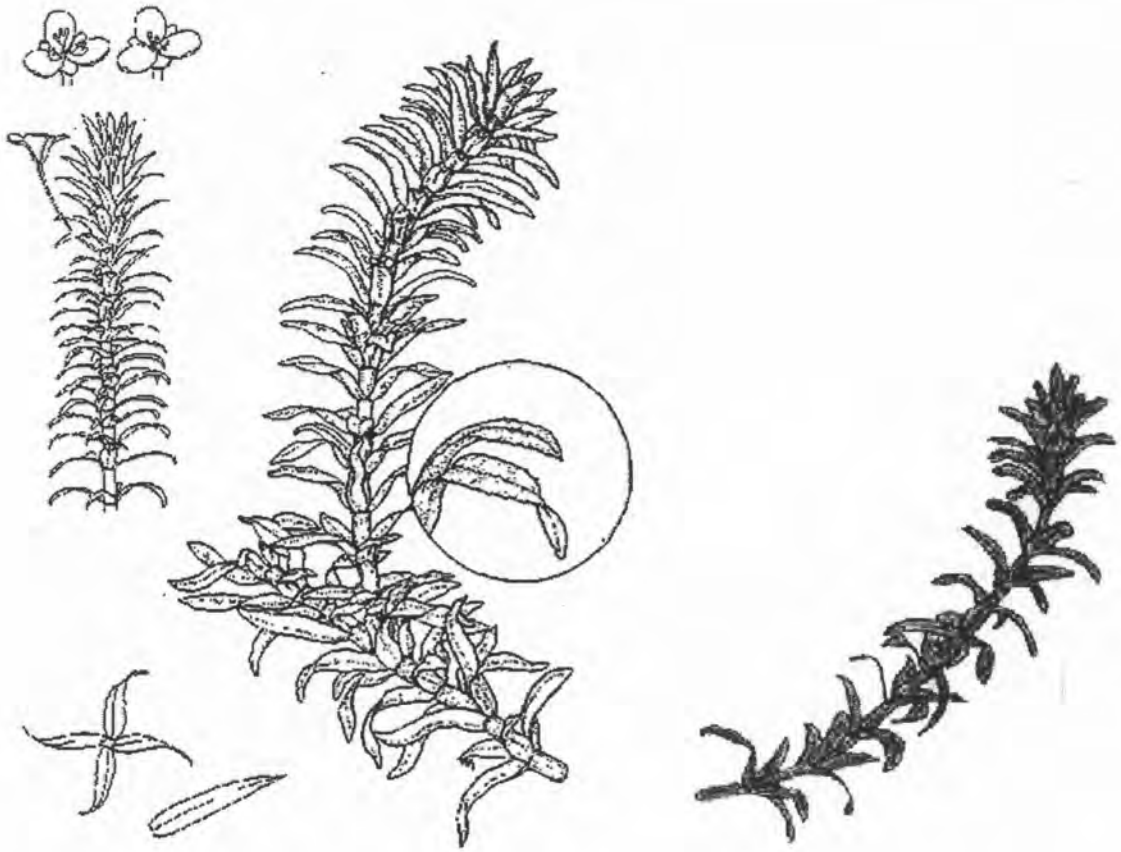
BIG LAKE
INTEGRATED AQUATIC VEGETATION MANAGEMENT PLAN



Prepared by:

David VanderMeulen
Joy Michaud
EnviroVision Corp.
1220 4th Ave E.
Olympia, WA 98506

Prepared for:

Skagit County Public Works
& Big Lake LMD

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PROJECT OVERVIEW

This plan serves as an update to the original Big Lake Integrated Aquatic Vegetation Management Plan (IAVMP) that was approved by the Department of Ecology (referred to as Ecology hereon) in 1997 (EnviroVision 1997). The original IAVMP and a detailed guide for its implementation are included as an Attachment to this document. The following paragraphs summarize the problem, outline past activities, and identify the recommended plant control strategy for the lake.

The non-native aquatic plant, Brazilian elodea (*Egeria densa*) was first officially noted in Big Lake in the mid 1970s and is included among the plants listed in the 1977 restoration study of the lake (URS 1977). Since that time the plant has increased substantially; both in terms of its distribution and density in the lake. This has occurred despite treatment with aquatic herbicides. The noxious plants Eurasian watermilfoil (*Myriophyllum spicatum*), fragrant waterlily (*Nymphaea odorata*), and yellow flag iris (*Iris pseudacorus)* have also been found in the lake. All of these plants have the strong tendency to replace native vegetation. This can result in formation of monotypic stands of these plants, instead of a natural, diverse plant community. This has been the case in Big Lake.

Dense stands of non-native plants have been found to cause a variety of ecological problems in aquatic systems. These range from deterioration in water quality, to loss of habitat for fish and other aquatic organisms. They also cause problems for the human population by obstructing recreational use and reducing the aesthetic appeal of impacted lakes. It is the stated goal of the Big Lake community to "aggressively remove Brazilian elodea, Eurasian watermilfoil, fragrant waterlily, and yellow flag iris from the lake". Since Big Lake is a large lake and Brazilian elodea has proven to be very difficult to eradicate, the goal of the lake group has been to maintain as low a population of Brazilian elodea and Eurasian watermilfoil in the lake as financially possible.

In the early 1990's, residents used Skagit County's mechanical harvester to assist with control of their aquatic plant problem. Big lake residents volunteered and were trained to perform the annual harvesting. However, the size of the lake, in combination with the fast growth rate of the plants, made the harvesting program inefficient. Basically, continual harvesting was unable to keep up with plant growth and no real relief was gained from the effort.

In 1994, Big Lake residents in concert with the Skagit County Aquatic Weeds Program applied for and received a grant from Ecology to develop an IAVMP for the lake. The purpose of that IAVMP was to develop strategies for managing aquatic plants in the lake. During the 1994 planning process, residents supported the use of sterile grass carp as a biological control mechanism to reduce the plants. However, it was unclear whether this approach could be approved by the Washington State Department of Fish and Wildlife (WDFW). Treatment of the lake with an herbicide was selected as a secondary alternative in the event of not gaining approval for the grass carp.

Grass carp were not approved for use in Big Lake because of salmon usage in the lake and the impossibility of screening all the inlets and outlets to retain grass carp, but allow salmon passage. The use of herbicide to control Brazilian elodea became the primary choice of the lake residents. The residents of Big Lake formed a lake management district in 1998 for a 5-year period and implemented the IAVMP. In 1998 Sonar® (active ingredient fluridone) was used to treat 177 acres of the lake. Since then, two other large-scale (100+ acres) herbicide treatments have taken place at the lake to control noxious weeds.

In 2002 Big Lake LMD reformed for a 10-year period. The Big Lake Advisory Committee in concert with Skagit County applied for and received a grant from Ecology to update the original IAVMP. Since the original plan was drafted, several new herbicides were approved for use in the State, as well as new aquatic plant control permits. This update also afforded the Big Lake residents the opportunity to provide input on past lake management activities and to reassess plant management goals and objectives.

The currently recommended strategy for control of Brazilian elodea in Big Lake is to maintain Brazilian elodea at low levels by annual use of the contact herbicide diquat (Reward®). Should the use of Reward® to spot treat areas of Brazilian elodea prove ineffective, the control strategy will be to use Sonar PR® to control this noxious weed. The aquatic herbicide Rodeo® will be used to control fragrant waterlilies and yellow flag iris where they are reducing beneficial uses. The long-term aquatic plant control strategy identified in the 1997 IAVMP is to implement a lake dredging program (EnviroVision 1997). Dredging was also determined to be a preferred strategy during the public meeting process in this updated plan. However, the Big Lake residents understand that this strategy is cost-prohibitive and therefore currently is not feasible. The recommended strategy for implementing the selected plant control alternatives is described in greater detail in later sections of this document. In addition to descriptions of the selected control strategies, the following report contains information on watershed protection, exotic plant control, and funding recommendations.

PUBLIC INVOLVEMENT

Public involvement for this project has included advisory committee meetings and public meetings. Each element is described below.

The Big Lake LMD has been in existence since 1998. The LMD is administered by Skagit County Public Works staff and is represented by an Advisory Committee that meets periodically to review lake management activities. The following lakeside residents are members of the steering committee: Jim Hanson, Bud Ebeling, Neil Hansen, Dan Jones, Mac McConnell, and Rick Tesarick. The Advisory Committee's role is to provide input and advice, on behalf of the lakeside community residents, to Skagit County. Skagit County staff administers and implements the LMD under the direction of the Board of Skagit County Commissioners.

EnviroVision staff met with the Advisory Committee on three separate occasions over the fall and winter of 2003 to 2004. The primary topic of discussion during those meetings was how to guide the development of an updated IAVMP for Big Lake. The Advisory Committee reviewed past plant control efforts and management goals, participated in public meetings, selected aquatic plant control alternatives, and reviewed funding options.

Two public meetings were held; one in May 2003 and another in February 2004 as part of the process to update the Big Lake IAVMP. These meetings were sponsored by the Big Lake LMD Advisory Committee and Skagit County Public Works. Public notices for these meetings were sent to all lake residents, staff at Skagit County, and consultants involved with lake management activities.

The first public meeting was held on May 20, 2003. The first meeting was devoted to providing general information on the lake and existing plant control efforts and to agreeing on aquatic plant management goals and objectives, generating a problem statement, and seeking comments and questions from the public. The second public meeting was held on February 23, 2004 to review aquatic plant control alternatives and select a few for further discussion. During this discussion a few plant control scenarios and their associated costs were presented in more detail and a preferred plant control scenario was selected. Appendix A contains copies of the public meeting agendas and lists of attendees.

LAKE AND WATERSHED FEATURES

Big Lake is located approximately 5 miles southeast of Mount Vernon in Skagit County. The lake is located in a 14,336 acre watershed that drains into the Skagit River. A detailed description of the watershed is described in the Nookachamps Watershed Nonpoint Action Plan (NWC&SC 1995). Big Lake has a total surface area of 520 acres and a total lake volume of 7,500 acre-feet. The lake is approximately 3 miles long with a maximum width of 0.5 miles. The lake is shallow, with a mean and maximum depth of 14 and 25 feet, respectively. Physical characteristics of the lake are summarized in Table 1.

Table 1. Physical characteristics of Big Lake and its watershed.

Watershed area	14,336 acres
Surface area	520 acres
Lake volume	7,500 acre-feet
Maximum depth	25 feet
Mean depth	14 feet
Shoreline length	7.6 miles

HYDROLOGY

Water enters Big Lake via groundwater seeps, direct precipitation onto the lake, stormwater runoff from the surrounding watershed, and small streams. Six unnamed tributaries are located along the western shore. The largest inflow, Lake Creek, discharges from Lake McMurray through a large wetland complex that abuts the southern end of Big Lake. Flow in this creek was measured as part of the Big Lake Restoration Study (URS 1977) ranged from 16 to 117 cubic feet per second (cfs) with an annual average discharge of 39 cfs. Flows of less than 1 cfs have been observed recently, although no direct flow measurements were taken (Woolett, S. Pers. Comm.) Water discharges from Big Lake through Nookachamps Creek on the northern shore, eventually ending up in the Skagit River. Flow in Nookachamps Creek has ranged from 18 to 129 cfs with an annual average flow of 56 cfs (URS 1977). Flow measurements were also taken in Nookachamps Creek from 2001 to 2003 as part of a baseline monitoring project (Skagit County 2004). Flow during this period ranged from 1 to 137 cfs at the lake outlet.

WATER QUALITY

"Eutrophication" is a term used to describe the physical, chemical, and biological changes associated with enrichment of a lake due to increases in nutrients and sediment over time. Although eutrophication occurs over time as a natural process, it can be greatly accelerated by human activities in a watershed. Natural eutrophication processes occur on a time scale of hundreds to thousands of years and are generally not observable in a single human lifetime. Human induced or "cultural" eutrophication can result from activities within the watershed including development, forestry, resource extraction (i.e., peat mining) landscaping, gardening, and animal keeping. All of these activities contribute nutrients and sediment to surface waters. Sediment inputs from watershed activities results in the slow filling in of lakes which also accelerates the overall eutrophication process. Cultural eutrophication can result in observable changes within a few decades, or less.

The most common way lakes are classified is by their trophic state, which defines a lake in relation to the degree of biological productivity. Lakes with low nutrients, low algae levels, and clear water are classified as nutrient poor or "oligotrophic". Lakes with high nutrients, high algae levels, and low water clarity are classified as nutrient rich or "eutrophic". "Mesotrophic" lakes have water quality characteristics between these two classifications.

Classifying a lake based on its trophic state is a useful way to describe changes in a lakes' water quality over time and assess the potential sensitivity of a specific lake to additional nutrient loading. Total phosphorus, chlorophyll *a*, and transparency are the three water quality parameters most often used to rate the overall trophic condition of a lake. Phosphorus is one of the essential nutrients for plant growth. Total phosphorus includes all soluble, organic, and particulate forms of phosphorus. Chlorophyll *a* is one of a family of green pigments that allows green plants to perform photosynthesis. Chlorophyll *a* concentration is correlated to the abundance of algae in a lake. Water transparency is commonly measured as the depth at which a black-and-white disk (i.e., Secchi disk), when lowered into the water, ceases to be visible. Algal growth, organic acids, and suspended solids all influence Secchi depth transparency.

Only sporadic water quality monitoring has taken place at Big Lake since detailed data was collected at Big Lake during the Phase I Restoration Study (URS 1977). Ecology collected and analyzed water quality data in 1995 and 1999 through the Lake Water Quality Program. The trophic status of Big Lake was determined by Ecology in those years using Carlson's (1977) trophic state indices (TSI) for chlorophyll *a*, total phosphorus, and Secchi disk depth (Table 2). The data consistently indicate the lake is borderline eutrophic for all three parameters. The lake was included on the 1998 Section 303(d) list of impaired waters of the federal Clean Water Act (WDOE 2004) for total phosphorus. It is important to understand that most monitored lakes in the Puget Sound Basin are likely to be included on this list for total phosphorus.

