, Fluridone was utilized to help eradicate this noxious weed for the system. For the next few years, diver surveys documented that eradication had been successfully achieved. Long Lake, like Capitol Lake, has a public boat ramp however. As Eurasian watermilfoil spreads from lake to lake primarily on boat trailers, there is always a threat of reintroduction of this noxious weed. After a few years of being milfoil fee, divers located a few Eurasian watermilfoil plants in Long Lake near the public boat ramp. Their vigilance allowed them to target this plant early and prevent the widespread impact this weed has on a lake system. They have been able to utilize diver hand pulling in the years since to maintain a lake free of the impacts of this noxious weed.

The two herbicide strategies presented have the potential to eliminate Eurasian watermilfoil from Capitol Lake. At a minimum, they will both reduce the population of this noxious weed to very low or negligible levels. A successful Integrated Treatment Strategy must include both ongoing survey efforts and an ability to rapidly respond when the target is Eurasian Milfoil.

It will be important to conduct reconnaissance on Capitol Lake in the years beyond the proposed work outlined here. Any discovery of this noxious weed should be mapped and targeted at once for removal.

This IAVMP should be reviewed and updated as necessary in the future. Over the years, management objectives for the lake can change. Conditions that face managers can change as well. New technologies for management of invasive species may emerge. An IAVMP should be an adaptive document that reflects the current conditions managers face.

Proposed Control Program for the Short Term

The use of fluridone aquatic herbicide is considered the best management option to eradicate the milfoil from Capitol Lake for the following reasons:

- It has a proven track record of milfoil treatment throughout Washington State
- It is a product that has good technical support
- New patented test to inform the owner of the lake how susceptible milfoil is to Fluridone concentrations
- New slow released formulations of the product

Eurasian Milfoil is widely dispersed through the middle and north basins of Capitol Lake. Plants have also been observed south of the Interstate 5 bridge. The plant communities are rapidly colonizing the lake system and will form dense canopies in the north and middle basins by the summer of 2003.

As the stated objective of the CLAMP is to eliminate this noxious weed from Capitol Lake, tools that can accomplish that objective on a cost effective basis have to be selected from the control options previously presented. An analysis of these options leaves two viable alternatives, either the herbicide 2,4-D or the herbicide fluridone. Of the two herbicides under consideration, fluridone would be the more desirable of these two options. As the infestation being targeted is lake wide, the use of this herbicide to target the infestation will be lake wide as well. The results of an effective treatment will be a degree of control that removes 95 to 100 percent of the Eurasian Milfoil in Capitol Lake.

The timing of this action is proposed for the summer of 2003. Fluridone is a herbicide that has to be maintained in contact with the target vegetation for an extended period of time. There is water flow through this system that will have some potential to dilute the herbicide requiring monitoring of herbicide levels and sequential treatments over the 6-10 week period to maintain target concentrations. These treatments should be made during the months of July and August during the historical low flow periods of the Deschutes River.

If herbicide levels can be maintained, this protocol has resulted in very near to 100 percent control of this noxious weed during the year of treatment. Historically, lakes treated under this protocol have remained milfoil free the following year. In some cases Eurasian Milfoil has been found at very low densities in the time frame of two to five years post treatment. In some cases these finds were clearly re-introductions, probably from boat trailers. In other cases it is theorized that upwelling of springs protected some of the milfoil root crowns or that milfoil re-emergence has come from seeds. In all instances where milfoil has been discovered in the years after Fluridone treatments, the populations have been very low and where effective long term strategies are in place for

monitoring and removal, these lakes remain relatively free from the impact of this noxious weed.

A fluridone treatment will be very compatible with this site. Eurasian Milfoil is documented to have a significant impact on lake ecosystems and fisheries. Capitol Lake is quite shallow and the entire 260 acres of this system are subject to dense colonization absent effective management. It is critical to consider the environmental consequences of not effectively targeting this invasive aquatic species. The use of fluridone places no restrictions on the use of the treated water with the exception of an irrigation precaution. There are no known users of the lake for irrigation. There will be no impact on the use of water during and after this treatment.

Before fluridone was approved by the US Environmental Protection Agency for application to waters of the United States, the product underwent over 17 years of testing for environmental and human health impacts. The product has been cleared by that agency and the Washington Department of Ecology based on the very low probability of impacting any component of the environment other than the target vegetation. The introduction of this herbicide is documented to have minimal direct impacts on waterfowl and wildlife associated with lake systems. There is no acute or chronic impact on fish and other invertebrates associated with the levels of this material that are allowed for application under the federal label. The actual applications rates contemplated here are well below this level. There may be short term impacts on the aquatic plant communities in this lake. This in turn may have a short term impact on fish and waterfowl use. The documented negative impact of not treating the Eurasian Milfoil is much more of a threat to the ecosystem of Capitol Lake however.

Human health risks from this proposed action are minimal to non-existent. The Washington Department of Health performed further analysis of this product including a review of the inert ingredients. They determined that Fluridone is not a carcinogen or mutagen and is not associated with reproductive or development affects in test animals. EPA determined that 150 parts per billion (ppb) is an acceptable level for potable water following Fluridone application. This level provides a 1000 fold safety factor between the no effect level in tests and the estimated human exposure via drinking water. DOH further determined that the inerts in fluridone are not of human concern at applied concentrations.

Fluridone Treatment Protocols for Capitol Lake

Fluridone aquatic herbicide is available in four formulations from two manufacturers. SePRO Corporation developed this product and markets it's formulations under the trade name Sonar. Griffin LLC produces a generic fluridone under the brand name Avast. Both SePRO and Griffin market a fluridone AS (aqueous solution). AS is a liquid formulation that is generally used in whole lake or pond treatments. There are also

three types of granular pellet formulas. Each of these has a different controlled release rate. Both SePRO and Griffin market a SPR (slow release pellet) that has a very long release rate and maintains very low concentrations in the treatment area over a six to eight week period. SePRO markets two additional pellet formulations. Sonar PR (precision release pellet) has an optimal release rate for the type of treatment contemplated for Capitol Lake. Sonar Q (quick release pellet) is used to treat ponds or water bodies where ease of application is desired. Sonar PR would be selected for this treatment.

Eurasian Milfoil is very sensitive to fluridone aquatic herbicide where many native aquatic plants have a higher tolerance for this herbicide. One of the new technologies available to aquatic plant managers is the PlanTEST biological assay. This assay can be used to define the lowest concentration of Sonar that will result in the control of Eurasian Milfoil. That defined rate becomes the objective of the application strategy. The result of the treatment insures effective control of Eurasian Milfoil and in many cases provides a margin of safety for other native aquatic plant species. The first step in the treatment protocol outlined above would be to collect Eurasian Milfoil plants from Capitol Lake and define this threshold using the PlanTEST assay method. That report would be used to develop the application rates and protocols for this application. For example, if the PlanTEST determined that the Eurasian Milfoil populations in Capitol Lake had a recommended threshold of exposure of 4 parts per billion, the application would be designed to deliver and maintain that rate.

The second step in the process would be to determine water volume and exchange in the lake. Water volume estimates are based on the surface acres multiplied by the water depths to provide the number of acre feet. The application would be made primarily in the middle and north basin of the lake. The surface area of the north basin is approximately 112 acres and contains approximately 396 acre feet of water. The middle basin is approximately 131 acres and contains approximately 524 acre feet of water. Water exchange is dependent on the flow into the lake from the Deschutes River. In the October 2000-September 2001 water year the average flow was 96 cfs in July, 85 cfs in August and 69 cfs in September. The statistics for the monthly mean over water years 1945 through 2001 are slightly higher. Those averages are 132 cfs in July, 108 cfs in August and 101 cfs in September. Given the historical information, water exchange or turn over in the lake would be approximately every 4.47 days in July, 5.47 days in August and 5.8 days in September.

Sonar PR has been used very effectively in situations where dilution or water exchange can affect the efficacy of the treatment. The pellets are designed to sink through the water column landing on the plants or the sediments. The herbicide is released from the pellet over a four to six week period with peak release occurring in about three weeks. This protects the herbicide from dilution and provides a continual source of exposure when applied properly.

The first treatment would be made in the July 1st time frame. This would take advantage of lower flow levels in the Deschutes River. Sonar PR granular would be applied to the surface acres of the middle and north basin using a granular blower at an application rate to deliver the desired concentration of Sonar as determined using PlanTEST data. In order to maintain the concentration of Sonar necessary to control Eurasian Milfoil, three additional treatments at two week intervals would be scheduled. Prior to these dates, FasTEST assays will be collected from the lake using a water sampling devise at representative locations within the target plant beds. The results of these assays will allow the applicator to adjust the target concentration in the lake by adding additional Sonar PR. This will allow for the maintenance of the desired concentration over the 6 to 10 week period necessary to control Eurasian Milfoil.

Permitting the Application of Aquatic Herbicides in Capitol Lake

DOE has administered the permit process for the application of any aquatic herbicide to Waters of the State within Washington. The agency has developed a Environmental Impact Statement for the permit program and this document has been updated over time. In recent years, the Agency developed updated risk assessments for most of the aquatic herbicides utilized in the State. Until 2001, the Agency regulated the application of aquatic herbicides under a Short Term Modification of Water Quality Standards permit.

In 2001, the US Ninth Circuit Court of Appeals rendered a decision in a lawsuit involving the mis-application of an aquatic herbicide in Oregon. The Court determined that a National Pollution Discharge Elimination System (NPDES) permit could be required when these products were used in Waters of the United States. DOE developed two general permits for the application of aquatic herbicides within Washington State in 2002. One of these permits covers applications made to target Noxious Aquatic Weeds, those on the state noxious weed list. The second of these permits covers applications made to target nuisance aquatic weeds and algae. Eurasian Milfoil is on the Washington State Noxious Weed List and the Noxious Aquatic Weed NPDES permit is the appropriate permit for the application of herbicides like Sonar to Capitol Lake if that option is selected.

This NPDES permit is a general permit and has been issued by DOE to the Washington Department of Agriculture (DOA). If a herbicide treatment is undertaken at Capitol Lake, the first step will be to obtain coverage under this general permit. The applicator or sponsor can apply for this coverage by filing a Notice of Intent with DOE. This form is available on line (http://www.ecy.wa.gov/programs/wq/pesticides/index.html) and presented in the appendix. Once this form is filed, DOA will send a letter back to the sponsor indicating coverage has been granted.

The Noxious Aquatic Weed NPDES Permit is also available online (http://www.ecy.wa.gov/programs/wq/pesticides/index.html). Once coverage has been applied for and granted, the applicator follows the direction and conditions in that document and the application can proceed. The permit contains public notification requirements to insure the public and residents around the lake understand that the application is taking place.

Monitoring and Evaluation of Plan

Fluridone treatments provide from 95 to 100 percent control of Eurasian Milfoil in the year of treatment when properly implemented. Approximately 90 days after the initial fluridone application is made, the target vegetation should be gone from the water column. A survey should be performed to map the conditions present at that time. A boat equipped with DGPS equipment should be used to traverse the lake on transect lines spaced to provide complete visual coverage of the lake. At a number of points along these transects, the boat should stop and attempt to collect aquatic plant samples. A throw rake can be used for this. The methodology would be to collect and store a GPS point for the sampling station. A rake with a 50 foot rope should be thrown three times in various directions from the boat and recovered. The observer would note the presence (or absence) of aquatic vegetation and record the species present. If the DGPS receiver has data logging capabilities, an attribute should be stored for the occurrence of each species and a density rating established. DOE has published protocols for monitoring aquatic plant communities and this technique is described in further detail in that document (Parsons, 2001). This information would transfer to GIS mapping software to build a map of conditions present. This data would be used to document the success of the control method and make decisions regarding the need for additional control options.

Generally in the year after treatment, the lake remains milfoil free. As this plant spreads by fragmentation, it can be re-introduced at any time by a boat coming from an infested lake. There needs to be an ongoing monitoring effort that monitors aquatic vegetation in the system and detects any reoccurrence of this or other noxious submerged aquatic weeds. The same protocols described above should be implemented in the summer of subsequent years. Each survey should have two main objectives; to detect any new Eurasian Milfoil present and to document the recovery of native aquatic plants that are removed by heavy Eurasian Milfoil presence. The transect boat survey is probably the most effective method for detecting Eurasian Milfoil in Capitol Lake. Water clarity is such that diver surveys would be prohibitively expensive and would produce marginally better results. Transects should be spaced so that complete visual coverage of the lake is assured. A GPS unit could be used to track the progress of the boat and insure complete coverage. The point survey for aquatic plant species and frequency should be duplicated each year as well. The boat would navigate back to the GPS points

used in the previous year's efforts and collection protocols would be duplicated. This information would provide an update on the plant conditions and document recovery of native aquatic plants.

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Appendix A

Public Involvement

1. **Minutes of Steering Committee Meetings**

2. **Public input from Public Meetings**

3. **Invitations to Public Meetings and other documentation**

From: Schilperoort, Dave (GA) [Dschilp@GA.WA.GOV]
Sent: Friday, December 13, 2002 8:17 AM
To: 'mstevie@squaxin.nsn.us'; 'carneddc@dfw.wa.gov';
'wlobaugh@ci.tumwater.wa.us'; 'langanr@co.thurston.wa.us';
'khan461@ecy.wa.gov'; 'terry@aquatechnex.com'; 'jerskin@ga.wa.gove';
'wswheeler@agr.wa.gov'; 'edobey@ci.olympia.wa.us';
'bachmej@co.thurston.wa.us'
Subject: Summary of the Milfoil Advisory Committee Meeting - 12 - 12 -
02

Aquatechnex will have a draft of the Integrated Vegetation Management Plan for Capitol Lake by the end of December. GA will distribute this document to members of this committee for review and comment.

The decision was reached that any efforts that GA will make will be to CONTROL milfoil - not eradicate it.

There has been a great deal of discussion, in the media, the community and on the Capitol Lake Adaptive Management Plan Committee regarding the possibility of returning Capitol Lake to a salt water estuary. Should this transition ultimately occur - it would be many years into the future. There are significant economic, environmental and community impacts that would have to be researched before this option could be considered. The impact that such a transition would have on the milfoil in Capitol Lake is uncertain. We do know that milfoil can survive and thrive in brackish water conditions. Thus, for these reasons, we cannot look for the creation of a salt water estuary to resolve our current milfoil problems.

The harvesting of milfoil was also discussed as an alternative. However, this process would mean that GA would accept the fact that milfoil would take over the entire lake. This is not the direction that GA desires to proceed.

Three different chemical applications were reviewed:

* AquaKleen
* Sonar
* Renovate

The advantages and disadvantages of all of these were discussed.

There is already a great deal of community opposition to the use of any product in the lake that contains 2 - 4 - D . This is the AquaKleen. However, of the three chemical applications - this product would be the most effective and economical at controlling the milfoil. The milfoil could be treated for approximately $550 per acre. The entire lake would not have to be treated - only the areas where milfoil is present.

Sonar would require treating the entire lake. It also requires more "contact time" with the plants. Can this "contact time" be secured in the Capitol Lake environment? Cost extimate would be $100,000.

Renovate has some definite potential for use in the lake. However, the State of Washington has yet to approve this chemical. Some members of the committee expressed concern regarding using this product - due to the fact that it is new and its impacts not fully known. Others on the committee said that this product has been studied for years.