Table 2. Trophic State Classification (TSI)[1] for total phosphorus (TP), Chlorophyll *a* (Chl *a*) and Secchi Disk (SD) depth.

Year	*TSI-TP*	*TSI-Chla*	*TSI-SD*
1995 [2]	51	54	46
1999 [3]	46	50	44

[1] *TSI's calculated using Carlson's (1977) trophic state indices. TSI values of 0 – 40 = oligotrophy, 40 – 50 = mesotrophy, and >50 eutrophy.*
[2] *Data collected May and September only. Source: WDOE 1995.*
[3] *Data collected monthly June – September. Source: WDOE 2002a.*

WATER RIGHTS

A search of Ecology's Water Rights Applications Tracking System indicated that there are 63 active surface water rights that list Big Lake as their source (WDOE 2004). Of these 63 surface water rights, 44 have "0" assigned to their current water withdrawal rate (Qi). The remaining water rights (19) have maximum Qi values ranging from 0.01 to 5.00 cubic feet per second. Ecology issues a disclaimer associated with water rights that states "*Because of unauthorized changes or non-use, Ecology cannot guarantee the validity of Permits, and Certificates.*" The actual number of residents who use the lake for irrigation has never been verified. To date, neither Skagit County nor the Advisory Committee has surveyed lakeside residents to determine if existing water rights on Big Lake are being used for drinking water (Woolett, S. Pers. Comm.). However, residents are notified of herbicide treatments (including associated water use restrictions) in advance by the company performing the work.

SEDIMENT

Sediment cores were collected at Big Lake as part of the Phase I Restoration Study (URS 1977). The sediments were found to be rich in organic material with high levels of nitrogen and phosphorus. However, it was theorized that the contribution of phosphorus to the water column from sediments was not likely to be a factor in fueling algae growth due to the short retention time of water in the lake (URS 1977).

In general, sediment in the nearshore areas along the western and eastern shorelines is rocky sandy cobble overlain by a thin layer of mucky material. This mucky layer is much deeper in the shallow areas in the northern and southern ends of the lake. It was determined that since 1945 the annual sedimentation rate in the lake has nearly doubled (URS 1977). This increased sedimentation rate was attributed mainly to soil erosion from logging activities in the watershed (URS 1977).

FISH AND WILDLIFE COMMUNITY

The Washington Department of Fish and Wildlife (WDFW) has managed Big Lake as a mixed fishery (warm and cold water fish) for many years. The warmwater fishery was last surveyed in 1997 prior to the Sonar® treatment in 1998 (WDFW 1999). The purpose of the survey was to collect baseline information that would be useful when monitoring the long-term effects of the Sonar® treatment (WDFW 1999). A list of all fish species found during the 1997 survey is shown in Table 3. No fish surveys have occurred at Big Lake since 1997.

Table 3. Fish species composition at Big Lake in the summer of 1997 (revised from WDFW 1999).

	by Weight		*by Number*		*Size Range (mm)*	
Fish species	*kg*	*%*	*No.*	*%*	*Min.*	*Max.*
Largescale sucker	52.3	31.4	53	3.1	176	542
Largemouth bass	58.8	35.3	439	25.2	21	488
Cutthroat trout	2.1	1.3	9	0.5	225	351
Yellow perch	27.3	16.4	874	50.3	32	247
Brown bullhead	12.8	7.7	23	1.3	139	386
Coho salmon	0.1	0.1	1	0.1	202	
Pumpkinseed	9.0	5.4	229	13.2	50	160
Black crappie	4.0	2.4	97	5.6	72	190
Sculpin spp.	0.3	0.2	14	0.8	29	155

The lake was stocked with rainbow trout fingerlings in 1988 and 1992 and is used by several resident and anadromous salmonids species (see Threatened or Endangered section). No rainbow trout are known to have been stocked in the lake since 1992 (Downen, M. Pers. Comm.).

THREATENED OR ENDANGERED PLANTS AND ANIMALS

Updated information on rare, threatened or endangered plant species was obtained from the Natural Heritage Program at the Washington Department of Natural Resources (WDNR 2004). The report did not identify any rare, threatened, or endangered plant species at Big Lake.

Information on rare, threatened or endangered animal species and priority habitats was obtained from the Priority Habitats and Species Program of the WDFW (WDFW 2004). Bald eagles were listed as a "breeding occurrence" in the report. According to the report, Big Lake is included as bald eagle territory based on "observed aerial survey observations, local knowledge, and information on basic eagle behavior".

The WDFW report also states that Nookachamps Creek (the outlet of Big Lake) has both priority anadromous and resident fish present. Anadromous fish species include coho salmon and winter steelhead. Resident fish species for Nookachamps and Lake Creek (the inlet to Big Lake) and Big Lake itself include: resident cutthroat trout, coho salmon, and Dolly Varden/bull trout. The presence of these anadromous and resident fish species was also documented in a salmon habitat limiting factors report for water resource inventory areas 3 and 4 (WSCC 2003).

The southern and northern ends of the Big Lake contain priority habitat in the form of high-quality wetlands. These areas are protected by local sensitive area ordinances. These wetlands serve as valuable habitat to fish and wildlife, act as filters to non-point sources of pollution, and help alleviate flooding.

CHARACTERISTIC USE

The lake is heavily utilized for recreation by the public and by shoreline residents and their guests. The WDFW ramp on the western shore provides public boat access. The lakes' close proximity to the City of Mount Vernon provides easy access for lake users for water skiing, jet skiing, fishing and boating. Big Lake "use zones" are shown in the original IAVMP (EnviroVision 1997). No significant changes have occurred with those "use zones" since the original IAVMP was developed.

Over 90% of the Big Lake shoreline has residential development. In 2002 the Big Lake LMD was comprised of:

- 255 single dwelling developed parcels,
- 89 undeveloped parcels,
- 13 Condominiums,
- 6 parcels with 2+ dwellings, or parcels with multiple access, and
- 1 WDFW (public) boat launch.

The residents use the lake for swimming, fishing, and boating and waterskiing. Most residents and lake users swim within the "no-wake" zones in the nearshore areas of the lake. Other activities such as fishing and boating occur lake-wide.

HISTORY OF PLANT CONTROL ACTIVITIES

The residents of Big Lake have managed aquatic plants since at least 1994. A summary of aquatic plant management efforts is provided in Table 4 and described below.

Table 4. Summary of aquatic plant control methods [1]

Year	*Control Method*
1994	Mechanical Harvesting [2]
1995	None
1996	None
1997	None
1998	Sonar® (177 acres)
1999	None
2000	None
2001	None
2002	Aquathol® (126 acres)
2003	Sonar® (177 acres)

[1] Does not include plant control (e.g. pulling, raking, bottom barriers, limited herbicide use) by individual lake residents

[2] Lake residents used Skagit County's harvester to control submerged plants. Total number of acres harvested is unknown. Continual harvesting could not keep up with plant growth and effort was deemed ineffective

In 1994 lake residents used the County's aquatic plant harvester to mechanically remove vegetation from the lake. However, continual harvesting could not keep up with plant growth and no sustained relief was gained from the effort. The lake residents applied for and received a grant from Ecology in 1994 to develop a plant management plan. Residents generally supported using grass carp for biological control but it was not clear if WDFW would approve. The lake residents also determined that herbicides were their second choice for aquatic plant control. A plan for grass carp was drafted (EnviroVision 1997) but with the salmon issues it did not seem likely to be approved.

In 1995 the aquatic plant communities were surveyed, with Brazilian elodea the dominant species. A general list of dominant plants in Big Lake included Brazilian elodea, coontail (*Ceratophyllum demersum*), pondweeds (*Potamogeton praelongus and richardsonii*), common waterweed (*Elodea canadensis*), spatterdock (*Nuphar lutea*) and watershield (*Brasenia schreberi*) in the shallow areas. Pioneering colonies of Eurasian watermilfoil were also discovered in 1995. By the summer of 1996 divers observed an expansion of Eurasian watermilfoil (*Myriophyllum spicatum*) and places where the plant was becoming dominant.

In 1998 a Lake Management District (LMD) was formed at Big Lake to coordinate efforts to combat the noxious aquatic plants. An aquatic herbicide called Sonar (active ingredient

fluridone) was the control method chosen by the lake residents and Skagit County. Prior to the application of this herbicide a preliminary dive survey was conducted (RMI 1998). Brazilian elodea was again identified as the dominant plant, and in many places was growing in monotypic stands or mixed with coontail and/or pondweeds. The littoral zone within the 13-foot depth contour of the lake (177 surface acres) was treated with a granular formulation of Sonar (Sonar SRP®) three separate times during the summer of 1998. A post-treatment aquatic plant survey was conducted in the fall. It was reported that the vast majority of the Brazilian elodea and Eurasian watermilfoil in the lake was controlled, as evidenced by dead and dying plants (RMI 1998).

An aquatic plant diver survey was conducted in the spring of 1999 (RMI 1999a). It was determined that significant weed control had taken place in 1998, with the complete elimination of monotypic stands of topped out Brazilian elodea. Overall, approximately 85-95% of the Brazilian elodea was killed, with only a few green stems remaining. No surviving Eurasian watermilfoil plants were found during the survey. An additional surface (non-diver) survey in the fall of 1999 revealed that Brazilian elodea was again dominant in the 5'-15' depth range, although the plants were only a few feet high and not interfering with recreational uses (RMI 1999b). It was noted in the report that the lake bottom in the 5'-15' depth range would likely be completely filled in with Brazilian elodea in a year or two, yet it was still significantly reduced at the time of the fall survey (RMI 1999b). However, Ecology staff surveyed the lake in the fall and found that the southern end of the lake did have areas of dense and topped out Brazilian elodea (Ecology 2002a). Ecology also found patches of Brazilian elodea growing in other areas of the lake. No Eurasian watermilfoil was detected in either fall survey in 1999.

An aquatic plant survey conducted in the spring of 2000 showed that Brazilian elodea was making a strong comeback (RMI 2000). Lake residents also reported that both native plants and Brazilian elodea were making a comeback (Skagit County 2000). As a cost-saving measure, the LMD Advisory Committee decided not to treat the lake in 2000. The Advisory Committee reasoned that this decision not to treat the lake in 2000 would allow sufficient funds for Aquathol® or Reward® treatments in both 2001 and 2002. However, due to statewide legal and permitting problems, no chemical treatments took place in 2001. Aquatic vegetation continued to be problematic due to extensive growth of native pondweeds and Brazilian elodea (AquaTechnex 2001).

In 2002 residents of Big Lake decided to use their remaining funds to treat the lake with Aquathol® (Aquathol® was the only affordable alternative to the residents, as diquat was not yet approved for use by Ecology.). Approximately 126 acres of the littoral zone was treated with Aquathol® in July (AquaTechnex 2002). The primary objective of the treatment was to provide season-long relief from Brazilian elodea until a more effective treatment could take place in 2003. The effectiveness of the treatment was not documented. The LMD was re-formed at the end of 2002 with the primary goal of updating the existing IAVMP and implementing its recommendations.

A dive survey of the lake was conducted in the spring of 2003 prior to an herbicide treatment (see 2003 Aquatic Plant Community section). The lake was heavily infested with Brazilian elodea (EnviroVision 2003). Three applications of Sonar PR® were made to 177 acres of the

lake from late May to early July (AquaTechnex 2003). Control of aquatic vegetation was reported to be in excess of 90% (AquaTechnex 2003). A diver survey is scheduled to take place in the spring of 2004 and will provide an update on Brazilian elodea survival and document the recovery of native vegetation.

2003 AQUATIC PLANT COMMUNITY

An aquatic plant survey was conducted on June 2 and 3, 2003 to identify aquatic plant communities in Big Lake and document plant coverage. During the survey a SCUBA diver swam from the shore to the extent of aquatic plant growth in transects perpendicular to the shoreline. Detailed locations and relative densities of the different plant communities were relayed to technicians on a support boat along each transect. Locations of the different plant communities were recorded along each transect using GPS equipment preloaded with a georeferenced aerial photograph of the lake. The aerial photograph was provided by Skagit County Geographic Information Systems (GIS) Mapping Department and Space Imaging.

Dive transects were established every few hundred feet along the shoreline. In areas of the lake with relatively homogenous aquatic plant community composition (eastern and western shorelines) individual transects were located farther apart. In the northern and southern ends of the lake with more diverse aquatic plant communities transects were located closer together.