Terry McNabb will send the "labels" of these three chemicals to me and I will forward them on to the committee members.

The drawdown of the lake and back-flush with salt water was also discussed. This process was last performed in 1997. The Dept. of Ecology is opposed to this process - due to the fact that it will not kill the milfoil - but it will kill many of the beneficial plants currently in the lake environment. GA received special permission from the state regulatory agencies to lower the lake this past summer - due to the need to complete some specific construction work related to the Deschutes Parkway. GA attempted to physically dig some of the milfoil plants at the time when the lake was lowered. However, the inability to adequately maintain the low water level in the lake and the depth of the mucky sediment - resulted in the inability to complete this task.

The following represents the position of the member entities:

* The City of Olympia - Use chemicals only as a last resort -- the use of 2 - 4 - D would be a problem
* Thurston County - Use chemicals only as a last resort - should chemicals be used -- definitely don't plan on using them as a long term - on-going - solution.
* Squaxin Tribe - Don't rush into this. Go slow, perform the necessary research. Secure the services of an aquatic botonist. Look for all other available alternatives. Don't jump to quickly into the chemical alternatives.
* The City of Tumwater - Their position will be forthcoming.
* State Dept. of Agriculture - no comment
* State Dept. of Ecology - not present
* State Dept. of Fish & Wildlife - not present

GA wants to do what is "right" for the lake, for the environment and for the citizens of our State. GA will be developing a communication strategy that will involve public meetings and work with the media on this topic. The committee will have the opportunity to review this strategy before it is made public. GA would also hope that the members of this committee could also participate in the public meetings.

If I have incorrectly interpreted what I heard at the meeting or left an element out that you would like to have incorporated in these minutes - please contact me.

Thank you for your participation.

The following people were in attendance:

* Larry Kessel --- GA Dept.
* Jim Erskine --- GA Dept.
* Wendy Sue Wheeler ---- WSDA
* Kathy Hamel - DOE
* Bob Barnard ---- WDFW
* Terry McNabb ---- AquaTechnex
* Emmett Dobey ---- City of Olympia
* Dave Schilperoort ---- GA

The Draft Capitol Lake Integrated Aquatic Vegetation Management Plan was reviewed.

Kathy Hamel stated that additions need to be made to the Plan to allow it to meet DOE's minimum standards. Samples of additional elements that need to be incorporated include:

* Deschutes River Watershed Information
* Deschutes River water flow information
* Documentation of the effects that Sonar has on fish, wildlife, people etc.
* Utilization of Long Lake Sonar treatment as an example of product effectiveness
* Sonar toxicity study
* Sonar label
* Address questions that the public might ask --- in a Question and Answer format - Frequently Asked Questions.

Terry will address these and other questions directly with DOE personnel. Terry anticipates that he can incorporated the necessary elements to DOE's satisfaction within one month (April 19th, 2003) At that time the draft plan would again be submitted to GA for their review. The Plan would be forwarded to the members of the Milfoil Advisory Committee.

The recommendation of the Aquatic Vegetation Management Plan is the use of Sonar in Capitol Lake. The Committee had significant discussion regarding this herbicide. The following are some of the comments:

* The City of Olympia is opposed to the use of any herbicide unless there is adequate opportunity for the public to comment on the Plan and on the use of Sonar.
* What is the documented impacts of Sonar on fish, wildlife and people?
* The entire lake - all 260 acres - will need to be treated. It is not known if milfoil is present in Percival Cove - This will need to be investigated. It is also not know if milfoil is present in the Deschutes River above Tumwater Falls.
* The application of the herbicide would likely occur during a 6 week

period from July 1 - Aug. 15. During this time there could be multiple applications of Sonar to maintain the appropriate herbicide level in the lake

* GA plans to conduct two public meetings - during the month of May - to allow the public the opportunity to comment on the Plan and on the application of Sonar to the lake. The dates of the public meetings have not been scheduled.

Other comments made during the meeting:

* Contact time is absolutely crucial to the success of the Sonar. This is why the river flow data through the lake during the summer months is important
* The suggestion was made to monitor the river flows during this summer and try to gauge if the sonar would be effective. GA has many years of historic data regarding river flows. Each summer is different - wet summer vs a dry summer. We would hope for a dry summer for an effective application program of Sonar.
* GA needs to be committed to the Sonar application -- go all the way or not at all
* The question was raised about closing the Capitol Lake dam to help insure the herbicides contact time with the milfoil.
* Discussion about the various herbicide options - AquaKleen, Sonar and Renovate. Renovate contains the product garlon - garlon is negatively viewed by some entities. AquaKleen contain the product 2 4-D that also has negative public connotations.
* GA has contacted the following individuals regarding the use of Sonar in Capitol Lake

Joan Hardy - WA St. Dept. of Health --- A toxicologist - with extensive experience with aquatic herbicides

PhD. Mark Sytsma - Portland State Uni. - a University professor with extensive experience on the ecological impacts of herbicides.

Shaun Hyde --- The SePro product representative - SePro is the company that produces Sonar.

All of these people have expressed a willingness to participate in the public meetings. They all believe that, if properly applied --- Sonar is a definite option to addressing the milfoil situation in Capitol Lake.

Determination:

The Integrated Aquatic Vegetation Management Plan will be presented to the CLAMP on May 1, 2003. The two public meeting will be scheduled during the month of May. If GA ultimately decides to proceed with the application program of Sonar during the summer of 2003 - the latest this decision can be made is June 1, 2003.

Committee Members: If I inadvertently left out something that you would want incorporated in these minutes - please contact me ASAP. Also, to those committee members who could not attend the meeting..... if you would like to submit your comments about the IAVMP - please get them to me by no later than Monday, March 24th, 2003.

From: Schilperoort, Dave (GA) [Dschilp@GA.WA.GOV]
Sent: Tuesday, April 22, 2003 7:21 AM
To: 'bachmej@co.thurston.wa.us'; 'carneddc@dfw.wa.gov';
'edobey@ci.olympia.wa.us'; 'Hamel, Kathy'; 'langanr@co.thurston.wa.us';
'Michelle Stevie'; 'Rick Johnson'; 'RMIWA@aol.com'; 'Steve Morrison';
'Terry McNabb'; 'wlobaugh@ci.tumwater.wa.us'; 'lkessel@ospi.wednet.edu';
Erskine, Jim (GA); Stepelton, Andre (GA)
Subject: The public "open house" on the Integrated Aquatic Vegetation
Management Plan - Milfoil - May 15th, 2003

The GA Department has scheduled a public "open house" for the Capitol Lake Draft Integrated Aquatic Vegetation Management Plan (DIAVMP)- Milfoil, for May 15th, 2003, 6:30 p.m. - 8:30 p.m. in the auditorium of the GA Building on the grounds of the Washington State Capitol Campus.

The DIAVMP recommends that GA utilize the herbicide Sonar to attack the milfoil in Capitol Lake. Following the Sonar application program - GA would monitor the lake and would address future milfoil plant encounters with manual removal techniques.

The open house will provide the public the opportunity to comment on the DIAVMP. The format of the meeting will allow the public to visit with a number of individuals who are qualified to address a variety of questions and concerns related to milfoil and the Sonar product. Thus far, the following individuals and agencies have agreed to "staff" a table and provide verbal and visual educational materials to the public.

* Joan Hardy - WA St. Dept. of Health
* Shaun Hyde - SePRO Corporation (the company that produces Sonar)
* PhD. Mark Sytsma - Doctorate degree in ecology from UC Davis, Director of the Center for Lakes and Reservoirs at Portland State University.
* Terry McNabb - AquaTechnex
* Kathy Hammel - WA St. Dept. of Ecology - manages the statewide Aquatic Weeds Management Program
* Kathy Wykoff - Past President of the Long Lake Property Owners Assoc. (this organization successfully applied Sonar to Long Lake to address the milfoil in that body of water)
* Dana Coggons - WA St. Noxious Weed Board.

I am still awaiting word from others to join those listed above.

GA is contacting all of the property owners who have frontage on the lake and the adjacent Olympia neighborhood associations to attend the May 15 meeting. We are also contacting the media and a list of individuals who have been asked to be kept informed about our milfoil plans. GA is placing the DIAVMP on the GA home page along with a questionnaire (copy attached). The questionnaire and copies of the DIAVMP will also be available at the May 15th meeting. We also are planning to provide citizens the opportunity to have their comments, regarding the plan, recorded. The comments that are received will be reviewed by GA before any final decision is made on the Sonar application. GA will need to make the final determination early in June - if a summer 2003 application of Sonar is scheduled.

Should you have any questions regarding the May 15th open house --- please contact me. I am hopeful that you can attend and be part of this process. Thank you for your involvement on the Milfoil Advisory Committee. If you have any

ideas regarding how we can secure public comment regarding the DIAVMP - please let me know.

<<Milfoil questionnaire - May 15, 2003.doc>> <<Final Draft IAVMP Rev_1_.pdf>>

Joe Cole, 6127 Thornbury Court SE Lacey, SE 98503, said he has researched Sonar for three years and was involved in a lawsuit against Thurston County when the county wanted to apply Sonar to Long Lake in 1991. He noted the litigation was tied up in court for several years with Judge McPhee ruling - "Thurston County had the right to be wrong" and not that what they were doing was right.

Capitol Lake has it own special set of problems. Everything going into Capitol Lake eventually runs into Budd Inlet. Budd Inlet was home to Cascade Pole, a creosote manufacturer. In the course of making creosote and other wood products, they used a treatment process that created toxins like dioxin, arsenic, and cyanide. Cascade Pole dumped mercury in the bay and a whole host of 100 or more chemicals that could be traced to that area.

Science has not done any research on the synergistic consequences of what fluridone and other chemicals would do if mixed together. We have no idea what would happen. In Warwick, New York, officials stopped the use of fluridone for this very reason because they had no idea what the synergistic affects would be on the chemicals known to be in their lake. Fluridone is the active ingredient in Sonar, the product proposed to be used in Capitol Lake.

Western Washington University did a study last year on Campbell Lake and Lake Eerie for the Sammish Indian Tribe and found that using fluridone in both lakes almost doubled the amount of phosphorous and nitrates in the lakes, which is very dangerous to fish, the turbidity of the water, and dissolved oxygen. We need more research. It would be insane to use these chemicals in a place where we already have more phosphorous loading than is safe for the fish environment now. Adding more will only make it substantially worse.

The next problem is that the Department of General Administration (GA) has not put the project out to bid. There are other eminently qualified chemical applicators that can do the job. There are also other chemicals that come under a different name that are fluridone or Sonar and are sold for several hundred dollars less. But GA is not giving an opportunity for these other qualified applicators to even submit a bid. That is wrong and telling us stories that this is very scientifically intricate is not going to wash. There are too many people, like Allied Aquatics, who have been doing this business for over 30 years and are eminently qualified to at least put in a bid and do the same kind of job if they are the low bidder. The public is not being well served by the way the process is going.

Larry Dudley, 1306 Boone Street SE, Lacey, 98503, said he has lived in Olympia for the most part of his life (since kindergarten) and used to live on the westside of Olympia. He watched how Cascade Pole destroyed the waters and how they handled Capitol Lake. Adding more chemicals to the chemical problem that exists does not make any sense. It would be easier to flush out the lake with saltwater and let Mother Nature take care of the problem than throw in more chemicals.

Fred Robischon, 3206 Long Lake Drive, Lacey 98503, said he is for the use of Sonar in the treatment of Capitol Lake. He lives on Long Lake and it was successfully treated with Sonar. It saved the lake, basically. For the most part it has been eradicated. When he moved to Long Lake in 1991 he couldn't put a boat in the water because milfoil was so thick.

Colleen Wasner, 1325 10th Avenue SE, Olympia, 98501, stated she would provide history about who she is. She is not a scientist nor with the state but her job for 15 years before moving to Olympia was on Wall Street in New York at the law firm of Sullivan and Cromwell at 125 Broad Street and at 250 Park Avenue. This law firm's clients included manufacturers of the chemicals that are being considered to treat Capitol Lake.

She also worked at Cahill Gordon in New York as well. They also had large chemical manufacturers as their clients. Her job included "Corporate owned and government operated" and "Government owned and Corporate operated" facilities. Each facility engaged in the use of chemicals such as fluridone. Her job was to read classified documents regarding the effects of these chemicals upon the environment and upon citizens. One case in particular involved pesticide in lakes where children swam. They died from the experience and this was covered up and no one was to know.

Some of these companies have nefarious histories and their chemicals have been used during WW II to kill Jews and other people in Europe. I.G. Farben is one of those companies. They make Bayer aspirin and Zyklon B, which was used to kill Jews.

Ms. Wasner referred to an article from the *Tacoma News Tribune,* Wednesday, May 8, 2002 with the headline, "Dead Orca was loaded with Toxin." The headline – "Off the Charts High PCB Levels Raise Red Flag About Pollution in West Coast Marine Waters" stated, "An Orca found dead on an Olympic Peninsula beach in January was so full of contaminants, polychlorinated biphenyls, that the levels were off the charts. The 22-foot long female basically knocked our instruments off, said Gina Latalo, a researcher for the National Marine Fishery Service. The instruments, once recalibrated, found concentrations of about 1,000 parts PCBs per million parts of fat, dozens of times higher than those known to affect the growth, reproduction, and immune systems of harbor seals. The animal had contaminants we did not expect, said John Stine, Director of the Environmental Conservation Division of NMFS's Northwest Fisheries Science Center. It is unclear whether the dead Orca had reproduced and with levels that high we wonder if she was able to produce, Latalo said. Puget Sound is a PCB hot spot in the regional environment. This is what Ross is saying, and Ross is a marine mammal toxicologist with the Canadian Government Institute of Ocean Sciences in Sidney, BC."

Ms. Wasner said she has lots of articles that are getting to the same thing, which is, that we are completely over toxicizied. We are purchasing chemicals from manufacturers who have no interest in us or in the environment. Their only interest is in making more money. She said she just arrived back from Scandinavian at the beginning of the month and no one there uses pesticide. Denmark is considered a pesticide free country. They are healthier too!

Douglas Dorling, representing a firm called Northwest Aquatic Eco Systems, said he has a number of concerns directed at this project. The first being the selection process GA used in selecting the contractor to perform this task. GA has gone out to a small works roster for the selection process, basically eliminating a large majority of the other potential consultants for this project. This small pool that GA is working with of perspective consultants has resulted in only one contractor or consultant, AquaTechnex,

having any viable or long-term input into the project. They have been the company involved with surveying the lake. They have been involved in writing the plan and also recommending the materials to be used in the project.

That brings me to my second point of contention. Throughout the entire draft plan that was written by AquaTechnex, they make reference to the preferred plan as an application of Sonar, which is a fluridone complex. There are other fluridone products out on the market that are less expensive than Sonar currently is. And yet, in the entire report, there is no mention of the other supplier of other fluridone products, which is the Griffith Company, which produces a fluridone product called Evast. The shortfall of just mentioning Sonar may well be attributed to the fact that in the past and possibly currently, the owner of AquaTechnex has been the sole representative and dealer of Sonar in the Pacific Northwest. The company that manufactures Sonar; Cepro, has had an incentive program whereby those applicators that use their material are reimbursed either monetarily or they are given trips or vacations based on the amount of material they have sold. We feel this is inappropriate for a dealer or somebody that was or still may be a dealer of this particular product, to be the writer of the report recommending materials that he may receive financial benefit from. The other problem we have with this particular management group is the fact that the Cepro people are being represented by a gentleman that was employed by one of the owners of AquaTechnex. So not only do we have the dealer in the area writing the report, we also have the chemical manufacturer representative involved in the project who is also a past employee of the owner of AquaTechnex.