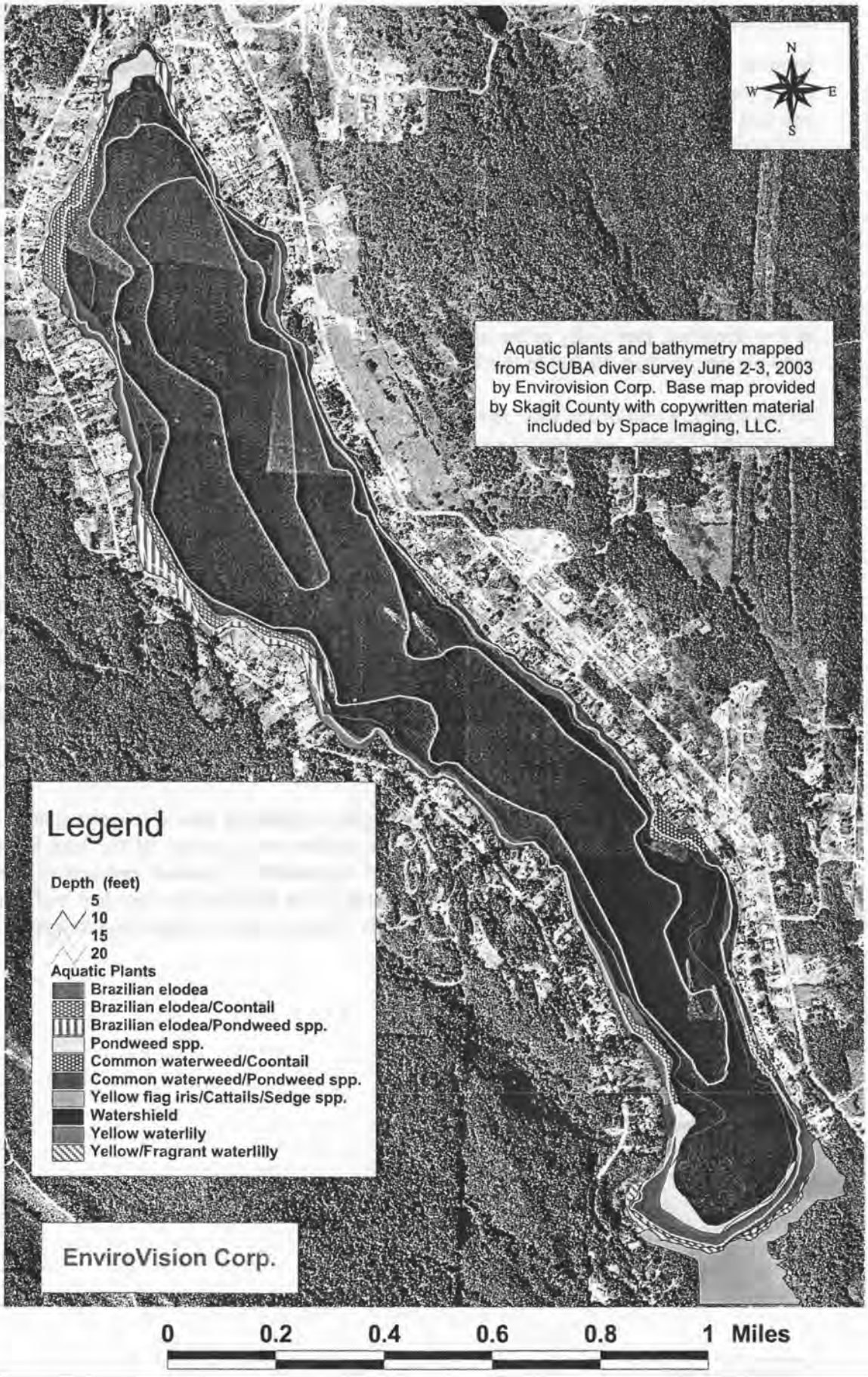
A bathymetric survey was conducted after completion of the diver survey using a depthfinder and GPS equipment. Lake depths were recorded at the 5, 10, 15, and 20-foot depth contours during frequent transects from the western to eastern shorelines. Transects were also established at the northern and southern ends of the lake and ran perpendicular from the shoreline to the intersection of a west to east transect.

Data on plant community composition and lake depths was differentially corrected to sub-meter accuracy using GPS software, downloaded into a GIS program (ArcView 3.3), and displayed on a georeferenced aerial photograph of Big Lake. The data from the plant and bathymetric survey transects was then used to produce a map showing the aquatic plant communities and depth contours of the lake (Figure 1). The aerial photograph supplied by Skagit County was used as the base layer for this mapping effort.

The map simplifies the coverage of submerged and emergent aquatic plants in the lake to major growth zones. Although plant community composition can be unique to any given area of the lake, the map depicts a reasonably accurate portrayal of the different locations of the plant communities in relation to each other, the shoreline, and the depths at which they are dominant.

Bathymetrically, the western and eastern shorelines have a relatively steep slope and depths increase dramatically from the shoreline out into the lake. Sediment accumulation in these areas is low near the shoreline with a rocky sandy cobble in the nearshore areas. The northern and southern areas of the lake are relatively shallow and have a more gradual slope to deeper water depths. These areas provide more extensive habitat for emergent and submerged aquatic plants and have deeper accumulations of sediment in the nearshore area.

Figure 1. Big Lake 2003 Aquatic Plant and Bathymetric Survey



In most of the lake native plants or a mixture of native plants and Brazilian elodea exist at low (0-10 plants per square meter) to medium (10 to 20 plants per square meter) density between the one and five-foot depth. Between the 5 to 10 foot depths Brazilian elodea or some combination of Brazilian elodea/coontail/pondweeds dominates the lake at moderate to high (>20 plants per square meter) densities. Richardson's pondweed (*Potamogeton richardsonii*), white-stemmed pondweed (*Potamogeton praelongus*), and coontail dominate the deeper (>10 feet) waters at low to moderate densities. A list of all aquatic plant species found during the survey is shown in Table 5.

At the northern end of the lake, native submerged aquatic plants are mixed with Brazilian elodea at low densities, especially in the northeastern corner. No submerged aquatic plants were found growing deeper than 10 feet in this region of the lake.

At the southern end of the lake, Brazilian elodea mixed with pondweeds, coontail, and American waterweed (*Elodea canadensis*) were observed at the 2 to 5 foot depths in high densities. The 5-10 foot depth was dominated by Brazilian elodea at high densities while white-stemmed and Richardson's pondweed was present at moderate to high densities in the waters deeper than 10 feet.

The plant communities of the western and eastern regions of the lake were fairly similar, with Brazilian elodea somewhat more common along the western shoreline than the eastern shoreline. Between the 1 to 5 foot depth, a variety of native aquatic plants existed, the most common being American waterweed. However, Brazilian elodea dominated the 1 to 5 foot depths in certain areas of the western and eastern shoreline where the lake bottom slopes steeply downward. Between 5 to 10 foot depth, Brazilian elodea, alone or mixed with native aquatic plants, dominated the bottom at highly variable densities. With a few minor exceptions, no submerged aquatic plants were found growing deeper than 10 feet in these regions of the lake.

The distribution of floating-leaved and emergent vegetation was relatively sparse and highly variable at the time of this survey. However, in the southern end of the lake the 0 to 2 foot depths were dominated by dense patches of spatterdock (*Nuphar polysepala*) and fragrant waterlily (*Nymphaea odorata*), while the wetland to the south of the lake had highly dense areas of yellow flag iris (*Iris pseudacorus*), cattails (*Typha* spp.), sedges (*Carex* spp.), and rushes (*Juncus* spp.).

Table 5. List of aquatic plants and macroalgae observed during the 2003 SCUBA survey of Big Lake.

Scientific Name	*Common Name*	*Community Type*
Brasenia schreberi	Watershield	Floating-leaved
Carex spp.	Sedges	Emergent
Ceratophyllum demersum	Coontail	Free-floating
Egeria densa	Brazilian waterweed	Submerged
Elodea canadensis	American waterweed	Submerged
Iris pseudacorus	Yellow flag iris	Emergent
Isoetes spp.	Quillworts	Submerged
Juncus spp.	Rushes	Emergent
Nuphar polysepalum	Yellow water lily	Floating-leaved
Nymphaea odorata	White water lily	Floating-leaved
Potamogeton foliosus	Leafy pondweed	Submerged
Potamogeton pectinatus	Sago pondweed	Submerged
Potamogeton praelongus	White-stemmed pondweed	Submerged
Potamogeton richardsonii	Richardson's pondweed	Submerged
Typha spp.	Cattails	Emergent
Vallisneria americana	Water celery	Submerged
Chara	Muskgrass	Macroalgae
Nitella	Nitella	Macroalgae

AQUATIC PLANT MANAGEMENT GOALS

The following list of aquatic plant goals was developed by the Big Lake Advisory Committee and lake residents:

- Aggressively remove noxious weeds such as Brazilian elodea, Eurasian watermilfoil (if found), fragrant waterlily, and yellow flag iris from the lake
- Promote better watershed management
- Reduce algae blooms
- Eliminate the need to mechanically harvest weeds
- Swim, waterski, and boat without touching weeds

The list of goals was used to create a problem statement for Big Lake. The purpose of the problem statement is to describe as clearly as possible how the lake and its inhabitants are being negatively impacted by aquatic plants. The following problem statement was developed for the lake:

> *Big Lake provides important wildlife habitat, and offers many recreational opportunities, including; swimming, fishing, boating, and shoreline-related*

activities. The lake has a WDFW boat ramp and is heavily used by both lake residents and the public for recreation. Beneficial uses of the lake have been severely impacted from dense, prolific growth of invasive aquatic plants.

The shallow shoreline area provides an excellent habitat for aquatic plants. Over the past decade both physical and chemical control methods have been used to target aquatic plants. However, dense stands of Brazilian elodea continue to negatively impact recreational uses. Although these noxious weeds are currently at low levels they remain a threat to fish and wildlife habitat and beneficial uses. Fragrant waterlily and yellow flag iris populations are beginning to expand in the lake and residents are concerned about the impact these plants are having on recreation and lake access. Unfortunately these plants grow at their densest in the nearshore zone, which is also the portion of the lake that is valued and utilized most by lake residents and visitors.

In summary, because of the presence of noxious weeds and to a lesser extent native plants, the lake community is concerned about the impact to/effect on recreational use of the lake. They are also concerned about the long-term deterioration in water quality the plants will cause, the safety hazard the plants present to swimmers and boaters, and the commensurate loss in property values.

PLANT CONTROL OPTIONS

As part of a comprehensive review of plant management techniques, all control alternatives described and approved by Ecology (WDOE 1994) (also see: http://www.ecy.wa.gov/programs/wq/plants/management/index.html) were initially considered for use in Big Lake. These included the use of various herbicides, harvesting, rotovation, sediment dredging, stocking grass carp, and other techniques. The process for selection of the preferred control option(s) began with presenting the entire range of control alternatives typically available to Washington State residents. The advantages and disadvantages of each were described as well as a discussion of their appropriateness for use in the lake.

The aquatic herbicide diquat (Reward®) and two pelleted formulations of Sonar® (Sonar PR® and Sonar Q®, active ingredient fluridone) have been approved for use in Washington State since the original IAMVP and implementation plan was written (EnviroVision 1997). Triclopyr and imazapyr are two herbicides now approved for use in 2004. However, neither triclopyr nor imazapyr are suitable for the control of Brazilian elodea, although either herbicide may be used for the control of yellow iris and fragrant water lily. Appendix B provides detailed information on the aquatic plant control methods approved for use in Washington. (Appendix C provides information on permitting requirements for the different aquatic plant control methods.) The most feasible control alternatives were selected and combined to form different strategies that met some or all aquatic plant management goals.

The main aquatic plant of concern in Big Lake is Brazilian elodea. Although the most recent herbicide treatment has nearly eradicated Eurasian watermilfoil, it has been found in the lake at pioneering levels and is also a concern. Other concerns include; the presence of the noxious weed fragrant waterlily in shallow waters, degradation of shoreline habitat by the noxious emergent plant yellow flag iris, preserving aquatic vegetation in undeveloped areas of the lake, and keeping individual homeowners informed on how to perform small-scale plant control efforts.

Four methods for controlling Brazilian elodea were presented. These were:

- Annual use of mechanical harvesting.
- Stock grass carp for long-term control.
- Annual use of contact herbicides (diquat or endothall).
- Periodic use of a systemic herbicide (fluridone)

Only one technique for the control of non-native floating-leaved (fragrant waterlily) and emergent vegetation (yellow flag iris) was considered since other control methods were deemed to be ineffective and/or not feasible. The control method was:

- Applications of the systemic herbicide glyphosate (Rodeo®) to control fragrant waterlilies and noxious emergent plants (yellow flag iris) when they impede beneficial uses (e.g. swimming, lake access).

A few residents had some concerns about the use of chemicals in an aquatic environment. Discussions of the toxicity of the selected herbicides and the herbicide approval process helped to alleviate some of these concerns. Toxicity information for diquat, fluridone and glyphosate is provided in Appendix D. The following summary of the herbicide approval process is provided for clarification.

To be approved for use in aquatic environments, an herbicide must pass stringent toxicity testing by the federal government. These tests are designed to assess impacts to the target population (plants) as well as non-target populations such as fish, aquatic insects, and other organisms. The tests also examine what happens to the chemical over the long-term to insure the chemical quickly breaks down into a non-toxic form and that, for example, it does not accumulate in sediments or fish tissue. Herbicides approved for use in Washington State undergo an additional review process called a risk assessment. Many of the aquatic herbicides approved for use in the United States have been approved for use in Washington, although a few are not allowed under the State's more stringent standards. The relatively low toxicity of the herbicides (diquat, fluridone, and glyphosate) considered for use in this plan warranted their acceptance as three aquatic herbicides allowed for use in Washington State.

RECOMMENDED AQUATIC PLANT CONTROL PLAN

The following control strategies were agreed upon after lengthy discussion. A detailed discussion of plant control methods is provided in Appendix B, permitting requirements are provided in Appendix C, and herbicide toxicity and water use restriction information is provided in Appendix D.

INVASIVE AQUATIC PLANT CONTROL

BRAZILIAN ELODEA CONTROL

The management objective for Brazilian elodea is control. Because of the difficulty in eradicating this weed from the lake during past efforts, the Advisory Committee, lake residents, and Skagit County staff have determined that maintaining this plant at low levels is more realistic. The contact herbicide diquat will be used to perform annual spot control of Brazilian elodea.

It is estimated that up to 50 acres of Brazilian elodea will require treatment in 2004. This estimation is based on past experience with Sonar® at Big Lake and how much Brazilian elodea remained the year after treatment. The areas most likely to be treated include the narrow western and eastern shorelines and near the Lake Creek Inlet. Annual spring surveys will be performed to document where Brazilian elodea survived the treatment from the previous year and where new areas of infestation are occurring (see Monitoring, Evaluation and Implementation section). The annual surveys will provide a more exact number of acres to be treated.

The optimal time to treat aquatic plants with herbicides is in the spring, when most aquatic plants are still actively growing and more susceptible to herbicides. However, WDFW has a "Timing Table" that restricts the timing of certain aquatic herbicide applications to protect specific fish species during spawning and early development. In accordance with this table, diquat treatments should not occur at Big Lake prior to July 15 in order to protect juvenile coho salmon, steelhead, bull trout, and large-mouth bass. The treatment of Brazilian elodea with diquat should take place as soon as possible after July 15 to maximize the amount of time that lake users experience improved recreational opportunities.

Diquat is a contact herbicide that became available for use in Washington for noxious and nuisance weed control in 2003 (WDOE 2002). As with any aquatic plant control efforts involving herbicides, employing diquat as a control method requires a National Pollution Discharge Elimination System (NPDES) permit. This non-selective herbicide, applied at a rate of two gallons per surface acre as suggested by the product label, should control all aquatic plants above the sediment it comes in contact with (note: the actual application rate is determined by the applicator). However, in accordance with the label diquat should only be used to treat up to ½ of littoral zone of the lake in any single treatment event to avoid excessive oxygen loss in the water due to decomposing plants. Additionally, the applicator must wait at least 14 days before performing a follow-up treatment if necessary.

There are water use restrictions indicated on the herbicide label that the lake residents, property owners, and lake users must be made aware of. In accordance with the NPDES permit, these restrictions will be provided to lake residents before the treatment occurs. A summary of the water use restrictions (# of days after application until water is safe for a particular use) for diquat when used to treat aquatic plants at a rate of two gallons per surface acre is as follows:

- drinking water – 3 days,
- fishing and swimming – 0 days (no restriction),
- livestock consumption – 1 day,
- spray tank applications and irrigation for turf and ornamentals – 3 days,
- irrigation and spray tank applications for food crops – 5 days.

Additionally, a 24-hour swimming advisory must be posted at all public entry sites to the treatment area warning that exposure to treated water may result in eye irritation (WDOE 2003).

Diquat is removed from the water column very quickly, mainly by adsorption to plants, suspended particles, or sediments (EPA 1995). Diquat also is degraded by sunlight (photodegredation) if it remains in the surface waters and is not already absorbed to particulate matter. Little to no bioaccumulation of diquat occurs in fish, and consuming fish from the lake after treatment should not be a concern (EPA 1995).

Because Brazilian elodea often grows in dense beds that reach the surface, water exchange is often inhibited between the upper and lower areas of the water column. Applicators should consider applying this herbicide using a boom and weighted hoses to insure adequate coverage. Not applying the herbicide in this fashion may only cause the upper portions of the plants to be "burned" back, potentially allowing for rapid regrowth. Additionally, care should be taken to not disturb bottom sediments during application as increased water turbidity has been shown to reduce diquat efficacy (Poovey and Getsinger 2002).

The 2004 diquat treatment of 35 to 50 acres is estimated to cost up to $15,000. In the following years approximately $40,000 will be collected annually for Brazilian elodea control. Therefore, in those years diquat could be used to treat 100 to 130 acres. The total cost estimate to annually treat Brazilian elodea with a contact herbicide over the 10-year period of the current LMD is $327,000 (Table 6).

Contingency Plan – Sonar PR®

The residents of Big Lake and Skagit County staff understand that even with annual surveys and herbicide treatments with diquat there is no guarantee that Brazilian elodea will remain under control. Therefore, if surveys reveal that Brazilian elodea is not being effectively controlled by the diquat treatments, the systemic herbicide Sonar® will be used to reduce the Brazilian elodea population in the lake. The objective of the treatment would be to eliminate up to 90% of existing Brazilian elodea so a contact herbicide (diquat) could be again used annually to maintain the plant at low levels or until Sonar® is needed again.

It is likely that the methods used to employ this control technique would be similar to those used in the 2003 treatment. In short, a granular formation of Sonar® would be applied to most of the littoral zone of the lake on three or four occasions at 2-3 week intervals in the spring and summer. This allows the concentration of the active ingredient (fluridone) to remain at a high enough level to kill the Brazilian elodea through long-term exposure.

The cost of the 177-acre Sonar® treatment in 2003 was approximately $175,000 (Table 6). It is likely that this cost will increase in the future due to annual increases in the cost of product and services. Although specific funds were not designated the LMD to perform this treatment in the future, money remaining in any one year is rolled over to the next and could be used towards this effort. Additional funds may be required in order to implement this control method if it is employed.

FRAGRANT WATERLILY CONTROL

The management objective for fragrant waterlilies is also control. To meet these needs, targeted applications of glyphosate (Rodeo®) are recommended.

Fragrant waterlilies grow in nearshore areas (<10 feet deep) and favor areas with deep mucky sediment. Most of the fragrant waterlilies are located at the southern end of the lake adjacent to the large wetland. However, some of these plants are beginning to encroach into residents' waterfront areas near the wetland, as well as smaller patches in other areas of the lake (Figure 1).

The first treatment should take place no earlier than mid-summer to ensure that all fragrant waterlilies have reached the surface of the lake in the areas where they will be treated. It is common for some plants to survive the initial treatment as they are either not identified by the applicator or herbicide is washed off by waves. Thus a second treatment conducted a few weeks later would result in improved control.

Glyphosate was selected for the herbicide treatment because of effectiveness, duration, low cost, and negligible environmental impact. Glyphosate is a systemic herbicide that is absorbed by foliage and passed throughout the plant. Since it kills the rhizomes, it results in long-term control of the plant community. This herbicide has low toxicity to bottom-dwelling organisms, fish, birds, and other mammals and dissipates quickly; therefore it is considered to have a low environmental impact. Fragrant waterlilies co-exist with other native floating-leaved plants such as spatterdock (yellow waterlily) and watershield. Care should be taken by the applicators to avoid collateral damage to the native floating-leaved plants.

The Big Lake Advisory Committee and Skagit County staff should request that lake residents contact the County if they think they have these plants in front of their property and would like them sprayed. Prior to treatment a detailed aquatic plant survey and GPS mapping effort would be conducted to identify all the fragrant waterlilies (individual plants and patches of plants) in the lake and verify reports from lake residents. Glyphosate would then be applied to these patches and single plants in the areas requested by lake residents. One advantage of glyphosate

is that it can be used to control fragrant waterlilies inside of lake residents' docks, providing more relief from these noxious weeds.

It is recommended that the treatment of fragrant waterlilies be performed by the same herbicide applicator who is conducting the diquat treatment. This will be the best use of LMD funds. The total number of acres of fragrant waterlilies depends on how many lake residents request that they be sprayed. This could range from no treatment at all up to a few acres. The areas to be treated with glyphosate should be reviewed and approved by the Advisory Committee prior to any treatment.

The cost of using glyphosate typically ranges from $250 - $350 per acre treated. Because no more than a few acres of fragrant waterlilies are likely to be sprayed in any given year, funds not used for Brazilian elodea treatment could be used to spray fragrant waterlilies (Table 6).

Lake residents need to be aware that spraying waterlilies may result in floating mats of decomposing roots and rhizomes up to a year after treatment. Mat formation appears to be dependent on sediment type and may not occur in Big Lake. If floating mats do occur, an individual Hydraulic Project Approval from Fish and Wildlife (a kind of permit) will be needed to remove these mats. The mats could become navigation hazards or block access to the lake for individual residents if they are not removed from the water.

It may not be cost-effective to hire an applicator to spray fragrant waterlilies if only a few plants are targeted for control by lake residents. The residents might consider waiting until more fragrant waterlilies are targeted for control in subsequent years. Alternatively, although difficult, other methods such as hand-pulling or diver hand-removal could be used to control low numbers of these plants. It should also be emphasized that lakeside residents are allowed to locally remove fragrant waterlilies by handpulling, installing bottom barriers, or other physical methods, as long as they follow the Hydraulic Project Approval provisions as outlined in the Fish and Wildlife brochure – Aquatic Plants and Fish. Although these other methods require time and energy on the part of the residents, it complements other control efforts.

YELLOW FLAG IRIS CONTROL

Yellow flag iris is a noxious aquatic plant that is targeted for control. This emergent plant inhabits the shoreline of the lake and often exists in locations above the waterline. It is a fast-growing plant that can quickly spread throughout shoreline and wetland areas, displacing native vegetation. This plant is not susceptible to herbivory by vertebrates and invertebrates, and may even cause gastroenteritis if eaten by cattle (Sutherland 1990). Because yellow flag iris mainly propagates through rhizomes, it is very difficult to control through physical methods on a large scale.

As with fragrant waterlilies, all yellow flag iris will be identified and mapped during the annual plant survey. In 2003 the overall abundance of this plant at Big Lake was relatively low but it had a wide patchy distribution. Lake residents are strongly urged to contact Skagit County staff

if they have yellow flag iris on their property, and if possible, permission to treat these plants should be obtained from homeowners. Glyphosate will be used to treat it at the same time that fragrant waterlilies are sprayed. Controlling this plant before it becomes even more abundant is a priority.

The total number of acres to be targeted is dependant on how many lake residents request to have the yellow flag iris in front of their homes treated. Acres treated in any given year could range from none to a few. Because no more than an acre or two of yellow flag iris is likely to be sprayed in any given year, funds not used for Brazilian elodea treatment could be used to perform this task. The applicator should spray this noxious weed. The areas to be treated with glyphosate should be reviewed and approved by the Advisory Committee prior to any treatment. The herbicide applicator should also obtain permission from lakefront property owners prior to spraying yellow flag iris. If there are desirable non-target plants growing nearby the yellow flag iris, the applicator can be requested to cover desirable plants before spraying. This was done in King County last year and excellent selective control resulted with non-target plants being completely unaffected by the treatment (Hamel, K. Pers. Comm.).

Because this is a shoreline plant that may be considered attractive by homeowners an ongoing education program that emphasizes the negative aspects of noxious weeds should be implemented. An annual event where lake residents hand-pull small plants or dig up or cover mature plants should occur if yellow flag populations decrease to the point at which herbicide treatments are no longer cost effective. The use of herbicides should be reinstated if at any time the population appears to be increasing or if physical control is not deemed effective.

NATIVE AQUATIC PLANT CONTROL

NATIVE SUBMERGED PLANTS

Mechanical (harvesting) and chemical (fluridone and endothall) control methods used in past years to target Brazilian elodea also impacted the native submerged plants in the lake. Although control of native submerged plants was not identified as a priority during the public meeting process, these plants might become overabundant and threaten beneficial uses in the future.

It is expected that in 2004 native submerged plants will be in the initial stages of recovery from the 2003 Sonar® treatment. Plant species less susceptible to Sonar® are expected to recover faster than those more susceptible. Because these plants will not be at nuisance levels for at least a few years (if ever), it is not practical (or possible) to develop a detailed control strategy that meets the requirements of the State's National Pollution Discharge Elimination System (NPDES) permit for conditions that currently do not exist. Nevertheless, tracking the status of native submerged aquatic plants should be a component of the annual aquatic plant surveys (see Monitoring, Evaluation, and Implementation section). If native submerged plants threaten beneficial uses in the future, an action plan should be developed to treat them. This action plan should adhere to the requirements of the State's National Pollution Discharge Elimination System permit and include items such as:

- Setting an action threshold for native submerged plant control,
- Identifying areas of high, moderate, low, and no control,
- Developing a mitigation plan for threatened, endangered, and sensitive species,
- Monitoring for herbicide residues, and
- Assessing effectiveness of the treatment.

This plan should be made available for review by lake residents and County and State agencies, and a public meeting should be held to obtain input prior to implementation. The action plan to control native submerged aquatic plants would then be included as an addendum to this IAVMP.

SMALL-SCALE PLANT CONTROL

Although annual plant management activities are expected to take place at Big Lake, there is no guarantee that they will occur in the same areas of the lake year after year. Therefore, it is likely that a number of lake residents will have to be responsible for managing aquatic plants in the nearshore areas of their waterfront. The strategies outlined above do not preclude lake residents from any small-scale physical control methods (e.g. raking or cutting) in areas of the lake adjacent to their properties. Additionally, representatives from residential developments on the lake are not precluded from using these plant control methods (e.g. bottom barriers in swimming areas) to manage vegetation in front of their community access points.

INVASIVE PLANT PREVENTION AND DETECTION PROGRAM

The use of herbicide treatments (and physical removal) in Big Lake should effectively control Brazilian elodea, fragrant waterlily and yellow flag iris where they are targeted. However, these or other noxious plants could return to those areas through introduction by boat activity or wildlife. The focus of control efforts for non-native plants is a prevention and detection program.

There are a number of other non-native plants that are as destructive and difficult to control as the Brazilian elodea, fragrant waterlily and yellow flag iris in Big Lake. Other non-native, highly invasive plants of concern that are already present in Washington State include; Parrotfeather (*Myriophyllum aquaticum*), Hydrilla (*Hydrilla verticillata*), Fanwort (*Cabomba caroliniana*), Water Hyacinth (*Eichhorinia crassipes*), Purple loosestrife (*Lythrum salicaria*) and Garden loosestrife (*Lysimachia vulgaris*). These plants grow in the littoral zones or riparian areas of lakes, ponds, or rivers. A pro-active program to prevent their introduction or detect them before they become widespread is critical.

Eurasian watermilfoil (*Myriophyllum spicatum*) is another noxious weed that has been documented at pioneering levels at Big Lake in the past. These plants were reported to have been eradicated as a result of the Sonar® treatments. Other lakes in the area are known to contain Eurasian watermilfoil and re-infestation of this plant in Big Lake is a constant threat. The annual surveys should be used to detect new infestations of this plant and allow for their immediate removal if they are found. If the area infested is too large to control by handpulling,

or if after follow-up surveys Eurasian watermilfoil is still present, bottom barriers should be employed. Treatment with herbicide (e.g. 2,4-D or Triclopyr) is recommended as a final resort if these efforts do not result in eradication.

To be effective this program should include both a source control component (prevention) and a detection program. The objective of source control is to prevent non-native aquatic plants from entering the lake. The objective of the detection program is to be able to quickly identify noxious plants in the lake before they become widespread and more costly to control.