The other problem is that the owner of AquaTechnex; Terry McNabb, formed a business partnership relationship with Cepro, forming a company by the name of Remtrix, which is also involved in surveying, monitoring, and developing lake management plans. So, there are a number of channels where Cepro is at least being selected above other manufacturers that really have had no chance at all to represent themselves to this project. GA, in their report said they are willing to listen to every possible alternative but we have problems with that because of the fact that we have tried to talk to the GA office and have been unsuccessful in sitting down and talking about any type of business relationship. Again, we feel the report that was written should have been undertaken by somebody that was not involved in the possible manufacture of this material. There are numerous references in the report and there is also mention of material that used to be called Aqua Clean. There are numerous other formulas of the material that are not identified in the report and there is also now a liquid formula of 2-4-D that is not identified in the report. Anyone reading the report would assume the only products available to control milfoil on Capitol Lake are Sonar and Aqua Clean. That is incorrect and needs to be corrected. Thank you.

Stanley Stahl, 120 State Avenue NE, PMD 232, Olympia, 98501, said he doesn't know much about this subject but has some idea that milfoil is causing a major problem for recreational activities on certain lakes. He doesn't think that is the case with Capitol Lake. He knows there are some recreational activities, but overall, the lake is a reflective surface for showing off the Capitol. His personal opinion is that at least part of it should go back to an estuary. In any case, it is his understanding there have not been any definitive results showing that milfoil is a problem if left alone.

In terms of using a fluridone product, he went to the State Department of Health and asked he if could take a sip from a glass of water that contained 14,000 times the amount that is being recommended to be applied to the lake. The person kind of laughed but he doubts if anybody would take even half of that dose if it was 7,000 times, which would be very safe according to the statement. If we had a glass of water for two parts per billion at 7,000 times that, (whatever that comes too) I don't think there would be anybody in the room that would drink that water. He knows water in the lake is not meant for drinking but it is a general philosophy of his that whether you put poison on the lawns that eventually goes to the aquifers and poisons potable water or you put poison in your body for whatever reason or garden fertilizers and herbicides they eventually get into the water table. Just in general, any of these poisons (in this case, it is a fluridone derivative), is not good for people's health. Looking at it superficially (up at the upper crust) is not where we want to see it really happen. If it goes into the water supply, or in this case, he doesn't think it could find its way down to the deep aquifers for the artesian waters that we have here, but it does go in and out with the tide so it is going out to marine life. I have an objection, as much as it is diluted in the ocean, to this method of doing this with a plant that has not been shown to cause a problem here.

There are two companies that are making a large profit, or will make a large profit, in this case from selling and applying the product. So, there is a vested interest on their part. He said he can't believe anything from the Department of Health about the safety of 14,000 times the dose they want to use. Thank you.

Jerry Dierker, 1720 Bigelow Street NE Olympia 98506, said he has given a copy of his comments to General Administration employee Jim Erskine. He wanted it noted on the record that he has submitted comments to Mr. Erskine that are 10 pages long. He will also submit another set of comments before the end of the public comment period which he believes ends on May 29.

Thomas Nogler, 1325 10th Avenue SE Olympia, 98502, said he would like to register opposition to the use of fluridone to control Eurasian milfoil in Capitol Lake. He believes there are alternative methods for the management of Eurasian milfoil and believes the use of the term "elimination" is a misnomer and to think that an evasive weed, such as Eurasian milfoil, can be eliminated is an indication of an illusion that exists in GA. The influence of the chemical company producers of such products will make enormous profits in their distribution of herbicides and pesticides. Furthermore, he feels the use of pesticides and herbicides should be eliminated from society and it is an area that we can improve environmental quality by elimination of such toxic substances. He favors drainage of Capitol Lake and the creation of a natural estuary as was the river bottom, originally. He believes this would help in the restoration of an area that has been consistently polluted by upstream activity and by other toxic runoff into the river that has ruined the lake for all practical purposes and as its simple aesthetic quality as a pond below the Capitol. He will continue to work on his concerns and hopes the authorities at GA will take his concerns into account.

Jeffrey Denison, PO Box 922, Olympia, 98507, said he understood the half life is 21 days for this product. He would like the public to be provided with a complete analysis of every compound that fluridone breaks down into and the safety profiles for each of those compounds in isolation and in combination with the pollutants that are presently in the lake now for potential reactions with those

compounds. He said he understands Capitol Lake is already heavily polluted with polychlorophenol from the creosote used on telephone poles that is toxic in parts per billion. We need to know what the effects are in combination and in isolation to wildlife and native plants and what the potential human health hazards are.

Finally, it is not the public's responsibility to prove there is danger with these compounds. It is the State's responsibility to prove these are safe and that state employees are public servants. It's their duty to protect the public.

He requested a public hearing with the presence of chemists, not simply a sales representative. This is not satisfactory. The representative just informed him fluridone breaks down in a 21-day period. That is utterly absurd. Thank you.

Sue Danver, 7106 Foothill Loop SW Olympia, 98512, said she finds taking comments in the back room very odd and would prefer to have a public comment period where it is recorded in front of other people so that information shared is heard by all. She would like a public hearing on this eventually. It's an important decision. The whole process is bizarre and she is confused by it, and doesn't know what to say when. Is this my only opportunity to talk? She didn't expect this to be a hearing. She had a conversation with Jim Erskine and he did not tell her there would be an opportunity to make a recorded comment. He told her it was an open house.

She feels this should be an open bid process and that she seconds Jerry Dierker's comments about synergistic effects of chemicals. She does know that most chemicals do not have studies for children and that children are impacted by chemicals more so than adults. In the past year, the Journal of Environmental Health Perspectives is beginning to recognize that very minute levels of toxic materials are unexplainably toxic to human beings. It has always been the assumption in all EPA studies that the larger the dose the more toxic the dose. It has been coming out in the last few years that unexplainably, like a bell curve, large amounts and small amounts are unexplainably toxic and EPA has not looked at this.

She said she would like to see DOE or GA to pressure DOE to reconsider allowing the flushing of the lake by tidal waters. She would like an explanation by DOE since they say the saltwater will kill native vegetation. Well, so will Sonar! That explanation is not adequate for her.

She would like an open bid process for the granting of this contract or job. It doesn't make sense to her that there was no milfoil prior to the back flushing and now there is milfoil when flushing has not occurred. Maybe it is just circumstance the milfoil came in afterward, but maybe not. Maybe there is something about the salinity of the water that stopped milfoil. She said she is most concerned about the growing understanding that pesticides are accumulating. They say Sonar is not bio-cumulative. But, it does impact us in more ways by causing cancer.

In closing, she would like a public hearing process and asked as Jeff Dickison of the Squaxin Island Tribe did, why the decision to be made by the CLAMP Committee is now being made by General Administration. Why has this changed?

Barbara Bradshaw, 2817 Briarwood Court SE, Olympia 98501, said she is really against using any type of chemical because of problems that could happen afterwards since there are already many chemicals in the lake and there could be a fatal combination of different chemicals. It could make it a lot worse and she thinks that we can't even imagine that this happened in the past. She wants to remind people to think about the pill people took when they were pregnant for nausea. It was thoroughly tested on animals and deemed safe. However, bad things happened and you can see young adults with hands grown on their shoulders. The pill was supposed to be safe. It was supposed to be safe and was tested thoroughly. Even if Sonar is tested on animals or mammals we do not know what it really does. The average American has a much higher level of dioxin in the bones than the average German. I think in fact, to most Europeans in general. She lives here and doesn't want to pay the price for more toxic pollution. She said there is already enough and it really makes her sad. She is sure there are alternatives to chemicals and if need be, there may need to be more research. But, there are always alternatives. She would like to find a different solution. So many people have cancer and there is supposedly good medicine that should take care of things but too many people are dying and having health problems.

Angela Storey, Washington Toxics Coalition, Seattle, WA (206) 632-1545 Ext. 11, said she is the pesticide organizer for the organization. Her comments pertain to a variety of issues. The problem with the plan is that it is not integrated. To call it an "Integrated Aquatic Vegetation Management Plan" one would assume it would involve more than just one mode of action. Using just a fluridone product to deal with the milfoil problem is not integration of actions, she believes.

This also leads to her second point, which is; just trying chemical harvesting for one summer is not a very comprehensive study effort. She spoke to Terry with AquaTechnex that has been hired to do this, and he says they actually do a variety of things to control milfoil besides just doing applications. At Silver Lake in Everett, they have done entire diver dredging of the lake that took about five years. The issue with Capitol Lake is an erroneous goal which is to try and achieve 100% eradication of milfoil instead of trying to deal with managing milfoil and getting it down to a level that can be managed. This is what happened at Long Lake. They are not trying to eradicate it; they are trying to manage it because they know it is so difficult, if not impossible, to ever entirely eradicate a non-native evasive species- ever! That's why it is non-native and evasive – because it is really good at growing under terrible circumstances.

Then there are concerns about the use of fluridone (Sonar) and its impact to native plants. She knows milfoil is choking out native vegetation. But, if there is only going to be an application of Sonar, which is known to kill native vegetation we might as well flush it with saltwater because there would be no harm if both options result in the same outcome. It would also reduce the unknown risks and impacts from the chemicals. There have been some studies from Texas looking at stressors to fish of removing all vegetation. This is what happens when using a product like Sonar at lower levels, which are supposed to be more selective. However, you can never entirely predict if there will be impacts on the ecosystem – the habitat. So when fish are stressed by having their habitat changed and toxins are in the water, this makes a huge impact on their ability to survive.

Another thing is data gaps in the information presented about fluridone. There is no information about the inert ingredients or the synergists or the impacts to immune-compromised humans that are the most vulnerable population. The other thing of concern is the breakdown products of fluridone. There have been some studies that suggested that one of the breakdown products can have some terrible impacts to humans. These are some incredibly serious things that should be looked at, and if there is a possibility of have reproductive damage in humans from the breakdown products of fluridone, then that would be a red flag.

Persistence in soil is a huge problem and it is known fluridone persists in soil, including the bottom of lakes for a very long time. The persistence in hydro soil with the half-life of 90 days is unpredictable and can range up to five years. This is just for the half-life of the product. There have been some studies that have shown plants taking fluridone in its roots have prolonged impacts on growth. Native vegetation not only is impacted the first year, but also the second year when it undergoes its growth cycle. The plants have stunted growth or are unable to grow, which is a serious impact in an area where native vegetation is so important.

This is clearly a very complicated issue and something that requires more of a discussion and an integrated approach that needs to be a public process. Sitting in a little room and leaving comments is not much of a public process. A public process is a hearing where the public is invited to hear about and talk about the process. Thank you.

Prepared by: Valerie Gow, Recording Secretary
Puget Sound Meeting Services

-End-

Milfoil questionnaire

The following is a summary of the milfoil questionnaire results and other public comments as of May 20, 2003. These results do not include recorded public comments taken from the pubic meeting on May 15. General Administration will take public comment until Friday, May 30, 2003.

- **Total hardcopy and online surveys completed to date: 8**

Questionnaire

Eurasian Water Milfoil is a noxious aquatic weed. How much information do you know about the impacts that milfoil could have on the aquatic environment in Capitol Lake?

- None: -
- Some: 3
- Extensive Amount: 5

What has been the source of your information?

Web sites and other publications, Thurston Co. Weed Board, **research for a court case on use of Sonar in Long Lake.**

Which of the following three (3) options would you most prefer? Please choose one.

- Do nothing to the milfoil in Capitol Lake: -
- Eradicate the milfoil: 4
- Manage, but not eradicate the milfoil: 3

  **One no preference.*

The vegetation management plan considers the use of the herbicide fluridone (Sonar) to eradicate the milfoil in Capitol Lake. Would you agree or disagree with the possible use of Sonar in Capitol Lake.

- Agree: 2
- Disagree: 6
- Don't know:

Please explain your position in the space below.

- "Non-selective herbicide with residuals…Dead milfoil will further degrade water quality."
- "Sonar will eliminate the weed in a safe way."

- "RE: Sonar, What will happen during plant die off? Will the dissolved oxygen levels be so low that fish will be killed?..."
- "Use of any toxic substance will pose a risk to human health and to the ecosystem."
- "Should restore estuary."
- "The experts who were present are satisfied that it is safe."
- "Capitol Lake has been filled with saltwater to control weeds…Fill and kill the weeds and save $50,000."
- "Sonar, like all pesticides has hazardous waste as inert ingredients… eradicate milfoil, it will hurt 'natural' vegetation and increase the 'nutrient load'…"

Would you expand or add anything to the proposed management plan? If yes, please explain in the comment box below this question.

- Yes: **5**
- No:
- No response: **3**

Please explain how you would incorporate or expand the plan.

- "Estuary habitat restoration…"
- "Non-toxic controls, such as divers and bottom barriers, need to be more fully explored."
- "Mechanical processes."
- "Public input"
- "Mechanical controls and diver removal in combination with a 3 week draining of the lake..."

Please use the space below to provide any other comments you would like to make regarding the management plan.

- "Restoration of saltwater intrusion…"
- "Why does the committee rely only on the internet for communication about this very important topic?"
- "Setting unrealistic goals, such as 100% eradication of milfoil in Capitol Lake doesn't make sense. Especially with other non-toxic options and larger questions, such as removing the dam."
- "We need to be looking at alternatives, so we can manage adaptively. What about Lake Venice Disease? What about backflushing?..."
- "A 3 week draining of the lake …allowing saltwater to inundate the lake area will eliminate the milfoil at very little cost to the public."