The public boat launch represents an area where there is a high potential for introduction or re-introduction of invasive plants. The addition of a boat and trailer wash facility is sometimes recommended to enhance plant fragment removal. However, these can be expensive to install and they require continual oversight and maintenance. Furthermore, it is difficult to regulate their use and therefore their effectiveness is questionable. For these reasons it is not recommended. At a minimum, existing signage at the boat launch warning about exotic plant introductions should be enhanced with specific instructions on how to clean boats and trailers.

Lake residents should also receive informative brochures or newsletter articles on an annual basis reminding them of plant invasion problems and the importance of keeping their own equipment free of plants. It is also recommended that the lake community conduct a public information campaign for opening day of the fishing season and a few other key weekends. Simply having volunteers hand out exotic plant identification cards for a few hours and help with boat and trailer checks will emphasize the importance of the effort and remind boaters of their responsibility to check equipment.

Early detection is the next step to protect against new infestations. While an infestation is still small there are options for control that are much less expensive than the whole-lake treatment methods. Early detection, if done properly, requires both a trained group of lake volunteers who are responsible for occasional patrol of the lake, and periodic diver surveys to assess the plant community. The main purpose of these surveys is to search for non-native aquatic plants. However, it will also provide a means for monitoring the native plant communities and determining where future control efforts should be focused. Volunteers would be trained each year in plant identification and survey techniques and each would be given the responsibility for surveying a certain section of shoreline once a month during the growing season. Their purpose would be to note any substantial changes in the plant community and to look for new invasions of nuisance species. Professional divers would periodically perform more complete surveys. (While divers are surveying the lake they can determine whether new infestations can be handled by handpulling the plants or whether, for example, bottom barrier should be installed in a few places to ensure complete control.)

The primary advantage of controlling small infestations is that it reduces the chance that a large area would need to be controlled by a more intensive and expensive technique. Drawbacks of controlling small infestations are the high costs associated with diver surveys and hand pulling. (Costs for hand pulling by contract divers range from $500 to $2,500 per day depending upon plant type, acreage, and density.) Although the volunteer survey program should have no long-term cost, training workshops would be necessary in the first few years (Table 6).

The exotic plant control plan complements the plan for managing Brazilian elodea, fragrant waterlily, and yellow flag iris. The surveys would be relied upon to detect new infestations of existing noxious weeds and allow immediate removal of the plants. If another exotic plant is found, immediate action should be taken and a survey should be planned for later in the same year to insure there were no surviving colonies. If the area infested is too large to control by handpulling, or if after two follow-up surveys the exotic plant is still found, bottom barriers would be placed in all areas where the plant was detected. Treatment with herbicide is recommended as a final resort if these efforts do not result in eradication of the exotic plant.

These additional surveys, bottom barrier installation, and herbicide treatments are contingency elements to the overall aquatic plant control plan for the lake. Since these costs would only accrue in the event of a significant expansion of the existing noxious weeds that currently reside in the lake, or infestation by another exotic plant, the costs could possibly be covered through an "early infestation grant" by Ecology.

PLANT CONTROL ADVISORY COMMITTEE

Proper implementation of this plan relies upon the continuation of an Advisory Committee for the lake, LMD administration by Skagit County Public Works and the cooperation of other interested agencies. With assistance from the Advisory Committee and interested agencies, Skagit County Public Works has the following responsibilities:

- Review annual plant survey information and track potential problem areas.
- Ensure permit requirements are met.
- Review exotic plant problems and determine the appropriate control strategy and urgency of control needed.
- Recruit and direct volunteers for annual surveys.
- Select and hire contractors when necessary for tasks such as training, hiring aquatic plant control contractors, monitoring, etc.
- Provide information and newsletters to lake residents and act as spokespeople for answering questions on plant control problems and supporting long-term implementation of this plan.

PUBLIC EDUCATION PROGRAM

The public education program for Big Lake consists of three parts; the exotic plant prevention plan previously described, lakeside stewardship education, and watershed protection/pollution prevention for protecting the lakes' water quality.

EXOTIC PLANT PREVENTION

All watershed residents should be sent copies of an exotic plant prevention brochure. A group of willing lake homeowners should be solicited and trained to identify invasive plants and perform periodic volunteer surveys of the lakeshore. The exotic plant prevention plan was described in detail in the Invasive Plant Prevention and Detection Program section.

LAKESIDE STEWARDSHIP EDUCATION

Each lakeside resident should be educated about how to reduce the amount of pollutants entering the lake from their property, as well as about things they should do to help retain a complex, diverse, and therefore healthier lake environment. The properties located directly adjacent to the lake have a high potential for adversely impacting the lake since pollutants generated on these properties have direct access to the water.

Lakeside property owners should be provided with information about problems associated with typical urban type landscapes around lake shorelines. This should include information on the drawbacks of using ornamental turf (lawns), and the benefits of adding shoreline plants and diversified lawn plantings, which create habitat structure for birds and wildlife.

Some important considerations for proper stewardship of lakeside property are described here. Informative brochures or newsletter articles should be used to educate lakeside property owners about best management practices (BMPs). Some examples of stewardship ideas include:

- Limit turf and landscaped areas to no closer than 25 feet from the shoreline. Native plants and grasses should be considered for landscaped areas to decrease the amount of fertilizers, pesticides, and other pollutants used.
- Establish a "pollutant free zone" within 50 feet of the shoreline. Try to keep all pollutants; gas for boats, painting projects, landscape fertilizers and poisons, and etc. away from this zone.
- Plant a shoreline buffer of shrubs and tall grasses, preferably native species. This one small activity will cause multiple environmental benefits. If properly designed it will keep geese and other waterfowl from moving onto lawn areas. The vegetation will help filter out pollutants from landscaped areas before they reach the lake. It will provide protection from shoreline erosion, and it will provide habitat for the many wildlife species that utilize nearshore areas.
- Preserve natural "structure" that exists along the shoreline and in the shallow nearshore area, or if necessary, clean up only a narrow strip alongside the dock area. If a tree along the shoreline finally falls in, leave it. Add structure in the form of tree tops, twig bundles, and rocks to diversify and naturalize the nearshore area and attract more fish and wildlife.
- Allow emergent vegetation, and other plants to colonize some portion of waterfront area.

Public education and involvement will also center on the annual plant survey. In the spring of each year the Advisory Committee should plan a short workshop to describe plant survey results from the past year and the plant control strategy for that year (e.g. where and when diquat and glyphosate). During the workshop, a schedule should be agreed upon for volunteer surveys. At this time, or soon after, volunteers should be trained or re-trained on plant identification and survey techniques.

Skagit County Public Works is a resource for technical assistance and noxious weed identification training. The County could also provide speakers on lake-related topics and can tailor programs to the community needs.

WATERSHED PROTECTION/POLLUTION PREVENTION

Over the long term, the quality of Big Lake may be most impacted by development activity in the watershed. Skagit County Public Works is currently working with a consultant to develop a Drainage Study/Capitol Facilities Improvement Study for the Big Lake Watershed. The intent of this project is to examine existing stormwater drainage problems and anticipate drainage problems related to future development in the watershed. A prioritized list of drainage improvement projects will be produced at the conclusion of the study. Construction of these improvements is intended to address issues of water quantity, although water quality concerns may also be addressed.

Recommendation of watershed protection measures is beyond the scope of this plan; however lake residents should be aware of the potential impacts and take a pro-active role to ensure protection of their lake. Lake residents need to monitor watershed-related activities to make sure that appropriate best management practices (BMP's) are being carried out in nearby commercial and residential developments. This should include; tracking where activities are occurring, reviewing permit applications to insure proper BMP's have been included, reporting violations to permit conditions or water quality standards, and generally keeping informed about the watershed problems.

Since much lake-related public education information is already contained in available brochures, there is little cost associated with developing the information. A $500 per year cost has been included for development, reproduction, and mailing of brochures. It is assumed that the first plant workshop would be done by a professional who can develop a training and survey program. The cost for the initial workshop was estimated at $2,000, and would be followed by a second workshop a few years later. After that the workshops would be put on by lake resident volunteers. This cost was included as part of the invasive plant protection program.

PLAN ELEMENTS, COSTS, AND FUNDING

This section outlines the main aquatic plant control elements and their associated costs. These were developed by the Big Lake Advisory Committee and Skagit County, through consultations

with an herbicide applicator that performs treatments at the lake (Woolett, S. Pers. Comm.). The proposed rate structure was set below $200 for each residential waterfront parcel and the ten-year costs of lake management funds raised through assessments was not to exceed $584,000 (Hansen, N. Pers. Comm.).

The primary elements of this plan are direct aquatic plant control (Reward® and Rodeo®), monitoring and evaluation (aquatic plant surveys and herbicide monitoring), and public education. Table 6 provides a summary of each element identified in this plan and the associated costs. It is intended as a guide for estimated annual and 10-year costs. Total cost for the plan for the first ten-year period is estimated at $684,000 for an average of about $68,400 per year.

The highest cost occurs during the first year when most of the plan components are implemented simultaneously. Some of these (e.g., volunteer training and public education brochures) could be offset to the following year to spread out the costs. These costs are based on current cost estimates and do not include potential increases due to inflation. A combination of grant funding and local revenue from the Big Lake LMD is proposed to fund the plan's implementation.

Currently, the administrative costs for the implementation of Plan are funded by Skagit County and not the Lake Management District. Costs associated with the administration include the preparation of grant applications, progress reports, financial reports, annual evaluations, as well as contract development, Advisory Committee coordination, response to inquiries from lakeside landowners, and agency and interest group coordination. Annual administrative cost estimates are based on staff time and resources required to effectively implement the various plan elements.

Table 6. Estimated Costs for Implementation of the Updated IAVMP for Big Lake. Source: Skagit County 2002.

Control Treatment	2003	2004	2005	2006	2007-20012	Total 10 Year
Sonar Treatment – 177 acres	$175,000	-	-	-	-	$175,000
Subsequent Contact Herbicide Treatments	-	$15,000	$35,000	$40,000	$237,00	$327,000
Treatment Permits	$300	$350	$350	$400	$2,800	$4,200
Surveys and Mapping	$2,500	$2,500	$2,500	$2,500	$15,000	$25,000
Herbicide Residue Sampling	$5,000	$3,000	$15,000	$3,000	$18,000	$44,000
Signs/Training/Educational Materials	$2,000	-	$2,000	-	-	$4,000
Brochures/mailing	$500	$500	$500	$500	$2,800	$4,800
Administration	$10,000	$10,000	$10,000	$10,000	$60,000	$100,000
Annual Total	$195,300	$31,350	$65,350	$56,400	$335,600	$684,000

FUNDING STRATEGY

Short Term Funding

One of the main sources of funding to implement an IAVMP is through the State's Aquatic Weed Management Fund (AWMF). There is a competitive process for awarding these grant funds that begins with a written application. The annual application period begins October 1st and closes on or about November 1st of each year. Workshops are held before or during the application period to explain the application process and general program requirements. Grant applications are evaluated according to established criteria. Application guidelines, criteria, and other information about this program are detailed on Ecology's Aquatic Plants and Lakes website, under Aquatic Weed Grants.

Limits have been set on the size of grants that are available:

- The maximum grant amount for general aquatic weed management is $75,000. With the local match requirement of 25 percent, this equates to a project cost of $100,000.
- Planning grants are limited to $30,000. With the local match requirement, this equates to a project cost of $40,000.
- The maximum grant amount for early infestation grants is $50,000.

The development of this IAVMP was partially funded by a planning grant. The general aquatic weed management fund is often used to implement IAVMP's approved by Ecology. Early infestation grants are used to quickly control noxious aquatic weeds before they become widespread.

Successful completion of this IAVMP should give the LMD an advantage to obtain funds from Ecology for implementation, although sponsors that have already received funding from the Fund for implementation activities generally receive lower funding priority than sponsors just implementing their plans Funding priority typically is given to lakes with noxious weeds, and the LMD and Skagit County staff should apply for a grant to control Brazilian elodea, fragrant waterlily and yellow flag iris at the lake. A public body (e.g. a local agency such as Skagit County) must sponsor the grant application and ultimately be responsible for meeting grant requirements. These public entities are also required to provide matching funds for AWMF grants.

Limits have also been set on the amount of funds available to each public body during each funding cycle. The ceiling amount per public body is $75,000 for general aquatic weed management projects and $75,000 for early infestation projects. Funding for implementation of an IAVMP is expected to be used over a five to ten year period and does not occur annually.

Long-Term Funding

Ultimately these projects will fail unless funded through some sort of self-taxing district (e.g. a LMD) to carry on with monitoring and other long-term efforts. The Big Lake LMD is a special assessment district whose taxes are used to fund lake management activities. The LMD has already established a track record for accomplishing these tasks. The LMD has been in existence

since 1998 and was reauthorized beginning in 2003 for another ten years. Table 7 shows the existing rate structure for the current Big Lake LMD.

Table 7. Annual Rate Structure for the Current Big Lake LMD (Skagit County 2002).

Type	*# of Units*	*Rate/Unit*	*Revenue*
• Undeveloped parcel	89	$60	$5,340
• Commercial parcel	1	$380	$380
• Developed parcel (1 dwelling)	255	$168	$42,840
• Parcel w/ ≥ 2 dwellings, or parcels w/ multiple access	6	$240 - $280	$1,560
• Condominium, each	13	$120	$1,560
• Public Boat Launch	1	$6,720	$6,720

The LMD currently collects approximately $60,000 in annual assessments to fund lake management activities. Almost all of these funds are spent on annual lake management activities such as surveys and direct plant control. Any funds not used in a given year are "rolled over" to the following year and are held as a contingency fund for unanticipated lake management efforts.

It is expected that Skagit County will continue to cover administrative costs associated with the implementation of the IAVMP as it did with the 1997 Plan.

MONITORING, EVALUATION AND IMPLEMENTATION

MONITORING AND EVALUATION STRATEGY

Several plant control-related monitoring and evaluation needs are identified for Big Lake. These include:

- Plant surveys,
- Herbicide residue monitoring, and
- An annual evaluation of lake management activities.

Water quality monitoring may also be a part of lake management activities but is not part of this plan. The following sections describe specific activities as they relate to aquatic plant management at the lake.

Aquatic Plant Surveys

Ongoing surveys are critical to preventing the rapid expansion of existing Brazilian elodea, fragrant waterlily and yellow flag populations, or new infestations of other noxious weeds. When infestations are relatively small there are options for control that are much less expensive

than, for instance, treating the whole lake with herbicide. The objective of this survey should be to monitor both noxious and native plant populations in the lake. The survey should also include the use of GPS equipment to help document the relative densities and locations of different plant species. This data would then be used to create a detailed map of the different aquatic plant communities similar to Figure 1. This survey and mapping effort should be performed annually as a regular component of the long-term surveillance program. A map and an explanatory report should be prepared and provided to the residents of Big Lake as part of the Education/Awareness program. The Big Lake Advisory Committee and Skagit County with input from an herbicide applicator have anticipated an annual cost of $2,500 for this survey and mapping task.

Performing an additional survey later in the growing season was not included as a component of this plan but should be considered if new infestations of other noxious plants are detected. It is recommended that a post-treatment aquatic plant survey be conducted to assess the effectiveness of the plant control efforts.

Herbicide Monitoring

The NPDES Noxious Weed Permit requires permit holders to monitor herbicide residues. Only those projects funded through Ecology's Aquatic Weed Management Fund will be required to perform the monitoring. Therefore, the cost of the monitoring will be covered by the grant. However, monitoring is still useful in determining if herbicide concentrations are such that water use restrictions are no longer applicable and that the applicator is meeting contractual obligations. A detailed discussion of these requirements and the procedures used to monitor herbicide residues may be seen by reviewing the Department of Ecology's Annual Group Monitoring Plan at:
http://www.ecy.wa.gov/programs/wq/pesticides/final_pesticide_permits/noxious/monitoring_data/2003monitoring_plan.html.

Herbicide sampling should be accomplished by experienced water quality professionals. This may include but is not limited to: a County or State water quality professional, a private firm with monitoring expertise, or lake residents who have received training on how to perform herbicide monitoring (Note: Ecology recommends that the person sampling should not be the applicator or use applicator's boat or equipment because of the possibility of sample contamination). In general, monitoring for herbicide residues involves sampling water within and outside of the treatment area; immediately before and after treatment, 24 hours after treatment, and at some later time interval. Exact locations, time to sample, and number of samples vary depending on the herbicide(s) applied and target species. Samples are then sent to an accredited laboratory for analysis. The results of herbicide monitoring are submitted to the Department of Ecology and/or Agriculture annually in the same year that treatment occurs. It is estimated that herbicide monitoring would cost approximately $3,000 in the years in which herbicide is used at the lakes.

Annual Evaluation

It is important that there is some mechanism in place for periodic evaluation of this plan and determination of whether it is meeting stated goals or whether the goals have changed. This

evaluation should be done on a yearly basis. It should begin with a description of which elements of the plan have been fully implemented, those that have not, and why. It should also include a summary of the plant monitoring results, both those obtained by volunteers and those by professionals. These results should be used to aid in the determination of whether goals have been met. The community should also be asked for input on their satisfaction with plant and lake conditions. For example, it is possible that the goals will be met, but that some people will remain dissatisfied. Although it is unlikely that the needs of all stakeholders will be met, an effort should be made to track concerns, especially if they are widespread. This information should be used to decide on the following activities; was the herbicide treatment effective? Has there been a dramatic increase or decrease in the amount of noxious weeds in the lake? Have any other noxious aquatic plants been identified? Should other control tools (bottom barriers, for example) be considered? Is it necessary to implement a back-up plan? Is funding adequate for the control measures in place? Over the long-term, adequate annual evaluations can make the difference between project success or failure. It is expected that this annual evaluation will be carried out and funded by Skagit County.

IMPLEMENTATION PLAN

Year 1 - 2004

The first and most important steps for implementing IAVMP's have already been taken by the Big Lake residents. These include, securing a long term funding source (i.e., the LMD) and establishing a committee to oversee plan implementation. Therefore, activities in the first year can focus directly on aquatic plant control. As soon as this updated IAVMP is approved by the State, Skagit County should immediately move forward on applying for an implementation grant from Ecology.

The Big Lake LMD with Skagit County as a sponsor should have a competitive advantage for winning an implementation grant. This is because the lake group has already taken the most difficult step of establishing a long-term funding source (i.e., the LMD), it has an established record for accomplishing aquatic plant management goals, the IAVMP includes a strong public education element, and also because some of the steps required for plan implementation are related to management of invasive or noxious plant species.

The Big Lake Advisory Committee and Skagit County have already hired a contractor to perform herbicide applications for the next two years. Following the spring aquatic plant survey, a treatment strategy will still need to be agreed upon and implemented, as well as the herbicide monitoring effort. An annual evaluation that details all lake management activities should be prepared at the end of the year.

Year 2 - 2005

The activities of year 1 would continue to the second year. The aquatic plant survey in the spring will be especially useful in determining Brazilian elodea recovery from the diquat treatment in the previous year. This information will assist the Advisory Committee and Skagit County in determining if annual diquat or periodic fluridone treatments are the best option to control Brazilian elodea.

This second year would also be a good time to include the use of trained lake volunteers to assist in the detection of new invasive species. The efforts of these volunteers would complement other survey efforts and allow lake residents to actively participate in lake management activities. During the second year herbicide treatments and monitoring, volunteer training, and an annual evaluation would still occur.

Ongoing

Each year the Advisory Committee and Skagit County Public Works will need to evaluate the past year's progress. At the very least they will need to determine if the herbicide treatments were effective. In the event invasive species are found during annual surveys, they will need to be ready to apply for early infestation grants and to act immediately using LMD funding to prevent the spread of any newly discovered invasive weeds. Early infestation funds are available on a first-come-first-served basis and may not always be immediately available if demand is high that year. The Advisory Committee in cooperation with Skagit County Public Works staff should also review annual evaluations from past years to determine if long-term aquatic plant management goals are being met.

Other items to be considered on an annual basis include; boater education at the boat launch and checking that signage and information is still available, as well as identified tasks for lakeside resident education and volunteers.

SUMMARY AND CONCLUSIONS

The residents of Big Lake have been active in controlling aquatic plants since at least 1994 and formed a lake management district in 1998 to fund plant control activities. The 1997 Aquatic Plant Management Plan (EnviroVision 1997) has served as an aquatic plant management guide for lake residents and Skagit County for the past seven years. This IAVMP serves as an update to the 1997 Aquatic Plant Management Plan.

This plan was developed through a public involvement process following guidelines set by Ecology (WDOE 1994). During the plan development process lake residents reviewed plant management goals and objectives, control methods, and selected a preferred aquatic plant control strategy. This strategy was designed to address noxious plants at the lake.

The noxious plant Brazilian elodea at Big Lake impedes recreational uses such as swimming, boating, and fishing, and degrades fish and wildlife habitat. The noxious aquatic weeds fragrant waterlily and yellow flag iris also threaten beneficial uses and fish and wildlife habitat. Without some sort of action plan the aerial coverage of these aquatic plants are likely to increase and further impede beneficial uses of the lake. This report details a plan for:

- controlling Brazilian elodea with the use of an herbicide (Reward®), and
- controlling fragrant waterlily and yellow flag iris with the use of an herbicide (Rodeo®).

Implementation of this plan is estimated to cost approximately $684,000 for an average of about $68,400 per year.

Re-invasion by Brazilian elodea, fragrant waterlily, and yellow flag iris in areas where they are targeted will be closely monitored through annual surveys. The surveys will also assess the condition of both noxious and native aquatic plants in other areas of the lake. Public education and awareness programs will be focused on exotic plant prevention, and providing general pollution prevention and best management practices information to lake residents.

Lake residents, primarily through the Advisory Committee, will be involved in development of the yearly plant control strategy and will be responsible for soliciting volunteers for surveys and plant control activities. This will ensure long-term involvement of lake residents in lake management decisions and activities.

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APPENDIX A

RECORD OF PUBLIC MEETINGS

Big Lake LMD Public Meeting
May 20, 2003, 7 pm, Big Lake Elementary School

Advisory Committee Members

Jim Hanson, Chairman – Present	Mac McConnell – Present
Bud Ebeling – Present	Neil Hanson – Present
Dan Jones – Present	Rick Tesarik – Absent

Others present: Terry McNabb - Aquatechnex, David VanderMeulen - Envirovision, Ric Boge - Skagit County Public Works, and Carly Ruacho - Skagit County Public Works, Betty Prothero – citizen, Steve Wicks – citizen, George Bosler – citizen, Dru Saunders – citizen, Eugene Johnson – citizen.

Purpose:

1) Present the schedule and information regarding the upcoming herbicide treatment of the lake.
2) Present the schedule and an overview of the plan update requirements.

Discussion:

Terry McNabb of Aquatechnex presented information on the planned May 27th, June 9th, and June 23rd herbicide treatments. Information included:

Brazilian Elodea (aquatic weed)
Washington State Noxious Weed List
Federal Aquatic Invasive Species List
Adverse impacts on human use (boating, swimming danger)
Adverse impacts on the environment (increases water temperature, chokes our native plants)

Sonar (herbicide)
Safe for drinking water @ 150 ppb (parts per billion)
Application concentration will be @ +/-20 ppb
No irrigation for approx 14 days (or until less than 10 ppb)
Irrigation is safe @ 10 ppb
3 treatments (1 every 2 weeks depending on Assay results)

Assay (testing method)
Will be used to monitor herbicide concentration levels in the lake
Will be used to monitor plant reaction to the herbicide

Reward (contact herbicide)
Used to spot treat as needed
No irrigation for 72 hours

David Vandermeulen of Envirovision presented a history of past aquatic plant management activities on Big Lake. Mr. Vandermeulen engaged those in attendance for discussion on the main problems facing the lake currently and the goals and objectives for future management. The consensus of the group was that the problems and goals/objectives that the citizens concluded during the initial writing of the plan were still currently the main priorities. The main problems continue to be the weed presence in the lake and the algae blooms that occasionally occur. The prominent goals and objectives remain cost effective control of the weeds and algae blooms, most likely utilizing approved aquatic herbicides.

Mr. Vandermeulen indicated the timeline for the completion of the plan update was early in 2004. He also indicated that as part of the plan update process more detailed aquatic plant mapping would take place, as well as a review of relevant plant control methods. Through this discussion, it is expected that members of the advisory committee and residents of Big Lake choose a preferred aquatic plant management scenario (i.e. combination of control methods) for future lake management efforts.

Tentatively, the required second public meeting was scheduled for fall 2003.
(This meeting was later decided to be rescheduled for February/March of 2004.)

Citizen Questions:

1) Are the herbicides safe?
For Sonar there are no restrictions for swimming, potable water use, or fishing for the proposed application concentration levels. A 14 day restriction for irrigation use of lake water will be in effect after each treatment. For Reward, there is a 2 day restriction for irrigation and potable water use of the lake water and a recommended 2 day restriction for swimming.

2) Have non-chemical weed control methods been investigated?
Mowing of the vegetation was the primary means of weed control on the lake for a number of years, but became more difficult as the plant presence increased. The placement of grass carp was considered during the writing of the previous lake management plan, but due to permitting difficulties it was determined that chemical herbicide treatment was the most effective and practical of the treatment options available.

3) Will the proposed treatment eradicate a 'green slime' problem noticed on the lake?
Not directly. Lessening of the concentration of the aquatic vegetation around the lake shore, which would be the result of the herbicide treatments, may consequently lessen the accumulation of the 'slime' but would not affect it chemically.

NOTICE OF PUBLIC MEETING

For Property Owners within Lake Management District #1 & The Big Lake Community at Large Regarding: 1) Integrated Aquatic Vegetation Management Plan Update 2) Big Lake Drainage Study/Capital Facilities Improvement Presentation

Monday, February 23, 2004
6:00 P.M.
Big Lake Elementary School Library

Agenda:

- Welcome from Envirovision; purpose of tonight's meeting
- Review past aquatic plant management activities on the lake
- Summarize technologies available for aquatic weed management
- Discuss a few of these in greater detail
- Develop framework for a revised action plan
- Skagit County Drainage Study and Capital Facilities Improvement presentation

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Background:

1) IAVMP Update: The current Big Lake Integrated Aquatic Vegetation Management Plan (IAVMP) was finalized in April 1997. Using the IAVMP as a guide for lake management activities, Aquatechnex conducted a whole-lake Sonar treatment during the first 'treatment season' in 1998 and treated the lake with Sonar again last summer. The Department of Ecology, (the agency that permits lake treatment and approves grants for some lake treatments) recommended that the 1997 IAVMP be updated to include information on new aquatic plant control methods and a different permitting system. The County applied for and received a partial grant from the Department of Ecology to update the Big Lake IAVMP. Envirovision was hired to work with the Big Lake community and the County to develop a revised IAVMP that considers current plant management objectives and new treatment options. This will be the last public meeting prior to completion of the plan update, scheduled for spring 2004.

2) Drainage Study/Capital Facilities Improvement: In response to the large number of drainage complaints received over the past decade in the Big Lake area, Skagit County Public Works is in the process of acquiring a consultant to conduct a drainage and capital facilities improvement study. The purpose of this study is to identify infrastructure improvement projects adjacent to Big Lake to effectively address regional drainage problems.

For more information contact David VanderMeulen, Envirovision at (360) 754-7944.

SKAGIT COUNTY
PUBLIC WORKS DEPARTMENT
1800 Continental Place, Mount Vernon, WA 98273-5625 (360) 336-9400 FAX (360) 336-9478

Big Lake Public Meeting
Meeting Notes
February 23, 2004

Community Members Who Signed In: Bruce Thomson, Cecile West, Betty Prothero, Richard Moe, Carl Rogers, Rachel McConnell, Mac McConnell, Ed Gruel, David Grobschmit, Tammie Grobschmit, Neil Hansen, James Hanson, Jim Simmons, Eldeen Simmons, Pam Baird, Rick Carter, Dan Nystrom, Jim Hicks, Jim Minitie, Dick Gabrielson, Caryl Gabrielson, Dean Anderson, Bruce Thomson, Dan Goodfellow, Mike Skjei, Leslie Dann, Mike McCoy, George Bosler, Dan Goodfellow. (Approximately 10 people did not sign in.)