If you would like to be placed on a GA mailing list so we can keep you informed about the milfoil in Capitol Lake, please complete the following:

Appendix B

Watershed and Water Body Information

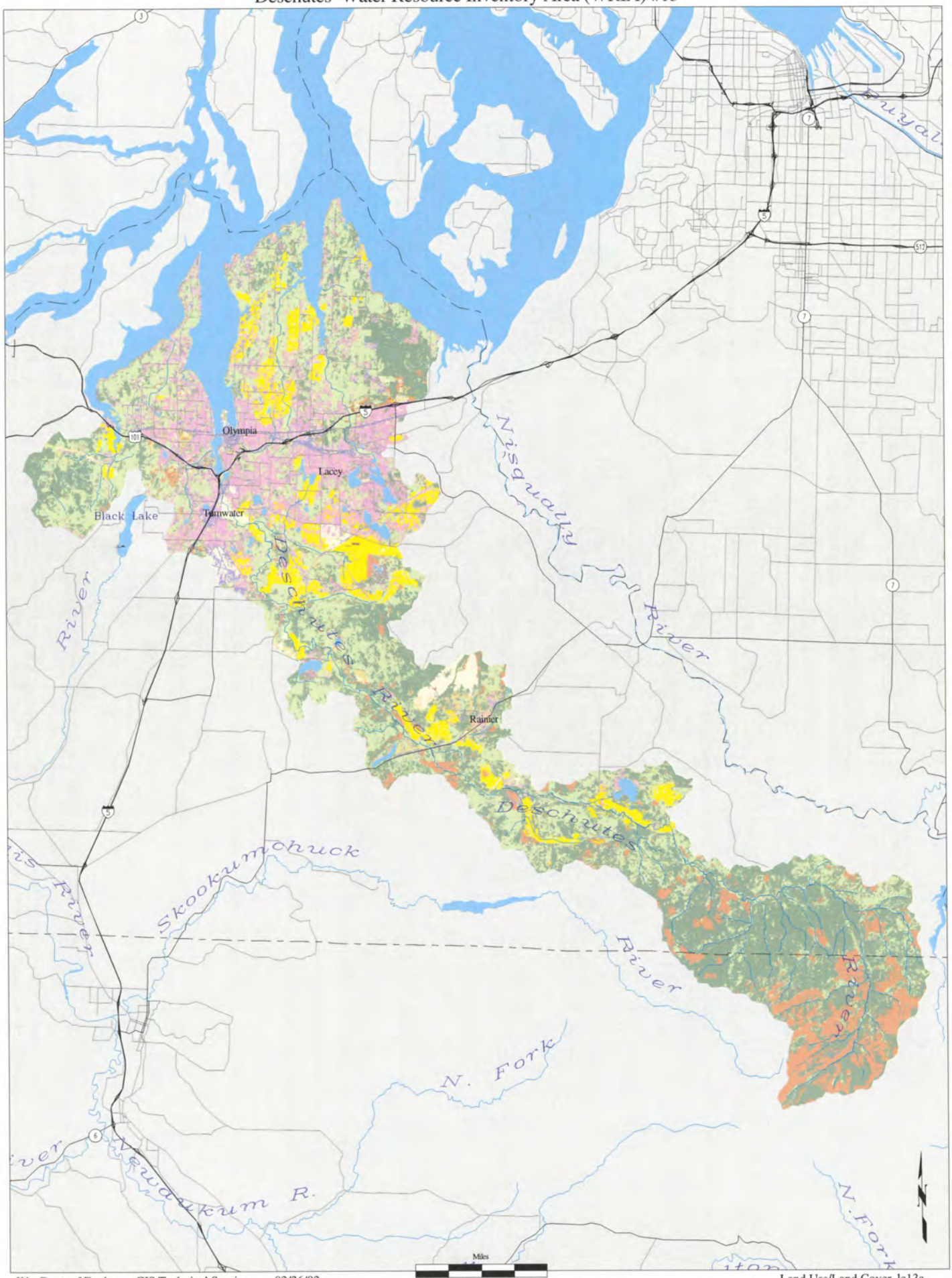
1. **Watershed Map**
2. **Watershed Map with Land Use Classifications**
3. **Capitol Lake Map with Aquatic Plant Communities**
4. **Capitol Lake Contour Map**
5. **WRIA 13 Deschutes River Basin Summary**
6. **303d Map and listings for WRIA 13**
7. **Stream Gauge Data for Deschutes River near Capitol Lake**

Deschutes Water Resource Inventory Area (WRIA) #13 Elevation Model

Wa. Dept. of Ecology, GIS Technical Services 07/25/02

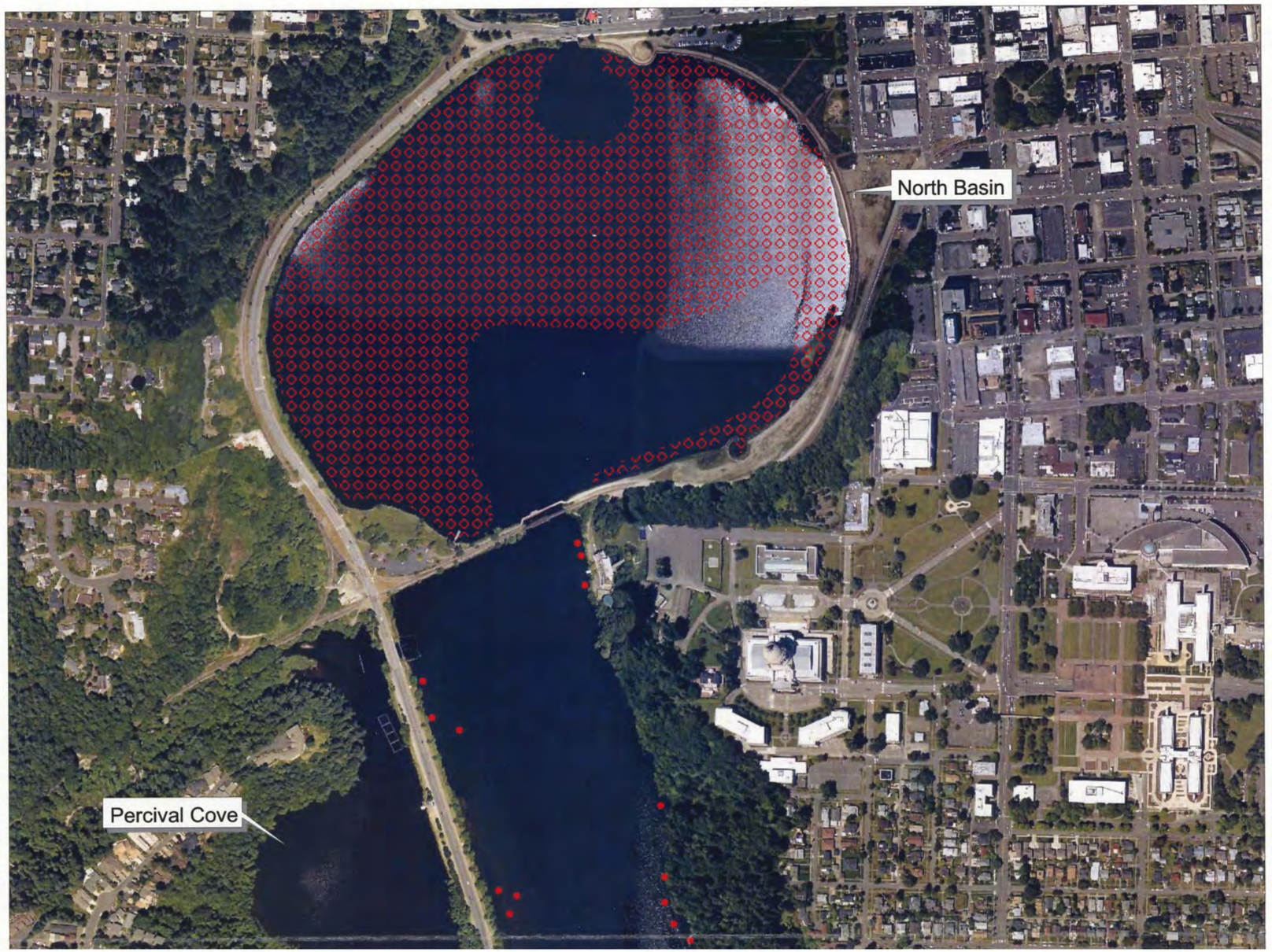
WRIA County 10-meter resolution DEM, topo13

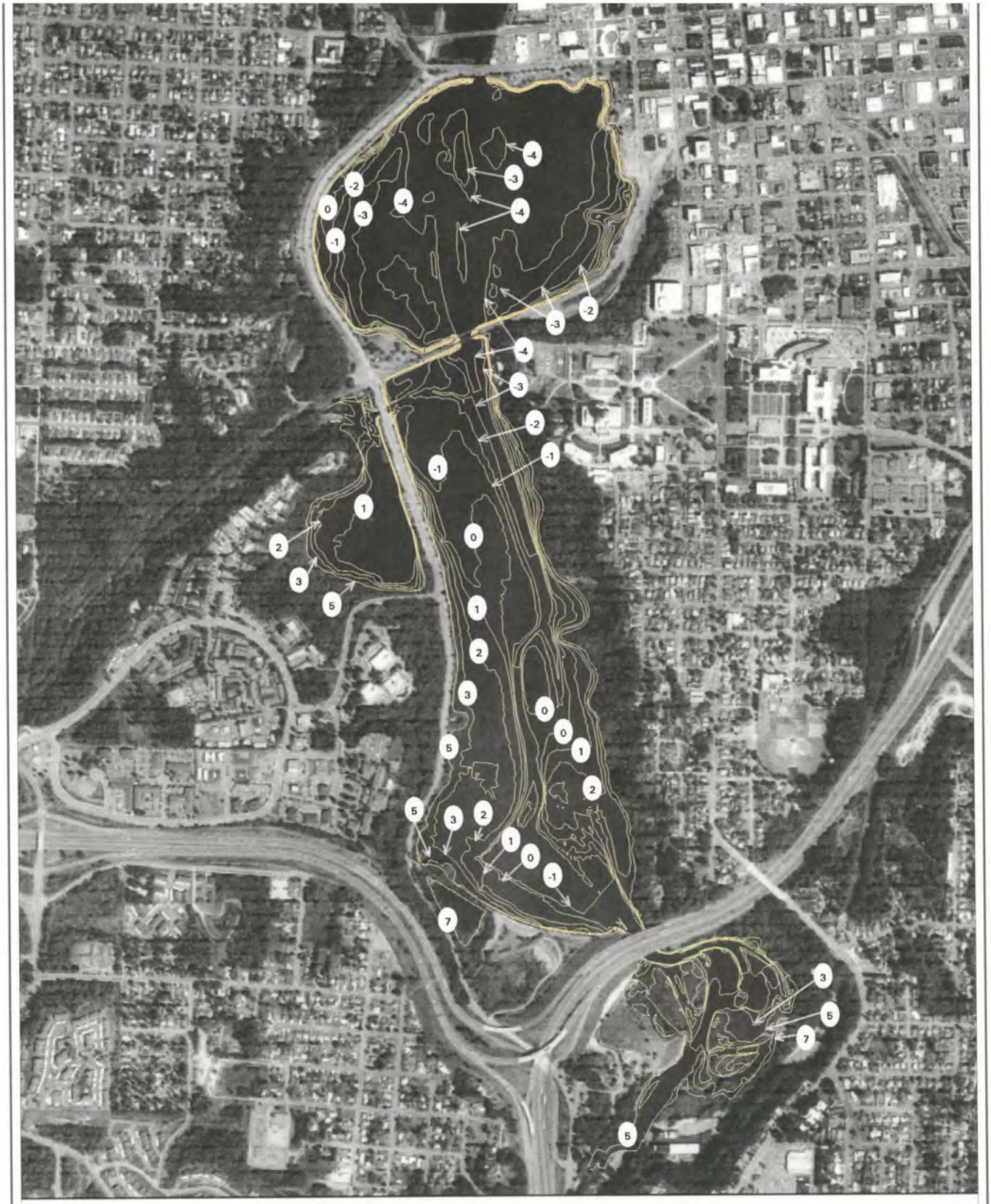
Deschutes Water Resource Inventory Area (WRIA) #13



Wa. Dept. of Ecology, GIS Technical Services 02/26/02

Land Use/Land Cover lc13a


North Basin
Percival Cove



LAKE BOTTOM CONTOURS

Capitol Lake Adaptive Management Plan

Bathymetry is in feet, relative to msl.

The average summer lake level is 6.45 ft. msl.

0 800 feet 1600 feet

Data Source: ENTRANCO 1997
Aerial Photos Taken 1996
For copies of this map or for more information,

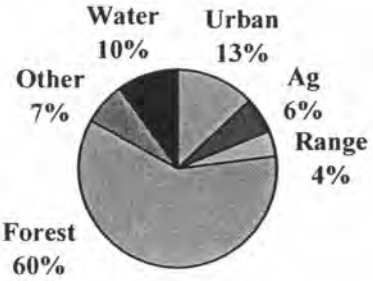
Figure MP-11

Deschutes Basin - WRIA #13

Located in southern end of Puget Sound, 90% of this basin is in Thurston County, and 10% in Lewis County. The basin encompasses about 189,721 acres and is part of the Puget Lowland Ecoregion.

Demographics

Land Use in Deshutes Basin



Land Base (in acres)

Federal	5,592	3.0%
State	6,709	3.5%
Local	244	.1%
Tribal	-0-	-0-
Private	117,176	93.4%

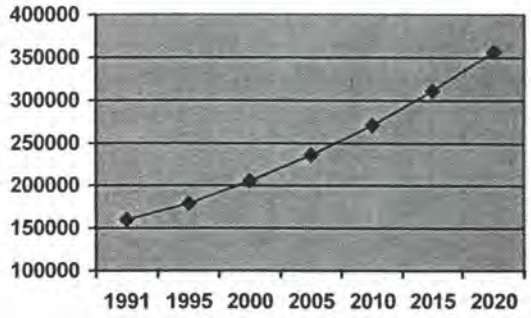
Principal Economic Activity (as total wages(

Government	- 40%
Services	- 21%
Retail Trade	- 18%
Other	- 11%

Population

There are approximately 200,184 people living in the Deschutes River Basin. The primary population centers are Olympia, Lacey, and Rainier. The majority of people live in unincorporated areas.

Projected population trends



Counties

Thurston (90%)
Lewis (10%)

Special purpose districts

Conservation Districts: Thurston; Lewis
Port of Olympia

Principal Cities

Olympia	Lacey
Tumwater	Rainier

Reservation Lands

None

General Landscape

This basin has nearly level to rolling glacial outwash and till plains with low gradient streams. Surface material is deep well drained gravelly loam, gravelly sandy loam, and sandy loam. Potential natural vegetation is western hemlock, western red cedar, Douglas fir, and big leaf maple. Mean temperature ranges from 33/45° (winter) to 52/77° (summer).

SurfaceWater Quality

303(d) listed waterbodies

1. 303(d) listed Problem Areas

Fecal Coliform in Ayer Creek, Capitol Lake, Deschutes River, Dobbs Creek, Henderson Inlet, Indian Creek, Mission Creek, Moxlie Creek, Nisqually Reach/Drayton Passage, Riechel Creek, Sleepy Creek, Woodard Creek, and Woodland Creek

High Temperature in Deschutes River Huckleberry Creek, and Woodland Creek

Dissolved Oxygen in Ayer Creek, Budd Inlet, Henderson Inlet, Peale Passage, Pickering Passage, Sleepy Creek, Squaxin Passage, Woodard Creek, and Woodland Creek

pH in Ayer Creek, Budd Inlet, Deschutes River, Dobbs Creek, McLane Creek, Peale Passage, Pickering Passage, Sleepy Creek, Squaxin Passage, and Woodard Creek

Metals in Budd Inlet

Organics in Budd Inlet

Nutrients in Capitol Lake

Low Instream Flow in Deschutes River and Woodland Creek

PCBs in Budd Inlet and Ward Lake

Sediment Bioassay in Budd Inlet

Large Woody Debris in Deschutes River

Fine Sediments in Deschutes River

Total Maximum Daily Loads

13 TMDLs required from the 1998 303(d) list

2. Impacted Beneficial Uses

Groundwater Quality

Nitrates – Levels detected >5mg/L
Pesticides – Have been detected in wells

Sole Source Aquifer

None

Water Quantity

Flows set, adequacy of flow level not determined; high growth

Air Quality

(From windblown dust)
No concerns

Public Health

Commercial Shellfish Growing Areas
Areas threatened and impaired

Domestic Water Supply

Within this WRIA are large community water systems that significantly utilize surface water sources.