Staff and Consultants Present: Ric Boge, Stephanie Woolett, John Abenroth, David VanderMeulen, and Terry McNabb

The meeting came to order at 6:00 p.m. Ric Boge, the Skagit County Natural Resources Project Manager, welcomed the members of the Lake Management District and the community at large. He explained that the purpose of the meeting is two-fold: 1) to host a discussion with the consultant hired to update the IAVMP for the Big Lake management district, and 2) to provide a format for Skagit County staff, John Abenroth, to introduce the Big Lake Drainage/Capital Facilities Study to the community. Of those present, Ric introduced Stephanie Woolett (Water Resources Technician), John Abenroth (Surface Water Engineer), David VanderMeulen (IAVMP consultant with Envirovision), Terry McNabb (lake treatment contractor with AquaTechnex), and members of the LMD Advisory Committee.

IAVMP Update

David VanderMeulen of Envirovision began his presentation for the IAVMP update by providing a brief overview of the project's history, as well as past treatment activities. The current meeting, he explained, is the second and final public meeting, which is intended to determine the objectives of the LMD and identify potential future treatment strategies to be included in the update.

Survey maps produced by Envirovision staff were used to illustrate the distribution of plant communities in Big Lake. David explained that in 2003 a granular form of Sonar was used to treat approximately 180 acres of Big Lake. These areas supported the growth of the noxious weeds Brazilian elodea and Eurasian milfoil.

Discussion:

- Effectiveness of Sonar on Water Lilies: A member of the audience questioned whether or not Sonar is effective in treating water lilies. Terry McNabb responded that Sonar is not effective in treating water lilies; however, there is an herbicide available, glyphosate, which can be used to target water lilies.
- Target areas: Another question was raised regarding the areas targeted by the herbicide treatment. Terry indicated that only the littoral zone is targeted for treatment. Several members of the community expressed concerns that limiting the treatment to the littoral zone, as opposed to conducting a whole lake treatment, is not the most effective means of eradicating Brazilian elodea. David and Terry explained that, due to size of Big Lake and the high cost of Sonar, a whole lake treatment would not be cost effective.
- Effects of activities in Lake McMurray: Because Lake McMurray and Big Lake are connected by Lake Creek, one member of the audience was concerned that infestations of noxious weeds in Lake McMurray could travel downstream and impair Big Lake. David responded that Eurasian milfoil has not been observed in Lake McMurray since 2000; therefore, infestations of noxious weeds from Lake McMurray should not represent a significant threat.
- Audience Observations on the effectiveness of 2003 treatment activities:
  - 30% reduction observed – location unknown
  - Northwest part of the lake: no plants observed
  - Southwest View Rd on the east side of the lake: In the early summer, the plants were not present at depth; however, they are still observed around docks in the shallows.
  - Southeast part of the lake, by the boat launch: plants were observed around docks.
- Brazilian elodea questions: Discussion of lake treatment success spawned questions regarding characteristics of elodea. David explained that Brazilian elodea appears to flourish at depths between 5' and 15'. Terry followed up with a brief explanation of the survival mechanisms employed by Brazilian elodea and the results characteristic of Sonar treatments similar to those performed at Big Lake. Typically the greatest benefits are observed during the following year.

Following the public discussion, David continued by presenting an outline of the proposed goals for the IAVMP update, which include: targeting Brazilian elodea, reducing/eliminating hazards to lake users, targeting noxious lilies, and eliminating the need for mechanical harvesting. Several methods of control are available for use in treating noxious weeds including mechanical, chemical, and biological methods. When deciding on potential lake treatment strategy, there are several considerations such as the scale of the problem, labor and equipment costs, and regulatory limitations of different options. Because Big Lake is so large, 520 acres, the equipment and labor costs of each treatment option should be carefully considered. For example, a whole lake Sonar treatment would not be cost effective since on gallon of Sonar costs $1,500. Introducing Grass Carp to Big Lake wouldn't be cost effective due to the fish passage limitations: a screen that prevents carp from traveling down stream and still allows salmon to pass freely would have to be installed. Additionally, David explained that some treatments target specific species of plants:

- Navigate/Aquakleen (2,4-D) targets broadleaf plants such as milfoil
- Reward (Diquat) burns plants down to the roots and is more effective in controlling Brazilian elodea.
- Triclopyr is similar to 2,4-D and does not target Brazilian elodea.

Discussion:

- Several citizens questioned whether Brazilian elodea could be permanently eliminated from Big Lake. Is it a continuous problem due to re-introduction from boating traffic? David responded that Brazilian elodea is a hardy plant and has not been eradicated in any Washington lakes. Terry echoed that response and stated that preventing the weed from becoming a hazard to lake users is the aim of treatment; however, that does not mean that it will never be eradicated. There are new treatments available that may yield positive results.
- Increased occurrence of dead fish: One community member asked if it was okay to treat the lake with herbicides and whether or not there are harmful impacts of the wildlife community. She indicated that between July and August over the past few years, she has observed between 10 and 15 dead fish wash up on her beach per day. Her property is located on south west View Rd. just down from the tavern. Terry responded that low levels of dissolved oxygen due to algal blooms are likely to be the culprit for increased fish mortality. The herbicides applied to Big Lake have undergone stringent tests specifically designed to evaluate the impacts of the chemicals on fish. These tests showed that fish are not harmed by them when applied at the permitted levels.

David presented the recommended plant treatment that will be included in the IAVMP. It calls for the use of Sonar and other aquatic herbicides to treat Brazilian elodea and Eurasian milfoil, if necessary. The plan also calls for treatment of white water lilies, education/training, and an annual evaluation of treatment success.

Discussion:

- Funding: the community raised questions regarding the possibility of gaining an outside funding source, such as an implementation grant. There was a general consensus throughout the room that the LMD wants county staff to apply for funding at every opportunity.
- Round-up: A question was raised regarding the effectiveness of household herbicides like Round-up on shoreline vegetation. The use of Round-up to control aquatic weeds would likely be ineffective because of the large quantity required to be effective. At this time, it was mentioned that upland activities such as the use of fertilizers, etc. could cause nutrient loading, which increases the growth rate of aquatic vegetation.
- Diminishing returns: A gentleman in the audience asked if the effectiveness of the herbicides reduces over time. Terry responded that Sonar impacts aquatic plants by preventing the production of a chlorophyll protecting pigment, which results in the degradation of the plant by sunlight. The pigment acts as a sunscreen for the chlorophyll, which allows the plant to produce food. Without the pigment the plant

cannot survive. Sonar's ability to impair the pigment does not decrease with usage over time.

- Community Feedback Terry encouraged community members to provide his team with feedback during the treatment season. The more information obtained will allow him to provide better services.

David closed the meeting with a discussion of cost estimates for the plan's implementation throughout the duration of the district. The community reiterated its desire to acquire grant funding to implement the IAVMP and control noxious weeds.

Skagit County Drainage/Capital Facilities Improvement Study

John Abenroth, a Surface Water Engineer with Skagit County Public Works provided a brief introduction to the drainage study scheduled to start within the near future. He explained that the project is in response to increasing numbers of drainage complaints from the Big Lake areas. The intent is to examine the drainage problems around Big Lake to identify regional solutions and prioritize projects based on which projects will yield the greatest benefits. Community members had several questions about the project. The remainder of the meeting followed a question/answer format. The meeting adjourned at 7:23 p.m. Skagit County staff and Envirovision and AquaTechnex consultants remained to address individual questions.

APPENDIX B

AQUATIC PLANT CONTROL METHODS

INTRODUCTION

Much of the information in this appendix is excerpted from A Citizen's Manual for Developing Integrated Aquatic Plant Management Plans (WDOE 1994), the Supplemental Environmental Impact Statement for the Department of Ecology's Aquatic Plant Management Program (WDOE 2001), and the Department of Ecology's Aquatic Plants and Lakes website: http://www.ecy.wa.gov/programs/wq/plants/management/index.html.

PLANT CONTROL TECHNIQUES

The No-Action Alternative

This management plan is primarily focused on the eradication noxious weeds and the control of native submerged plants. Both noxious and nuisance plants have reduced the beneficial uses of the lake. Several different options to control (or eradicate) these plants are presented in this plan. However, the "no-action" alternative should be examined in order to serve as a reference for all other proposed control techniques.

It is very likely that all beneficial uses of the lakes will continue to be further degraded if no aquatic plant control methods are implemented. Because the lake is eutrophic with nutrient enriched conditions (KCM 1991) the aquatic plants are able to absorb nutrients directly from the water column, making the likelihood of further plant growth certain. Therefore, the "no-action" alternative is not acceptable due to the further reduction of beneficial uses of the lakes (boating, fishing, and swimming). Other negative environmental impacts include a possible degradation of the lake fishery and overall aesthetics. The fish communities may be impacted directly (e.g. lack of dissolved oxygen) or indirectly (i.e. changes in food web dynamics) with an overabundance of aquatic plants. Excessive aquatic plants also influences water quality by causing more pronounced temperature stratification and potentially a reduction in water circulation. Chemical parameters such as pH, alkalinity, and dissolved oxygen may also be impacted through alteration of biological processes such as photosynthesis, respiration, and decomposition.

Advantages of No-Action alternative:
- no treatment cost

Disadvantages of No-Action alternative:
- quality of the lakes will continue to decline,
- recreational opportunities will decline,
- fish and wildlife habitat will be reduced or impaired,
- property values will decline.

Appropriateness for Big Lake:
- The No-action alternative is not appropriate for Big Lake due to the degradation that uncontrolled Brazilian elodea and other noxious weed growth will cause and the desire of residents to protect recreational uses and fish and wildlife habitat.

PUBLIC EDUCATION PROGRAM

The public education program for Big Lake consists of three parts; the exotic plant prevention plan previously described, watershed stewardship education, and watershed protection/pollution prevention for protecting the lakes' water quality.

EXOTIC PLANT PREVENTION

All watershed residents should be sent copies of an exotic plant prevention brochure. A group of willing lake homeowners should be solicited and trained to identify invasive plants and perform periodic volunteer surveys of the lakeshore. The exotic plant prevention plan was described in detail in the Invasive Plant Prevention and Detection Program section.

WATERSHED STEWARDSHIP EDUCATION

Each property owner within the Big Lake watershed should be provided with educational materials about how to reduce the amount of pollutants entering the lake. All properties within the watershed have the potential to adversely impact the lake since pollutants may enter the drainage system and flow into the lake. Integrating all watershed property owners in lake stewardship education efforts may increase the benefits to this valuable water resource by generating greater awareness of best management practices (BMPs) that have been demonstrated to reduce polluted runoff and increase valuable lake shore habitat.

Lakeside property owners should be provided with information about problems associated with typical urban type landscapes around lake shorelines. Because lakeside properties have direct access to the water, this should include information on the benefits of adding shoreline plants and diversified lawn plantings in place of ornamental turf, which create habitat structure for birds and wildlife, as well as filter pollutants from surface water prior to entering the lake.

Watershed property owners should be provided with information about the benefits of lake stewardship. Informative brochures or newsletter articles should be used to educate all watershed property owners about best management practices (BMPs) and other stewardship ideas. Some examples of lake stewardship ideas to consider include:

- Developing landscape schemes that incorporate diversified landscape materials.
- Promoting the proper use and disposal of pollutants such as gasoline, oils, fertilizers and other harmful chemicals.
- Providing information concerning the best type and proper use of chemical fertilizers.
- Planting a shoreline buffer of shrubs and tall grasses, preferably native species.
- Providing residents with information about the benefits of preserving natural vegetation and structure that exists along the shoreline and shallow nearshore areas.
- Allowing emergent vegetation, and other plants to colonize some portion of waterfront area.

Public education and involvement will also center on the annual plant survey. In the spring of each year the Advisory Committee should plan a short workshop to describe plant survey results from the past year and the plant control strategy for that year (e.g. where and when diquat and glyphosate). During the workshop, a schedule should be agreed upon for volunteer surveys. At this time, or soon after, volunteers should be trained or re-trained on plant identification and survey techniques.

Skagit County Public Works is a resource for technical assistance and noxious weed identification training. The County could also provide speakers on lake-related topics and can tailor programs to the community needs.

WATERSHED PROTECTION/POLLUTION PREVENTION

Over the long term, the quality of Big Lake may be most impacted by development activity in the watershed. Skagit County Public Works is currently working with a consultant to develop a Drainage Study/Capitol Facilities Improvement Study for the Big Lake Watershed. The intent of this project is to examine existing stormwater drainage problems and anticipate drainage problems related to future development in the watershed. A prioritized list of drainage improvement projects will be produced at the conclusion of the study. Construction of these improvements will primarily address issues of water quantity, although water quality concerns will also be considered.

Recommendation of watershed protection measures is beyond the scope of this plan; however lake residents should be aware of the potential impacts and take a pro-active role to ensure protection of their lake. Lake residents need to monitor watershed-related activities to make sure that appropriate best management practices (BMP's) are being carried out in nearby commercial and residential developments. This should include; tracking where activities are occurring, reviewing permit applications to insure proper BMP's have been included, reporting violations to permit conditions or water quality standards, and generally keeping informed about the condition of the watershed.

Since much lake-related public education information is already contained in available brochures, there is little cost associated with developing the information. A $500 per year cost has been included for development, reproduction, and mailing of brochures. It is assumed that the first plant workshop would be done by a professional who can develop a training and survey program. The cost for the initial workshop was estimated at $2,000, and would be followed by a second workshop a few years later. After that the workshops would be put on by lake resident volunteers. This cost was included as part of the invasive plant protection program.