Salmonid Stock Status

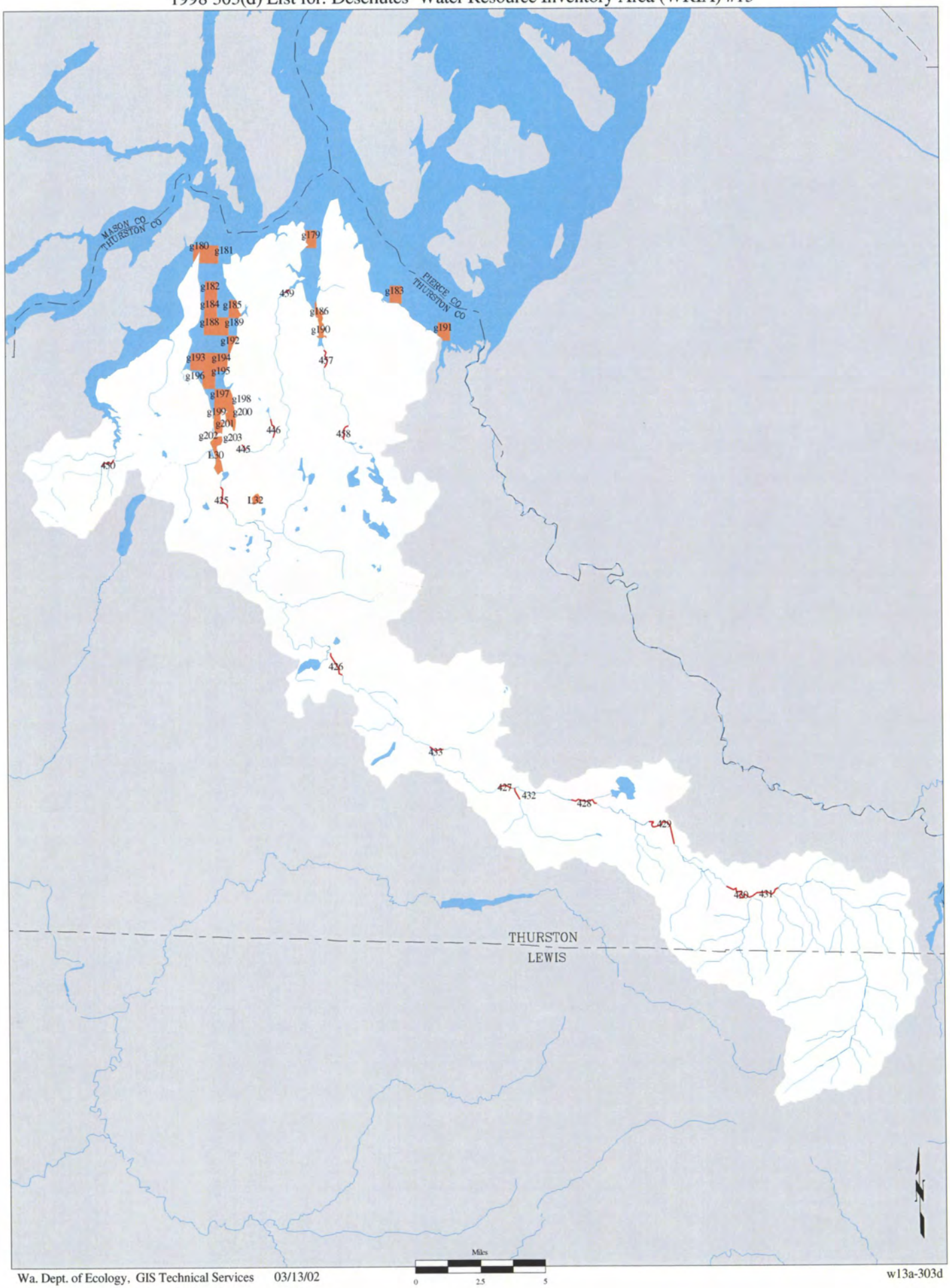
Healthy

3. Water Quality Programs

1. TMDL for Henderson Inlet
2. TMDL for Woodland Creek
3. TMDL for Woodard Bay
4. TMDL for Dobbs Creek
5. TMDL for Libbey Creek
6. Deschutes Rivers Watershed Action Plan
7. Capitol Lake Phase II Restoration
8. Chambers, Ward, and Hewitt

9. Comprehensive Drainage Basin Plan
10. City of Lacey Wetland Protection Plan
11. City of Tumwater Wellhead Protection Plan
12. Henderson Inlet Watershed Action Plan
13. Lake Lawrence Phase I Restoration Plan
14. Long Lake Phase II Restoration
15. North Thurston County Ground Water Management Plan
16. Pattison Lake Phase II Restoration Plan
17. Percival Creek Comprehensive Drainage Basin Plan
18. Deschutes Stream Team onsite sanitary survey
19. Stormwater control program/Stormwater utility
20. Puget Sound Indicator Project (PSH 2002), PSAT
21. Fecal Coliform & Paralytic Shellfish Poisoning Monitoring (Puget Sound Ambient Monitoring Program – PSAMP), DOH
22. Washington State ShoreZone Inventory, DNR/Coastal & Ocean Resources
23. Digital Coastal Atlas, DOE
24. Estuarine Health Indicator Project, PSWQAT
25. Biotoxins Monitoring Program, DOH
26. Commercial Shellfish Growing Area Classification Program, DOH
27. Recreational Shellfish Program, DOH
28. Henderson Water Quality Improvement Program, Thurston CD
29. South Sound Water Quality Program, Thurston CD
30. Farm Planning Program, Thurston CD
31. Water Quality Education Program, Thurston CD
32. Farm/Dairy Nutrient Management Program, Thurston CD
33. Septic O&M Program, Thurston County Health
34. Ambient Monitoring Program, Thurston County Health
35. North County Groundwater Program, Thurston County Health
36. Business Pollution Prevention Program, Thurston County Health

1998 303(d) List for: Deschutes Water Resource Inventory Area (WRIA) #13



Wa. Dept. of Ecology, GIS Technical Services 03/13/02

w13a-303d

1998 303(d) List for: Deschutes Water Resource Inventory Area (WRIA) #13

Id# Parameter, Name segment#

425 Fecal Coliform, Deschutes R [TM40PW]
425 Temperature, Deschutes R [TM40PW]
425 pH, Deschutes R [TM40PW]
426 Temperature, Deschutes R [TM40PW]
427 Instream Flow(h), Deschutes R [TM40PW]
428 Fine Sediment, Deschutes R [TM40PW]
428 Temperature, Deschutes R [TM40PW]
429 Temperature, Deschutes R [TM40PW]
430 Large Woody Debris(h), Deschutes R [TM40PW]
430 Temperature, Deschutes R [TM40PW]
431 Large Woody Debris(h), Deschutes R [TM40PW]
432 Fecal Coliform, Riechel Cr [PN14TO]
433 Temperature, noname [ST93WM]
445 Fecal Coliform, Indian Cr [KX91JE]
446 Fecal Coliform, Indian Cr [KX91JE]
450 pH, McClane Cr [SD15AI]
457 Instream Flow(h), Woodland Cr [JH31LN]
458 Dissolved Oxygen, Woodland Cr [JH31LN]
458 Fecal Coliform, Woodland Cr [JH31LN]
458 Temperature, Woodland Cr [JH31LN]
459 Dissolved Oxygen, Woodward Cr [MJ83ZH]
459 Fecal Coliform, Woodward Cr [MJ83ZH]
459 pH, Woodward Cr [MJ83ZH]

Id# Parameter, Name segment#

g179 Dissolved Oxygen, Henderson Inlet [390KRD]
g180 Dissolved Oxygen, Peale Passage [390KRD]
g181 Dissolved Oxygen, Peale Passage [390KRD]
g182 pH, Budd Inlet [390KRD]
g183 Fecal Coliform, Nisqually Reach [390KRD]
g184 pH, Budd Inlet [390KRD]
g185 pH, Budd Inlet [390KRD]
g186 Fecal Coliform, Henderson Inlet [390KRD]
g188 Dissolved Oxygen, Budd Inlet [390KRD]
g188 pH, Budd Inlet [390KRD]
g189 Dissolved Oxygen, Budd Inlet [390KRD]
g189 pH, Budd Inlet [390KRD]
g190 Fecal Coliform, Henderson Inlet [390KRD]
g191 Fecal Coliform, Nisqually Reach [390KRD]
g192 Dissolved Oxygen, Budd Inlet [390KRD]
g192 pH, Budd Inlet [390KRD]
g193 pH, Budd Inlet [390KRD]
g194 Dissolved Oxygen, Budd Inlet [390KRD]
g194 pH, Budd Inlet [390KRD]
g195 Dissolved Oxygen, Budd Inlet [390KRD]
g195 pH, Budd Inlet [390KRD]
g196 Dissolved Oxygen, Budd Inlet [390KRD]
g196 pH, Budd Inlet [390KRD]
g197 Dissolved Oxygen, Budd Inlet [390KRD]
g197 pH, Budd Inlet [390KRD]
g198 Dissolved Oxygen, Budd Inlet [390KRD]
g199 Bis(2-ethylhexyl) phthala(s), Budd Inlet [390KRD]
g199 Butylbenzyl phthalate(s), Budd Inlet [390KRD]
g199 Chrysene(s), Budd Inlet [390KRD]
g199 Dibenzofuran(s), Budd Inlet [390KRD]
g199 Dissolved Oxygen, Budd Inlet [390KRD]
g199 Fluoranthene(s), Budd Inlet [390KRD]
g199 Sediment Bioassay(s), Budd Inlet [390KRD]
g199 Total PCBs(s), Budd Inlet [390KRD]
g200 2-Methylnaphthalene(s), Budd Inlet [390KRD]
g200 Acenaphthene(s), Budd Inlet [390KRD]
g200 Acenaphthylene(s), Budd Inlet [390KRD]
g200 Anthracene(s), Budd Inlet [390KRD]
g200 Benz(a)anthracene(s), Budd Inlet [390KRD]
g200 Benz(a)anthracene(t), Budd Inlet [390KRD]
g200 Benzo(a)pyrene(s), Budd Inlet [390KRD]
g200 Benzo(b)fluorene(t), Budd Inlet [390KRD]
g200 Benzo(b,k)fluoranthenes(s), Budd Inlet [390KRD]
g200 Benzo(g,h,i)perylene(s), Budd Inlet [390KRD]
g200 Benzo(k)fluorene(t), Budd Inlet [390KRD]
g200 Chromium(s), Budd Inlet [390KRD]
g200 Chrysene(s), Budd Inlet [390KRD]
g200 Chrysene(t), Budd Inlet [390KRD]
g200 Copper(s), Budd Inlet [390KRD]
g200 Dibenz(a,h)anthracene(s), Budd Inlet [390KRD]
g200 Dissolved Oxygen, Budd Inlet [390KRD]
g200 Fluoranthene(s), Budd Inlet [390KRD]
g200 Fluorene(s), Budd Inlet [390KRD]
g200 Indeno(1,2,3-cd)pyrene(s), Budd Inlet [390KRD]
g200 Mercury(s), Budd Inlet [390KRD]
g200 Naphthalene(s), Budd Inlet [390KRD]
g200 PAHs(s), Budd Inlet [390KRD]
g200 Phenanthrene(s), Budd Inlet [390KRD]
g200 Pyrene(s), Budd Inlet [390KRD]
g200 Zinc(s), Budd Inlet [390KRD]
g200 pH, Budd Inlet [390KRD]
g201 Acenaphthene(s), Budd Inlet [390KRD]
g201 Chrysene(s), Budd Inlet [390KRD]
g201 Fluorene(s), Budd Inlet [390KRD]
g202 Dissolved Oxygen, Budd Inlet [390KRD]
g203 PCB-1254(t), Budd Inlet [390KRD]

Id# Parameter, Name segment#

L30 FecaLColiform, Capitol Lake [601ADB]
L30 Total Phosphorus, Capitol Lake [601ADB]
L32 PCB-1260(t), Ward Lake [729WNB]

1998 303(d) Streams
1998 303(d) Waterbodies
(s) Sample from Sediment
(t) Sample from Tissue
(h) Sample from Habitat
Rivers/Streams
Intermittent
Canal/Pipe
County

GIS Technical Services
03/13/02
w13-303key

Feature Source:
ECOLOGY - 303(d) List 1998 1:100K (WC_LIST, WB_LIST, WG_LIST)
ECOLOGY/WDNR - Water Resource Inventory Areas 1999 1:24K (WRIA)
ECOLOGY/WDFW - Hydrography 1998 1:100k (HYDROFW)
WDOT - Highways 2000 1:24k (SR24K)

Notes:
(*) Legend page for individual 303(d)/WRIA area maps, 1 - 62

12080010 DESCHUTES RIVER AT E STREET BRIDGE, AT TUMWATER, WA

LOCATION.--Lat 47°00'43", long 122°54'07", in NW $^1/_4$ Land Grant parcel 60, T.18 N., R.2 W., Thurston County, Hydrologic Unit 17110016, on left bank at "E" Street bridge, 0.2 mi upstream from Capitol Boulevard, and at mile 2.4.

DRAINAGE AREA.--162 mi^2.

PERIOD OF RECORD.--April 1945 to November 1954, water years 1955-57 (annual maximum), June 1957 to June 1964, published as "12080000 Deschutes River near Olympia". October 1990 to current year.

REVISED RECORDS.--WDR WA-96-1: 1991(P), 1992(P).

GAGE.--Water-stage recorder. Datum of gage is 62.01 ft above sea level. April 1945 to Nov. 1954, water-stage recorder, Nov. 1954 to June 1957, crest-stage gage, June 1957 to June 1964, water-stage recorder, at site 1 mi upstream, at different datum.

REMARKS.--No estimated daily discharges. Records good. Some small diversions for irrigation and domestic use upstream from station. No regulation. Miscellaneous discharge measurement site 1971-72, 1975, 1977-90.

AVERAGE DISCHARGE.--26 years (water years 1946-54, 1958-63, 1991-2001), 406 ft^3/s, 34.02 in/yr, 293,900 acre-ft/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 10,700 ft^3/s Feb. 9, 1996, gage height, 34.17 ft, on basis of slope-area measurement of peak flow; minimum discharge, 51 ft^3/s Sept. 22-24, 1995.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 2,400 ft^3/s and maximum (*):

Date	Time	Discharge (ft^3/s)	Gage height (ft)
Dec. 17	1130	*792	*26.37

Minimum discharge, 61 ft^3/s Sept. 22-25.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 2000 TO SEPTEMBER 2001
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	104	135	228	209	207	186	290	584	140	127	79	79
2	126	127	220	197	212	224	280	566	141	120	79	78
3	111	122	221	192	287	247	272	446	152	114	79	78
4	102	121	208	197	354	237	256	358	161	112	79	77
5	99	123	187	216	709	229	241	315	149	105	80	75
6	99	125	168	259	519	221	258	282	146	105	86	75
7	96	126	158	254	390	211	295	255	144	105	87	74
8	95	140	150	234	328	201	303	233	137	104	75	71
9	104	197	143	216	290	197	297	218	134	101	73	70
10	106	177	138	207	261	200	288	206	137	100	71	68
11	110	154	133	200	239	190	407	194	165	98	69	68
12	108	141	126	189	221	184	480	186	199	97	69	68
13	103	134	123	182	205	180	398	179	203	96	68	67
14	100	127	128	180	194	182	337	185	180	93	68	67
15	100	123	169	178	189	189	302	223	165	93	68	65
16	106	119	244	174	201	198	277	330	155	94	66	65
17	109	116	554	167	263	200	281	406	146	96	67	66
18	124	112	462	165	281	207	323	330	140	97	68	65
19	127	110	322	167	274	254	322	282	135	95	67	66
20	152	110	271	169	255	318	300	249	129	92	67	65
21	220	109	244	187	237	279	276	225	125	90	73	64
22	187	106	239	204	227	250	256	207	122	88	102	62
23	151	113	303	207	217	230	244	193	118	87	117	64
24	134	116	383	203	209	214	229	181	119	85	145	65
25	123	128	360	191	201	219	216	172	120	84	131	64
26	117	148	309	181	189	262	207	165	118	83	109	71
27	111	273	276	171	180	303	202	158	128	82	101	74
28	118	345	251	167	179	340	200	157	157	84	102	76
29	162	266	235	170	---	351	205	160	155	86	100	73
30	156	233	226	195	---	320	251	152	137	84	104	68
31	145	---	217	206	---	297	---	145	---	80	89	---
TOTAL	3805	4476	7396	6034	7518	7320	8493	7942	4357	2977	2638	2088
MEAN	123	149	239	195	268	236	283	256	145	96.0	85.1	69.6
MAX	220	345	554	259	709	351	480	584	203	127	145	79
MIN	95	106	123	165	179	180	200	145	118	80	66	62
AC-FT	7550	8880	14670	11970	14910	14520	16850	15750	8640	5900	5230	4140
CFSM	.76	.92	1.47	1.20	1.66	1.46	1.75	1.58	.90	.59	.53	.43
IN.	.87	1.03	1.70	1.39	1.73	1.68	1.95	1.82	1.00	.68	.61	.48

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1945 - 2001, BY WATER YEAR (WY)

MEAN	166	502	721	760	838	602	468	306	195	132	108	101
MAX	463	921	1480	1308	1753	1176	936	499	300	186	148	162
(WY)	1998	2000	1999	1953	1999	1950	1991	1948	1997	1997	1997	1997
MIN	76.8	84.1	239	195	244	236	283	140	110	77.1	69.8	57.2
(WY)	1953	1994	2001	2001	1993	2001	2001	1994	1992	1992	1992	1995

12080010 DESCHUTES RIVER AT E STREET BRIDGE, AT TUMWATER, WA--Continued

SUMMARY STATISTICS	FOR 2000 CALENDAR YEAR		FOR 2001 WATER YEAR		WATER YEARS 1945 - 2001	
ANNUAL TOTAL	115722		65044			
ANNUAL MEAN	316		178		406	
HIGHEST ANNUAL MEAN					658	1999
LOWEST ANNUAL MEAN					178	2001
HIGHEST DAILY MEAN	1880	Feb 2	709	Feb 5	8150	Feb 9 1996
LOWEST DAILY MEAN	90	Sep 26	62	Sep 22	52	Sep 22 1995
ANNUAL SEVEN-DAY MINIMUM	91	Sep 23	64	Sep 19	53	Sep 18 1995
ANNUAL RUNOFF (AC-FT)	229500		129000		293900	
ANNUAL RUNOFF (CFSM)	1.95		1.10		2.50	
ANNUAL RUNOFF (INCHES)	26.57		14.94		34.02	
10 PERCENT EXCEEDS	686		297		880	
50 PERCENT EXCEEDS	220		162		248	
90 PERCENT EXCEEDS	102		75		95	

Appendix C

Fluridone Herbicide Information

1. **Sonar PR US EPA Label**
2. **Washington Department of Health Department Fact Sheet**

Specimen Label

SePRO

Sonar* PR

Precision Release

Herbicide

A herbicide for management of aquatic vegetation in fresh water ponds, lakes, reservoirs, potable water sources, drainage canals, irrigation canals and rivers.

Active ingredient:
fluridone: 1-methyl-3-phenyl-5-[3-(trifluoromethyl) phenyl]-4(1*H*)-pyridinone 5.0%
Inert ingredients 95.0%
Total 100.0%
(Contains 1.5 pounds active ingredient per 30-pound container.)

EPA Reg. No. 67690-12 EPA Est. 39578-TX-1
SC-73-3271

Precautionary Statements

Hazards to Humans and Domestic Animals

Keep Out of Reach of Children

CAUTION PRECAUCION

Si usted no entiende la etiqueta, busque a alguien para que se la explique a usted no detaile. (If you do not understand this label, find someone to explain it to you in detail).

Harmful if Swallowed, Absorbed Through Skin, or if Inhaled

Avoid breathing of dust or contact with skin, eyes or clothing. Wash thoroughly with soap and water after handling. Remove contaminated clothing and wash before reuse.

In case of emergency endangering health or the environment involving this product, call INFOTRAC at 1-800-535-5053.

Statement of Practical Treatments

	First Aid
If in eyes	• Hold Eye open and rinse slowly and gently with water for 15 - 20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye. • Call 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 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.
Have the product container or label with you when calling a poison control center or doctor, or going for treatment	

Notice Statement: Read entire label before using. Use only according to label directions. **Before buying or using this product read the "Warranty Disclaimer" and "Limitation of Remedies" inside the label booklet.**

Environmental Hazards

Follow use directions carefully so as to minimize adverse effects on nontarget organisms. In order to avoid impact on threatened or endangered aquatic plant or animal species, users must consult their State Fish and Game Agency or the U.S. Fish and Wildlife Service before making applications.

Do not contaminate untreated water when disposing of equipment washwaters. Trees and shrubs growing in water treated with Sonar PR Precision Release may occasionally develop chlorosis. Do not apply in tidewater/brackish water.

Lowest rates should be used in shallow areas where the water depth is considerably less than the average depth of the entire treatment site, for example, shallow shoreline areas.

*Trademark of SePRO Corporation
SePRO Corporation. • Carmel, IN 46032, U.S.A.

Sonar* PR Precision Release Herbicide

Directions for Use

It is a violation of Federal Law to use this product in a manner inconsistent with its labeling.
Read all Directions Carefully Before Applying Sonar PR Precision Release.

Storage and Disposal

Do not contaminate water, food, or feed by storage or disposal.
Storage: Store in original container only. Do not store near feed or foodstuffs. In case of leak or spill, contain material and dispose as waste.
Pesticide Disposal: Wastes resulting from use of this product may be used according to label directions or disposed of at an approved waste disposal facility.
Container Disposal: 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 Information

Sonar PR Precision Release herbicide is a selective systemic aquatic herbicide for management of aquatic vegetation in fresh water ponds, lakes, reservoirs, drainage canals, irrigation canals, and rivers. Sonar PR Precision Release is a pelleted formulation containing 5% fluridone. Sonar is absorbed from water by plant shoots and from hydrosoil by the roots of aquatic vascular plants. It is important to maintain Sonar in contact with the target plants for as long as possible. Rapid water movement or any condition which results in rapid dilution of Sonar in treated water will reduce its effectiveness. In susceptible plants, Sonar inhibits the formation of carotene. In the absence of carotene, chlorophyll is rapidly degraded by sunlight. Herbicidal symptoms of Sonar appear in seven to ten days and appear as white (chlorotic) or pink growing points. Under optimum conditions 30 to 90 days are required before the desired level of aquatic weed management is achieved with Sonar. Species susceptibility to Sonar PR Precision Release may vary depending on time of year, stage of growth and water movement. For best results, apply Sonar PR Precision Release prior to initiation of weed growth or when weeds begin active growth. Application to mature target plants may require higher application rates and may take longer to control.

Sonar PR Precision Release is not corrosive to application equipment.

The label provides recommendations on the use of a chemical analysis for the active ingredient. SePRO Corporation recommends the use of an Enzyme-Linked Immumoassay (ELISA Test) for the determination of the active ingredient concentration in the water. Contact SePRO Corporation for the utilization of this test, known as FasTEST, for the incorporation of this analysis in your treatment program. Other proven chemical analyses for the active ingredient may also be used. The chemical analysis, FasTEST, is referenced in this label as the preferred method for the rapid determination of the concentration of the active ingredient in the water.

Application rates are provided in pounds of Sonar PR Precision Release to achieve a desired concentration of the active ingredient in part per billion (ppb). The maximum application rate or sum of all application rates is 90 ppb in ponds and 150 ppb in lakes and reservoirs per annual growth cycle. This maximum concentration is the amount of product calculated as the target application rate, NOT determined by testing the residues of the active ingredient in the treated water.

General Use Precautions

• **Obtain Required Permits:** Consult with appropriate state or local water authorities before applying this product. Permits may be required by state or local public agencies.

• **Hydroponic Farming:** Do not use Sonar PR Precision

• **WATER USE RESTRICTIONS FOLLOWING APPLICATIONS WITH SONAR PR Precision Release (DAYS)**

Application Rate	Drinking†	Fishing	Swimming	Livestock/Pet Consumption	Irrigation††
Maximum Rate (150 ppb) or less	0	0	0	0	7-30

† Note below, under Potable Water Intakes, the information for application of Sonar PR Precision Release within 1/4 miles (1320) feet of a functioning potable water intake.

†† Note below, under Irrigation, the specific time frames for each water body type and crop type.

• **Potable Water Intakes:** Concentrations of the active ingredient fluridone up to 150 ppb are allowed in potable water sources; however, in lakes and reservoirs or other sources of potable water, DO NOT APPLY Sonar PR Precision Release at application rates greater than 20 ppb within one-fourth mile (1320 feet) of any functioning potable water intake. At application rates of 8-20 ppb, Sonar PR Precision Release MAY BE APPLIED where functioning potable water intakes are present. **Note: Existing potable water intakes which are no longer in use, such as those replaced by connections to potable water wells or a municipal water system, are not considered to be functioning potable water intakes.**

• **Irrigation:** Irrigation with Sonar PR Precision Release treated water may result in injury to the irrigated vegetation. SePRO Corporation recommends following these precautions and informing those who irrigate from areas treated with Sonar PR Precision Release of the irrigation time frames presented in the table below. These time frames are suggestions which should be followed to reduce the potential for injury to vegetation irrigated with water treated with Sonar PR Precision Release. Greater potential for crop injury occurs where Sonar PR Precision Release treated water is applied to crops grown on low organic and sandy soils.

	Days After Application		
Application Site	Established Tree Crops	Established Row Crops/ Turf/Plants	Newly Seeded Crops/Seedbeds or Areas to be Planted Including Overseeded Golf Course Greens
†Ponds and Static Canals	7	30	30
Canals	7	7	30
Rivers	7	7	7
††Lakes and Reservoirs	7	7	7

†For purposes of Sonar PR Precision Release labeling, a pond is defined as a body of water 10 acres or less in size. A lake or reservoir is greater than 10 acres.
††In lakes and reservoirs where one-half or greater of the body of water is treated, use the pond and static canal irrigation precautions.

Where the use of Sonar PR Precision Release treated water is desired for irrigating crops prior to the time frames established above, the use of FasTEST is recommended to measure the concentration in the treated water. Where FasTEST has determined that concentrations are less than 10 parts per billion, there are no irrigation precautions for irrigating established tree crops, established row crops or turf. For tobacco, tomatoes, peppers or other plants within the Solanaceae Family and newly seeded grasses such as overseeded golf course greens, do not use Sonar PR Precision Release treated water if concentration are greater than 5 ppb.

Plant Control Information

Sonar PR Precision Release selectivity is dependent upon dosage, time of year, stage of growth, method of application, and water movement. The following categories, controlled, partially controlled, and not controlled are provided to describe expected efficacy under ideal treatment conditions using higher to maximum label rates. Use of lower rates will increase selectivity of some species listed as controlled or partially controlled. Additional aquatic plants may be controlled, partially controlled, or tolerant to Sonar PR Precision Release. Consult an aquatic specialist prior to application of Sonar PR Precision Release to determine a plant's susceptibility to Sonar PR Precision Release.

Vascular Aquatic Plants Controlled by Sonar PR Precision Release†

Submersed Plants:
bladderwort (*Utricularia* spp.)
common coontail (*Ceratophyllum demersum*)*
common Elodea (*Elodea canadensis*)*
egeria, Brazilian Elodea (*Egeria densa*)
fanwort, Cabomba (*Cabomba caroliniana*)
hydrilla (*Hydrilla verticillata*)
naiad (*Najas* spp.)*
pondweed (*Potamogeton* spp., except Illinois pondweed)*
watermilfoil (*Myriophyllum* spp. except variable-leaf milfoil)

Shoreline Grasses:
paragrass (*Urochloa* mutica)

†Species denoted by an asterisk are native plants that are often tolerant to Sonar at lower use rates. Please consult an aquatic specialist for recommended Sonar PR Precision Release use rates when selective control of exotic species is desired.

Vascular Aquatic Plants Partially Controlled by Sonar PR Precision Release:

Floating Plants:
Salvinia (*Salvinia* spp.)

Emersed Plants:
alligatorweed (*Alternanthera philoxeroides*)
American lotus (*Nelumbo lutea*)
cattail (*Typha* spp.)
creeping waterprimrose (*Ludwigia peploides*)
parrotfeather (*Myriophyllum aquaticum*)
smartweed (*Polygonum* spp.)
spatterdock (*Nuphar luteum*)
spikerush (*Eleocharis* spp.)
waterlily (*Nymphaea* spp.)
waterpurslane (*Ludwigia palustris*)
watershield (*Brasenia schreberi*)

Submersed Plants:
Illinois pondweed (*Potamogeton illinoensis*)
limnophila (*Limnophila sessiliflora*)
tapegrass, American eelgrass (*Vallisneria americana*)
watermilfoil--variable-leaf (*Myriophyllum heterophyllum*)

Shoreline Grasses:
barnyardgrass (*Echinochloa crusgalli*)
giant cutgrass (*Zizaniopsis miliacea*)
reed canarygrass (*Philaris arundinaceae*)
southern watergrass (*Hydrochloa caroliniensis*)
torpedograss (*Panicum repens*)

Vascular Aquatic Plants Not Controlled by Sonar PR Precision Release:

Floating Plants:
floating waterhyacinth (*Eichhornia crassipes*)
waterlettuce (*Pistia stratiotes*)

Emersed Plants:
American frogbit (*Limnobium spongia*)
arrowhead (*Sagittaria* spp.)
bacopa (*Bacopa* spp.)
big floatingheart, banana lily (*Nymphoides aquatica*)
bulrush (*Scirpus* spp.)
pickerelweed, lanceleaf (*Pontederia* spp.)
rush (*Juncus* spp.)
water pennywort (*Hydrocotyle* spp.)

Shoreline Grasses:
maidencane (*Panicum hemitomon*)

Note: algae (chara, nitella, and filamentous species are not controlled by Sonar PR Precision Release).

Application Directions

The aquatic plants present in the treatment site should be identified prior to application to determine their susceptibility to Sonar PR Precision Release. It is important to determine the area (acres) to be treated and the average depth in order to select the proper application rate. Do not exceed the maximum labeled rate for a given treatment site per annual growth cycle.

Application to Ponds

Sonar PR Precision Release may be applied to the entire surface area of a pond. For single applications, rates may be selected to provide 45 to 90 ppb to the treated water, although actual concentrations in treated water may be substantially lower at any point in time due to the slow-release formulation of this product. When treating for optimum selective control, lower rates may be applied for sensitive target species. Use the higher rate within the rate range where there is a dense weed mass, when treating more difficult to control species, and for ponds less than 5 acres in size with an average depth less than 4 feet. Application rates necessary to obtain these concentrations in treated water are shown in the following table. For additional application rate calculations, refer to page 5—Application Rate Calculations-Ponds, Lakes and Reservoirs. Split or multiple applications are recommended where dilution of treated water is anticipated; however, the sum of all applications should total 45 to 90 ppb and must not exceed a total of 90 ppb per annual growth cycle.

Average Water Depth of Treatment Site (feet)	Pounds of Sonar PR Precision Release per Treated Surface Acre 45 ppb	to	90 ppb
1	2.5		5
2	5		10
3	7.5		15
4	10		20
5	12.5		25
6	15		30
7	17		34
8	19.5		39
9	22		44
10	24.5		49

Application to Lakes and Reservoirs

The following treatments are recommended for treating both whole lakes or reservoirs and partial areas of lakes or reservoirs (bays, etc.). For best results in treating partial lakes and reservoirs, Sonar PR Precision Release treatment areas should be a minimum of 5 acres in size. Treatment of areas smaller than 5 acres or treatment of narrow strips such as boat lanes or shorelines may not produce satisfactory results due to dilution by untreated water. Rate ranges are provided as a guide to include a wide range of environmental factors, such as target species, plant susceptibility, selectivity and other aquatic plant management objectives. Application rates and methods should be selected to meet the specific lake/reservoir aquatic plant management goals.

A. Whole Lake or Reservoir Treatments (Limited or No Water Discharge)

1. Single Application to Whole Lakes or Reservoirs
Where single applications to whole lakes or reservoirs are desired, apply Sonar PR Precision Release at an application rate of 16 to 90 ppb. Application rates necessary to obtain these concentrations in treated water are shown in the following table. For additional rate calculations, refer to page 5—Application Rate Calculation-Ponds, Lakes and Reservoirs. Choose an application rate to meet the aquatic plant management objective. **Where greater plant selectivity is desired such as when controlling Eurasian watermilfoil and curlyleaf pondweed, choose an application rate lower in the rate range.** For other plant species, SePRO recommends contacting an aquatic specialist in determining when to choose application rates lower in the rate range to meet specific plant management goals. Use the higher rate within the rate range where there is a dense weed mass or when treating more difficult to control plant species or in the event of a heavy rainfall event where dilution has occurred. In these cases, a second application or more may be required; however, the sum of all applications cannot exceed 150 ppb per annual growth cycle. Refer to the following Section (No. 2) Split or Multiple Applications for guidelines and maximum rate allowed.

Average Water Depth of Treatment Site (feet)	Pounds of Sonar PR Precision Release Per Treated Surface Acre 16 ppb to 90 ppb
1	0.9 to 5
2	1.7 to 10
3	2.6 to 15
4	3.5 to 20
5	4.3 to 25
6	5.2 to 30
7	6.0 to 34
8	6.9 to 39
9	7.8 to 44
10	8.6 to 49
11	9.5 to 54
12	10.4 to 59
13	11.2 to 64
14	12.1 to 68
15	13.0 to 73
16	13.8 to 78
17	14.7 to 83
18	15.6 to 88
19	16.4 to 93
20	17.3 to 98

2. Split or Multiple Applications to Whole Lakes or Reservoirs
To meet certain plant management objectives, split or multiple applications may be desired in making whole lake treatments. Split or multiple application programs are desirable when the objective is to use the minimum effective dose and to maintain this lower dose for the sufficient time to ensure efficacy and enhance selectivity. Under these situations, use the lower rates (16 to 75 ppb) within the rate range. **In controlling Eurasian watermilfoil and curlyleaf pondweed and where greater plant selectivity is desired, choose an application rate lower in the rate range.** For other plant species, SePRO recommends contacting an aquatic specialist in determining when to choose application rates lower in the rate range to meet specific plant management goals. For split or repeated applications, the sum of all applications must not exceed 150 ppb per annual growth cycle.

Note:In treating lakes or reservoirs that contain potable water intakes and the application requires treating within 1/4 mile of a potable water intake, no single application can exceed 20 ppb. Additionally, the sum of all applications cannot exceed 150 ppb per annual growth cycle.

B. Partial Lake or Reservoir Treatments
Where dilution of Sonar PR Precision Release with untreated water is anticipated, such as in partial lake or reservoir treatments, split or multiple applications may be used to extend the contact time to the target plants. The application rate and use frequency of Sonar PR Precision Release in a partial lake is highly dependent upon the treatment area. Higher application rates may be required and frequency of applications will vary depending upon the potential of untreated water diluting the Sonar PR Precision Release concentration in the treatment area. Use higher rates where greater dilution with untreated water is anticipated.

1. Application Sites Greater Than 1/4 Mile from a Functioning Potable Water Intake
For single applications, apply Sonar PR Precision Release at application rates from 45 to150 ppb. Split or multiple applications may be made, however, the sum of all applications cannot exceed 150 ppb per annual growth cycle. Split applications should be conducted to maintain a sufficient concentration in the target area for a period of 45 days or longer. The use of FasTEST is recommended to maintain the desired concentration in the target area over time.
2. Application Sites Within 1/4 Mile of a Functioning Potable Water Intake
In treatment areas that are within 1/4 mile of a potable water intake, no single application can exceed 20 ppb. When utilizing split or repeated applications of Sonar PR Precision Release for sites which contain a potable water intake, FasTEST is required to determine the actual concentration in the water. Additionally, the sum of all applications cannot exceed 150 ppb per annual growth cycle.

Application Rate Calculation - Ponds, Lakes and Reservoirs

The amount of Sonar PR Precision Release to be applied to provide the desired ppb concentration of active ingredient equivalents in treated water may be calculated as follows:

- Pounds of Sonar PR Precision Release required per treated acre = Average water depth of treatment site x Desired ppb concentration of active ingredient equivalents x 0.054

For example, the pounds per acre of Sonar PR Precision Release required to provide a concentration of 25 ppb of active ingredient equivalents in water with an average depth of 5 feet is calculated as follows:

5 x 25 x 0.054 = 6.75 pounds per treated surface acre.

Note: Calculated rates should not exceed the maximum allowable rate in pounds per treated surface acre for the water depth listed in the application rate table for the site to be treated.

Application to Drainage Canals, Irrigation Canals and Rivers

Static Canals:
In static drainage and irrigation canals, Sonar PR Precision Release should be applied at the rate of 20 to 40 pounds per surface acre.

Moving Water Canals and Rivers:
The performance of Sonar PR Precision Release will be enhanced by restricting or reducing water flow. In slow moving bodies of water use an application technique that maintains a concentration of 10 to 40 ppb in the treated area for a minimum of 45 days. Sonar PR Precision Release can be applied by split or multiple broadcast applications or by metering in the product to provide a uniform concentration of the herbicide based upon the flow pattern. The use of FasTEST is recommended to maintain the desired concentration in the target area over time.

Static or Moving Water Canals or Rivers Containing a Functioning Potable Water Intake
In treating a static or moving water canal or river which contains a functioning potable water intake, applications of Sonar PR Precision Release greater than 20 ppb must be made more than 1/4 mile from a functioning potable water intake. Applications less than 20 ppb may be applied within 1/4 mile from a functioning potable water intake; however, if applications of Sonar PR Precision Release are made within 1/4 mile from a functioning water intake, the FasTEST must be utilized to demonstrate that concentrations do not exceed 150 ppb at the potable water intake.

Application Rate Calculation – Drainage Canals, Irrigation Canals and Rivers

The amount of Sonar PR Precision Release to be applied through a metering system to provide the desired ppb concentration of active ingredient in treated water may be calculated as follows:

1. Average flow rate (feet per second) x average width (ft.) x average depth (ft.) x 0.9 = CFS (cubic feet per second)
2. CFS x 1.98 = acre feet per day (water movement)
3. Acre feet per day x desired ppb x 0.054 = pounds Sonar PR Precision Release required per day.

WARRANTY DISCLAIMER

SePRO Corporation warrants that this product conforms to the chemical description on the label and is reasonably fit for the purposes stated on the label when used in strict accordance with the directions, subject to the inherent risks set forth below. 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 of application, or other factors, all of which are beyond the control of SePRO Corporation or 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 loss or damage 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 this Limitation of Remedies in any manner.

SePRO Corp. • Carmel, IN 46032, U.S.A.

Fluridone (Sonar®)

March 2000

Fact Sheet

Environmental Health Programs
Office of Environmental Health & Safety

Washington State Department of Health

Fluridone is an aquatic herbicide used to control common nuisance plants like pondweed and watermilfoil. It is not equally effective at killing all water plants and has been used in Washington to selectively remove certain nuisance weeds. It is absorbed by the leaves, shoots and roots of vascular plants and kills susceptible plants by inhibiting their ability to form carotene, a substance which plants need to maintain essential levels of chlorophyll. Damage in susceptible plants usually appears in 7-10 days after water treatment.

Fluridone is the active ingredient in Sonar® and comes in two formulations: pellets (Sonar SRP) and liquid concentrate (Sonar A.S.)

The initial rate of application recommended by Sonar labels is quite dilute and varies depending on the size of pond or lake, density of weeds, and susceptibility of targeted weeds. Control of watermilfoil in Washington is often accomplished with rates as low as 10-20 parts per billion (ppb).

Environmental Persistence

Fluridone is moderately persistent in water and sediments following treatment of a pond or lake. Field tests have shown that the average half-life in pond water is 21 days and longer in sediments (90 days in hydrosoil). Residues may persist longer depending on the amount of sunlight and the water temperature. Fluridone is primarily degraded by sunlight and microorganisms.

Health Impacts

Laboratory animals (mice, rats, dogs) fed fluridone in their diets showed little signs of toxicity even when fed levels which far exceed potential human exposure from use of Sonar. Fluridone is not considered to be a carcinogen or mutagen and is not associated with reproductive or developmental effects in test animals.

There is no EPA standard for maximum allowable concentration (MCL) of fluridone in public water supplies. For the purpose of Sonar product registration, EPA determined that 150 ppb is an acceptable level for potable water following Sonar use. This level provides a 1000-fold safety factor between the no effect level in experimental animals and the estimated human exposure via drinking water.

Common Questions

Appendix E

Review of the "Salt Water" Option

CLAMP TAC MINUTES – Milfoil Work Group

CLAMP – Technical Advisory Committee Meeting
Thursday, June 3, 2003 1:30 p.m. – 3:50 p.m.
1058 Capitol Way South, Lower Conference Room
Olympia, WA

Attendance:

Dave Schilperoort, GA
Wendy Sue Wheeler, WSDA
Kathy Hamel, WDOE
Tom Clingman, Thurston County
Margie Schirato, WDFW
Jeff Dickison, Squaxin Island Tribe
Steven Morrison, TRPC (recorder)
Kathleen Callison, Tumwater
Mike Matlock, Tumwater
Eric Egge, Port of Olympia
Perry Lund, Ecology
Larry Kessel, GA
Lenore Miller, GA
Jim Erskine, GA

The meeting began at 1:30 p.m. Dave Schilperoort greeted everyone and self introductions followed. He provided a short summary of the issue and why the meeting had been called. He indicated that the practice of salt water backflushing after the lake had been drawn down was discontinued in 1997 due to the concern of the practices adverse impact upon the lake ecosystem. Jeff Dickison agreed that while the long term goal was to eradicate milfoil, that adaptive management principles should be used, and that this may be an opportunity to experiment in the short-term in the north basin. Larry Kessel then provided a short history of how the siphon was added to keep the crater in the north basin from becoming a water quality problem.

Kathleen Callison asked about the term "backflushing". It was explained as allowing salt water to enter the lake, after it had been largely drained during a lower tide normally in the summer. Discussion followed about these historical events. Perry Lund indicated that from the 1997 Capitol Lake drawdown report it took from 3-5 weeks of flow from the Deschutes River and Percival Creek for the saltwater to be displaced. Mr. Schilperoort distributed copies of this report - *1997 Capitol Lake Drawdown Monitoring Results* (1997). Discussion followed that the lake had improved is several water quality parameters since the backflushing practice had been abandoned. It was noted that while the lake was lowered in the summer of 2002, it was allowed to slowly fill back up after construction was complete.

Mr. Dickison indicated that any of the reasons "why" the lake had been historically drained were no longer relevant. Growth of rooted plants in the lake did take more than one year and an unintended consequence of that new plant growth was that milfoil became established.

Mr. Lund indicated that he believed it was this one issue which was a contributing factor to the creation of the Capitol Lake Adaptive Management Plan process. GA could not continue to do what it wanted to do with the lake. Ecology's concerns about the continuing this practice were included in there shoreline permit conditions, which had wetland mitigation sites in the north basin (an island at the south end of the arc of statehood) and the former dredge spoils site in the middle basin (adjacent to the interpretative center). It was the goal of Ecology to maintain a freshwater system to insure that the wetland mitigation sites remained viable.

Mr. Schilperoort then indicated he wanted to hear about others concerns with the practice. Lenore Miller suggested that discussion rather focus on the beneficial uses of the lake that might be impaired by the milfoil. She indicated that GA is not interested in just going back to the old practices, but wanted to hear some discussion if saltwater could be used to control the milfoil.

Mr. Dickison indicated that obtaining a permit this year might not be possible, so he wondered if anything might be done this year. He suggested testing a hypothesis about salinity and contact time, much like the proposal to use of the chemical SONAR. Discussion followed about how this might be done, how much of the basin would need to be filled, what this might accomplish, and how much of the north basin might need to be treated. He emphasizes using this as an experiment, learning from that and then moving on to other alternatives. There was some discussion among others that a chemical treatment this year might still be possible.

Mr. Lund proposed structuring the questions to compare the affects of two chemicals: floridone (the active ingredient in SONAR) and sodium chloride (salt water). He indicated that his research showed that the secondary impact to non-targeted plants, invertebrates, bacterium, and rooted emergent plants showed that a treatment of sodium chloride would completely wipe these out. It would set the lake ecosystem back six years and set a poor precedent in the process. He concluded with asking, "Do we need to worry about milfoil in the lake?"

Margie Schirato asked if the milfoil had been mapped out. Mr. Schilperoort indicated that this had been and was in the draft IPM plan. Mr. Lund indicated that from his research, the concentrations would have to be higher than 15 ppt for the salt to affect the milfoil, and the results from the 1997 drawdown topped out at greater than 8 ppt. The salinity would have to be higher and the contact time greater to be effective.

Mr. Lund also pointed out the much lower tolerance levels salinity levels of other biota. He indicated that natural systems tolerate slower transitions, and that this dosing was damaging to the ecosystem. He also noted that the proposal is also somewhat inconsistent with the CLAMP Plan, which proposes maintaining a fresh water lake environment over the next 10 year period.

A question was asked about what happened to milfoil when it is dried out. Tom Clingman responded about the county's experience on Long Lake, and indicated that this practice may actually cause the plant to colonize more areas.

Mr. Lund indicated he did not want to get the issue of using salt water to kill the milfoil to be confused with the proposal to return the lake to an estuary. He believed that the estuary feasibility study scope of work was still being worked on, and that a decision on an estuary is still a ways off. Therefore, we still need to address the milfoil question. Kathy Hamel asked if the salt water could be limited to only one part of the lake. Discussion followed on this point indicating a need for a bathometry map (bottom contours of the lake) and a better inventory of

the types of aquatic weeds around the lake. Discussion flowed which indicated that the IPM plan did not contain a survey of species richness. It was then agreed that without good bathometry map and a current survey of the aquatic plants, it would be difficult to determine the impacts of the salt water backflushing. Without knowing this information, Mr. Lund wondered how much risk was warranted to eradicate the milfoil, this year.

Mr. Clingman indicated that treatment of the north and middle basin would still leave an up stream seed source, which would make eradication virtually impossible. He felt that controlling the milfoil might be an attainable target. Discussion followed that the use of salt water would again result in a perpetually disturbed site (lake).

Mr. Clingman discussed his concerns about the SONAR application, in that he was concerned that it would be difficult to attain the needed contact time in a flowing water system. Discussion followed with a comparison to the 1997 drawdown report. Figure 15 which showed significant reduction in all rooted aquatic plants after a treatment of salt water in 1972. Mike Matlock indicated it seemed clear like the folks managing the lake knew that salt water would kill aquatic plants. General discussion on several points then followed.

Ms. Hamel then commented on the contact time for several products. She indicated that palletized *Sonar* was the way the contact time could be maintained (like a time released pill). This application was somewhat new, but that it could be permitted. A discussion followed about the label restrictions to not apply SONAR into a brackish water environment. There was concern about the close proximity of Budd Inlet, and if this would violate the label. The concentration of 5 ppb was discussed as a safe level for all human contact and use.

Discussion followed about the label testing and if SONAR had been tested in brackish water. Ms. Hamel indicated that while some of the test species were marine organisms, she was unaware of any special testing since there is little market for such a product. Mr. Lund asked about the testing from EPA's "gold book", which describes the studies and the test results. Such data was not known.

Mr. Dickison indicated that it was not necessary to prove you can treat milfoil with salt water to make a case for an estuary. He also wanted to clarify that the Tribe is not advocating salt water treatment of the lake. Milfoil is a symptom of a poorly managed environment. He asked Mr. Lund if not implementing a salt water backfush was a CLAMP position or a regulatory position of Ecology. Mr. Lund replied that it was both, but explained that it was predominately linked to the shoreline permits and the shoreline program's regulatory authority. Mr. Lund also indicated that he felt that the discussion was in the CLAMP fashion to explore the best fresh water management techniques. He continued that while Ecology does support the estuary alternative, until a decision was made about the estuary the lake is "in between stage", where balancing of all interests is needed.

Mr. Dickison indicated that it was the Tribe's interest to restore the lake to an estuary. And that this is another example of attempting to maintain a system that won't maintain.

Ms. Miller indicated that she saw three options; 1) a SONAR treatment, 2) Salt water treatment, or 3) Do Nothing. She also noted that there does not appear to be enough data at this time to know the implications of a salt water treatment. Following there was discussion about the beneficial uses of the lake including recreation and fisheries.

The discussion of fisheries discussed the various species and sizes of fish raised by the co-managers (WDFW & Squaxin Tribe). Mr. Clingman indicated that he was aware of literature showing localized Dissolved Oxygen (DO) sags underneath mats of milfoil. The result is that the effective size of lake available to fisheries shrinks. A question about the long term status of fish rearing in the lake was asked. Mr. Dickison responded with a summary of the type and age of species which are being raised and released. He concluded that fisheries were still a priority within the basin.

Discussion followed about what would happen if the "do nothing alternative" was chosen. This included permitting regarding the Section 4 & 7 under the Endangered Species Act. Concern was again expressed that permits may not be obtainable this year in a timely fashion. Other questions were raised why this permit would be any different than that for any other lake in the state.

Mr. Clingman indicated that he did not see a huge risk if nothing was done this year. He also suggested that was an agency which might be very interested in answering detailed questions about milfoil and salinity. (The research entity was the US Army Corps of Engineers testing station in Vicksburg, MS.)

Ms. Miller asked if WDFW had any concerns with the "do nothing alternative". No definitive answer was provided, and the question "What is the future of Capitol Lake" asked in response. Mr. Clingman indicated that if the lake treatment was effective for 5 years before re-treatment was needed, then the questions about if the lake would become an estuary may be resolved during the 3rd treatment cycle.

Ms. Miller inquired about the need to monitor the lake this summer to document the change. Discussion followed about the need for the lake and if there was a reason to rush to treat the lake right now. Mr. Clingman suggested that some funding be provided (to the Army Corps) to answer the questions which Mr. Dickison had proposed.

Ms. Hamel indicated that SONAR in minimal levels would not eradicate the milfoil, and she too was concerned about the long required contact time to be effective. She indicated that in her 16 years of milfoil applications, these questions were not significantly different that any of the other sites where permits had been issued. Wendy Sue Wheeler also indicated that the potential permit complied with the application requirements from the WSDA.

Mr. Schilperoort summarized that it was agreed that additional knowledge was needed before either treatment was attempted. This included the composition and density of rooted aquatic plants around the lake. It was also included a new bathometry map of the lake. Mr. Lund volunteered to undertake a literature search to see if the effects of salinity on milfoil might already be known, without needing to fund a Corps research project. Ms. Wheeler indicated that she would look into the liability aspects. Ms. Hamel indicated she would look into the research for EPA's labeling restrictions.

The meeting ended at 3:50 p.m.

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
PO Box 47775 • Olympia, Washington 98504-7775 • (360) 407-6300

MEMORANDUM

11 July 2003

TO: CLAMP Steering Committee Members

FROM: Perry J Lund, Technical Advisory Committee

SUBJECT: Milfoil Treatment in Capitol Lake

At the request of the CLAMP (Capitol Lake Adaptive Management Plan) Steering Committee, a Technical Advisory Committee was formed to assess the question of using salt water back filling as a means of controlling Eurasian water-milfoil (*Myriophyllum spicatum*) in Capitol Lake. The question was raised after concerns were voiced over the use of the approved aquatic herbicide SONAR (fluridone) in Capitol Lake because of its relatively short residence time before discharging into Budd Inlet. The TAC, with representatives from the Squaxin Island Tribe, Thurston County, the cities of Tumwater and Olympia, and the departments of General Administration, Agriculture, Natural Resources, Fish and Wildlife, and Ecology met on two occasions to discuss this issue (3, 24 June 2003).

After considerable debate, the TAC agreed that a recommendation be made to the CLAMP advising no action be taken this year to conduct any treatment in Capitol Lake to control milfoil. We do not have enough information to adequately assess the possible deleterious effects of either treatment option and there is enough uncertainty over the potential efficacy of using SONAR or salt water to control milfoil in the unique environs of Capitol Lake. Based on the information we have presently, the potential benefit associated with controlling milfoil in Capitol Lake with either SONAR or salt water is not great enough to accept the risks associated with either option.

We also do not have the time to gather the necessary information quickly enough to ensure the successful implementation of a control plan in the time available for 2003. Therefore, in addition to our recommendation that no treatment be conducted this year, we urge the Steering Committee to approve the collection of additional information on the existing conditions of the lake (e.g., water quality, plant communities, and bathymetry) and other information necessary to allow for a complete assessment of the risks and benefits associated with treating Capitol Lake, or allowing the milfoil to remain. This information could be collected over the next few months allowing for adequate time to pursue a desired course of action in 2004.

SONAR

The two primary questions concerning the use of SONAR are whether adequate contact time can be achieved in Capitol Lake and the direct flow into marine water (Budd Inlet) with a chemical that has only been approved for use in fresh water. For fluridone to be effective it is necessary to be in contact with the milfoil for a period of 8 to 10 weeks at concentrations of 8 to 10 parts per billion. Because Capitol Lake is really an extension of the Deschutes River, the hydraulic residence time is less than typically experienced in a lake system. Repeated treatments over a 10-week period would be necessary to maintain adequate concentrations of fluridone. It would be useful to have a better understanding of the flow characteristics of Capitol Lake to model the expected concentrations over time and throughout different portions of the lake. A review of available research on fluridone treatment in flow-through systems is also recommended.

The label for the approved application of SONAR includes the following restriction: "Do not apply in tidewater/brackish water." This restriction has been raised as a concern in relation to the direct connection of Capitol Lake to Budd Inlet. The departments of Agriculture and Ecology are in agreement that treatment in Capitol Lake with flow through to Budd Inlet does not constitute an application in tidal water and would, therefore, be in compliance with label requirements. Further, information from Sepro, the manufacturer of SONAR, states that the necessary testing has been done on marine species to show that there are no adverse effects when used according to label requirements. However, Sepro has not sought the approval from the US EPA to remove this label restriction due to a lack of demand for use in marine environments. If a permit was issued, Ecology would establish minimum requirements for fluridone concentrations in the outfall and would require monitoring to ensure that threshold was maintained. The TAC recommends gathering additional information on the effects of fluridone on marine organisms.

Finally, because of the prolonged contact period required, the growth habits of milfoil, and the low-flow period of the Deschutes River it is essential that treatment occur in July and August for any likelihood of success. It would be almost impossible to meet that timeline for this year. If this course of action is chosen, preparation should begin soon to obtain the necessary approvals well in advance of July 2004.

Salt Water

Draining Capitol Lake of fresh water and back-filling with salt water was performed by GA as a routine operation until 1997. This practice was discontinued after considerable discussion by the Technical Committee and others involved with the management of the lake. There were several regulatory and technical reasons associated with that decision.

The permit for the construction of Heritage Park issued in 1997 requires the protection of the freshwater mitigation sites within Capitol Lake. Salt water flushing could significantly impair the wetlands that were created adjacent to Heritage Park and the larger mitigation area at the south end of the middle basin. The safest way for GA to ensure that these systems are maintained as freshwater sites is to prevent contact with salt water.

Salt water is as effective a toxin as any chemical under the right circumstances, but it is not target specific; all in-water plant communities will be affected, not just rooted aquatic vegetation (e.g., milfoil). Sodium chloride works in the same manner as other chemical agents, by disrupting the ph of many organisms. Freshwater organisms, plants and animals, have not developed the response mechanisms necessary to process elevated salt concentrations. This can result in decreased productivity or death. The entire freshwater community will be affected by salt water flushing; insects, plants, and other organisms. There has not been a comprehensive assessment of the existing habitat conditions in Capitol Lake since 1997. Without that information we can not have any certainty about the expected impacts resulting from back-filling Capitol Lake with salt water.

Available research also shows that milfoil has a greater tolerance to saltwater than many other species. Milfoil can withstand salinities in the range of 12 to 15 parts per thousand (ppt). Salt tolerance is usually measured at a threshold of 5 ppt; marine water is generally about 25 to 30 ppt. Other species of freshwater plants and animals do not have the ability to withstand salinities as high as milfoil. To effectively treat milfoil with salt water the salinity level would have to be high enough to affect the rest of the lake. Sampling done after the back-filling in 1996 and 1997 shows that it is extremely difficult to achieve and maintain elevated salinity levels throughout the lake. The problem then becomes similar to that of using SONAR – establishing conditions that maintain the contact time and concentrations necessary to achieve effective treatment.

The recovery time of the lake is much greater after salt water flushing as a result of the significance of the disturbance. The entire structure of the lake is disrupted, from algae and bacteria to fish and vegetation. There is a significant period of time required after salt water flushing for these pieces to be put back together. This almost complete elimination of biota in the lake makes it highly susceptible to future infestations of invasive species because there is nothing to prevent any other organism from moving in.

The release of brackish water into Budd Inlet after salt water flushing is known to have significant negative water quality impacts to the bay from high nutrient loading and the resulting low oxygen availability. Studies by LOTT showed a significant decrease in dissolved oxygen levels in Budd Inlet for a period of time after the flushing of Capitol Lake.

By adopting the Capitol Lake Adaptive Management Plan (October 2002), GA and the partnering entities agreed to keep Capitol Lake as a freshwater system for at least the next ten years while management alternatives are explored. We have a six-year head start on this process because salt water has been kept out of the lake since 1997. Reintroducing salt water now will very likely have a significant negative impact on the existing fresh water system; and even under an adaptive management approach, caution should be exercised before pursuing this option.

Status Quo

The TAC advised GA to consider a third alternative to managing milfoil in the lake; the "Do Nothing" alternative. There are not significant beneficial uses that are impaired by the presence of milfoil in Capitol Lake. There is a limited amount of boating and fishing that occurs on the

lake, but other (human-related) beneficial uses are generally restricted to out of water activities (e.g., walking and jogging, scenic viewing). Safeguards could be taken to prevent boaters and others from transporting milfoil out of the lake and into other freshwater systems. Some effort would need to be made to inform the community of the decision to leave the milfoil alone and safety measures that need to be taken (e.g., signs, boating restrictions, etc.). If aesthetics (i.e., maintaining a smooth surface on the reflecting pool) is the principle reason for treating Capitol Lake, then other options such as mechanical harvesting may meet that objective in a limited area.

There is some literature available that indicates fish, birds, and invertebrates use milfoil for cover and food. So, while a community of diverse native vegetation would be preferable as habitat, we could argue that some habitat in Capitol Lake is better than none. More information on the existing conditions in Capitol Lake, including a survey of plant and animal community diversity and density, would help in evaluating this alternative against the treatment options as well as provide necessary background information for the overall CLAMP process. The TAC also recommends continuing and enhancing existing monitoring in Capitol Lake to evaluate the effects of dense beds of milfoil on dissolved oxygen levels and other water quality parameters.

Final Recommendation

Given the questions surrounding either treatment option, the short time to the end of this growing season, and the lack of information about the present habitat features in Capitol Lake, the TAC advises that no treatment be pursued this year (2003).

In addition, more information is needed before a treatment option is selected for 2004. Foremost among the questions to be answered is – Can the necessary concentrations of SONAR be maintained for the duration of the contact period? Can a salinity level be established and maintained in the lake sufficient to destroy milfoil? What are the current habitat features (plants and animals) in Capitol Lake that would be impaired or eliminated by salt water? Are the beneficial uses of Capitol Lake or adjacent waters impaired or threatened to such a degree that treatment using herbicides or salt water is warranted given the chances of success and the risks to the environment?

Finally, the TAC is also of the opinion that the language of Objective #12 of the ten-year Vision Statement - Eliminating the Purple Loosestrife and Eurasian Milfoil noxious weed infestations throughout Capitol Lake, needs to be amended for milfoil. Setting a goal of eradication of a weed like milfoil is, perhaps, unrealistic. The Steering Committee should revisit this objective and establish a more reasonable and reachable goal; perhaps one of control at a defined and acceptable level. This should allow GA to more realistically define the needs for Capitol Lake and set a management course accordingly.

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