Currently Available Techniques - Preventive

Controlling the input of nutrients such as nitrogen and phosphorus into the lakes may aid in limiting the growth potential of aquatic plants (including algae). Certain preventative measures to control the input of these nutrients into the lake should be considered. Most of these preventative measures are described as Best Management Practices (see Lake Stewardship section presented earlier).

Watershed Controls: The Phase 1 Restoration Analysis completed in 1990 (KCM 1991) states 82% of the phosphorus budget of the lake comes from internal cycling, especially phosphorus released from the sediment. The study also states that less than 4% of the phosphorus budget is derived from overland runoff. Although nutrient additions via overland runoff from the watershed are small, implementation of non-point source phosphorus and nitrogen reduction measures in this watershed should have a beneficial impact on the nutrient loading to the lake. General watershed controls primarily presented as Best Management Practices were summarized earlier in the section titled "Lake Stewardship Education".

Advantages of Watershed Controls:
- lessen the amount of nutrients entering the lake,
- may lower the temperature of waters entering the lake
- lowers the potential for excessive sedimentation and erosion,
- may provide ecological benefits to areas beyond the lake.

Disadvantages of Watershed Controls:
- modification of land use may be required
- may have to purchase property
- may need to amend existing structures or regulate new construction,
- support staff may be required to monitor watershed activities

Costs of Watershed Controls:
- highly variable

Appropriateness for Big Lake:
- It is possible that watershed controls would improve or maintain the water quality at Big Lake but will not control or reduce noxious weeds.

In-Lake Nutrient Controls: The reduction in the availability of nutrients already present in the lake as a means of limiting algae and aquatic plant growth is a legitimate approach. The control of in-lake nutrients is an important component of the long-term reduction in overall aquatic plant growth. However, detailed in-lake nutrient control methods are more typically described in Lake Restoration projects and are outside of the scope of this plan. Yet, some possible in-lake nutrient control techniques are shown in an attachment to this plan and may reduce the amount of aquatic plants growing in the lake.

Public Awareness and Involvement Program: Lakeside and watershed residents should be informed of all aspects of aquatic plant, algae, and nutrient management. Their understanding of these management issues is critical to the long-term success of this plan. It is strongly

recommended that a public education and awareness program be a major component of any management plan. This program would serve to keep residents informed of past, current, and future lake management activities and aid in promoting lake stewardship. The residents should also be made aware of changes in the plan should they be necessary, as well as assessing the effectiveness of current management activities. Lake management activities should be advertised through newsletters, public meetings, and at local fairs and other events. This provides the residents with an opportunity to both understand current lake management activities and supply feedback to lake managers.

Lake and watershed residents should be supplied with information such as; tips on how to identify common aquatic plants, control of nutrients before they enter the lake (e.g. curbing fertilizer use on water-front property), simple aquatic plant control measure s that can be employed by individual homeowners, and regulations governing such activities.

In general, lake and watershed residents gain satisfaction and a sense of ownership when they are directly involved in lake management activities. Therefore, public participation should be a key component of any lake management plan. Direct participation may take place through volunteer surveys and data collection, organization of meetings, and dissemination of materials related to lake management.

Advantages of a Public Awareness and Involvement Program:
- allows for more informed lake management decisions by stakeholders,
- potentially builds public support for proposed activities,
- involves lake and watershed residents in the decision-making process.

Disadvantages of a Public Awareness and Involvement Program:
- public must be committed to implementing plan and maintaining long-term continuity.

Costs of a Public Education and Awareness Program:
- $1,600 to $8,000 per year (variable).

Appropriateness for Big Lake:
- This control method is appropriate for Big Lake and will be implemented through a Public Education program.

Currently Available Techniques - Physical Control
Physical control techniques encompass most manual or mechanical efforts that remove, cover, shade or desiccate all or some portion of the targeted aquatic plants.

Hand Removal: This control technique is generally accomplished by digging or pulling aquatic plants and is similar to weeding your garden. In shallow waters resident remove the plants by hand and/or by using hand-held gardening tools. In deeper waters ($\leq$ 3 feet) SCUBA divers can be used to hand remove plants. All plant materials are collected and placed in a bag for proper disposal on shore.

The effectiveness of this plant control technique is mainly a function of sediment type, visibility (water clarity), plant type, and the thoroughness in which the plants are removed. The duration of plant control mainly depends on the variables above and may last from weeks up to multiple years

Advantages of Hand Removal:
- immediate clearing of the water column,
- can selectively remove targeted plant species if necessary,
- is an effective control option around docks, rafts, and boats,
- Equipment is inexpensive.

Disadvantages of Hand Removal:
- technique is time consuming and labor intensive,
- may have delay in removing plants due to disturbed sediments and therefore low visibility
- use of SCUBA divers in deeper waters more costly,
- may not be feasible in areas of dense plant growth,
- some plant species difficult to remove

Costs of Hand Removal:
- no cost if performed by volunteers,
- $1,500-$2,500 per day for two divers and a support boat & operator

Appropriateness for Big Lake:
- This control method is appropriate for Big Lake and will be implemented through small-scale control efforts identified in the Recommended Aquatic Plan Control Plan.

Bottom Barrier Installation: Bottom barriers are essentially "underwater blankets" that cover the bottom sediments and the plants growing there. These barriers are made of many different materials. This list includes: burlap, sand-gravel, plastics, perforated black Mylar, and a material called Texel, which is specifically manufactured for aquatic plant control. These bottom barriers cover the bottom sediments and 1) kill the plants growing there, and 2) prevent new plants from becoming established. Although bottom barriers are mainly a small-scale control technique, they can be highly effective and provide long-term control.

Given enough time, almost all of these materials will trap pockets of gasses due to decomposition of organic material under them. When this occurs, many bottom barriers "ballon" upward, and become less effective and potentially hazardous to lake users. Therefore, it is important to properly anchor bottom barriers to the bottom, preferably using native materials such as rocks or sandbags. Bottom barriers should also be inspected periodically for sediment buildup and/or gas buildup. Periodic inspections also indicate if the materials being used need to be replaced, especially those that decompose (e.g. burlap).

Bottom barriers will control most aquatic plants but will not provide relief from freely floating plants such as coontail (Ceratophyllum demersum). Other plants such as Eurasian watermilfoil may be able to form a canopy over the bottom barrier by putting out lateral shoots around the

edges of the material, eventually growing up and over the barrier. Moreover, obstructions such as logs, rocks, and steep topography may inhibit the use of bottom barriers in some areas.

Bottom barriers can be installed by homeowners or by SCUBA divers depending on local conditions. The optimal time to install bottom barriers is in late winter or early spring before plants are growing rapidly. This minimizes the amount of gas that could potentially build up under the barrier due to decomposition of organic matter. If bottom barriers are to be used in areas of dense plant growth, it is advisable to cut and remove as much vegetation as possible prior to installation.

Advantages of Bottom Barriers:
- immediately creates an area of open water,
- relatively simple to install in swim beaches and around docks,
- controls 100% of plants where they are used,
- effective in targeting patches of plants to large to cost-effectively remove by hand.

Disadvantages of Bottom Barriers:
- high cost makes them cost effective only on a small scale,
- require periodic inspection and maintenance,
- may be a safety hazard to lake users if not maintained properly,
- will kill all plants in areas where used,
- negatively impacts many bottom-dwelling organisms and fish spawning,
- may need to be removed in order to reestablish native plants.
-

Costs of Bottom Barriers:
- $0.35 to $1.25 per square foot for materials
- approximately $0.75 per square foot for installation
- $100 - $200 for annual maintenance

Appropriateness for Big Lake:
- This control method is appropriate for Big Lake identified in the Recommended Aquatic Plan Control Plan. If necessary, bottom barriers will be used to control plants through small-scale control efforts and as a contingency to eradicate new noxious weeds.

Water Column Dyes: To use this aquatic plant and algae control method, water-soluble colored dyes are added to the water column to suppress plant and algae growth. The dyes reduce the amount of sunlight available to plants and algae, and therefore inhibit photosynthesis. The dyes are formulated to absorb segments of the electromagnetic spectrum (light) that are optimal for photosynthesis. The use of water column dyes is limited to lakes or ponds with higher retention times (low flushing) and have relatively clear water.

Advantages of Water Column Dyes:
- cost is low and no special equipment required,
- not toxic to humans, other wildlife using the water,

- may control both aquatic plants and algae.

Disadvantages of Water Column Dyes:
- may control both aquatic plants and algae,
- is less efficient when plants/algae at water surface,
- low water retention time may reduce effectiveness,
- may need to consider outflows and water rights of residents.

Costs for Water Column Dyes:
- $12.00 to $15.00 per acre foot.

Appropriateness for Big Lake:
- This control method is not appropriate for Big Lake due to its lack of target specificity and low expected efficacy on noxious weeds.

Sediment Removal: Removal of lake sediments controls aquatic plants primarily by reducing the available habitat where plants can growth by deepening the water body. This is most relevant for bottom-rooted aquatic plants. Sediment removal may also indirectly limit aquatic plant growth through removal of nutrients in the sediment, which are available to bottom-rooted plants. Sediments accumulate in a waterbody from many sources, including: stormwater drainage, surface water runoff, stream inflows, and erosion. Shallow lake and ponds often have abundant communities of aquatic plants. These plants accelerate the accumulation of sediment by trapping particles and through their annual senescence and decomposition.

Several different types of mechanical equipment are used to remove sediments from lakes. Some of these include: backhoes, drag lines, suction vacuums with pumps, and many other pieces of auxiliary support equipment used to de-water and transport materials. Settling ponds are often constructed to de-water sediments as transport of water-laden materials is very expensive. Extensive studies and testing are required prior to initiation of this control method. Several permits are also required, including one from the US Army Corps of Engineers.

Advantages of Sediment Removal:
- can be a long-term solution to suppress aquatic plant and algae,
- decreases available plant habitat and potentially reduces amount of in-lake nutrients.

Disadvantages of Sediment Removal:
- extremely costly,
- may require several years to acquire permits,
- shoreline access for equipment and noise often a problem,
- disturbance of benthic organisms and fish spawning habitat,

Costs for Sediment Removal:
- $400,000 to $600,000 for design, inspection, environmental monitoring,
- overall project cost typically in the millions of dollars.

Appropriateness for Big Lake:

- This control method is not considered appropriate for Big Lake due to the high cost, lack of target specificity, and issues associated with the salmon that use the lake.

Water Level Drawdown: Water level drawdown is most commonly used in reservoirs for power generation, flood control, or irrigation. During drawdown, water is either pumped or drained out of a system. The low water levels often expose aquatic plants that are then subjected to desiccation and/or freezing. Plants that do not have over-wintering structures such as turions or tubers often are more severely impacted. In some instances, plants that are not completely killed exhibit stunted growth after the water level is restored. The level of plant control is mainly a function of how low the water is drawn down to, the length of time water is at a low level, and the average temperatures to which they are exposed during drawdown.

Advantages of Drawdown:
- may already be a periodic activity to accomplish other objectives (e.g. power generation),
- lake residents incur no additional cost to control aquatic plants.

Disadvantages of Drawdown:
- short-term loss of beneficial uses (e.g. boating),
- may severely impact bottom-dwelling organisms and spawning habitat,
- lake morphology and water inflows may reduce effectiveness.

Costs of Drawdown:
- variable - unknown.

Appropriateness for Big Lake:
- This control method is not appropriate for Big Lake as there is no mechanism to draw down the lake, as well as the significant impact it would have on non-target organisms and recreational uses.

Currently Available Techniques - Mechanical Control

Hand Cutting: Hand cutting aquatic plants is accomplished by using a "cutting rake" to cut the plants below the surface. Most often the above-sediment portion of the plants are cut while leaving the roots behind. Some of the different "cutting-rakes" used are; scythes v-shaped rakes with a cutting edge, or thin cables. Often these tools have handles with a rope attached. The cutter is thrown out into to the water and retrieved to the shore, dock, or raft.

Advantages of Hand Cutting:
- equipment costs are minimal,
- requires no special training,
- provides immediate control,
- can be used around docks, boats, or rafts.

Disadvantages of Hand Cutting:
- time consuming, labor intensive,
- often required several times throughout the growing season,

- should collect all plant fragments and dispose of on shore.

Costs of Hand Cutting:
- equipment costs typically $50 to $1000
- no labor cost unless contractor hired

Appropriateness for Big Lake:
- This control method is appropriate for Big Lake for residents who want to conduct small-scale plant control in front of their homes. However, care should be taken to remove all plant materials.

Mechanical Harvesting: Mechanical harvesting is a control technique that is essentially mowing plants and collecting them to be disposed at on offshore location. Harvesters have blades that cut plants from 3-8 feet below the water and then move them up onto a conveyor belt and onto the machine. To offload the cut material, the harvester reverses the direction of the conveyer belt and transports the material to a truck on the shore. The truck then disposes of the material at a pre-determined location. A typical mechanical harvester may cut up to 2 acres per day. The amount of material that these machines can harvest is mainly limited by the time it takes to travel to the truck on the shore and offload the material.

Although mechanical harvesters can remove most of the aquatic vegetation in the areas in which they are working, they inevitably allow some of the cut material to escape. Also, simply cutting the upper portions of the plants does not inhibit their continued growth. Most harvesters only control plants for a few weeks up to a few months. Mechanical harvesting is not species-specific unless the harvester is used in an area that is basically a monoculture of a particular plant species. Due to the potential to produce many plant fragments, mechanical harvesting is not recommended for waterbodies with early or low density infestations of Eurasian watermilfoil. Mechanical harvesting also contributes to a significant mortality of small fish and invertebrates.

Advantages of Mechanical Harvesting:
- immediate removal of plants,
- no water use restrictions during operation,
- plant material may be used as a soil amendment.

Disadvantages of Mechanical Harvesting:
- time consuming, limited by availability of sites to offload vegetation,
- equipment intensive, maintenance may slow operation,
- usually must be repeated several times throughout the growing season,
- plant fragmentation may actually enhance growth,
- not species-specific,
- negative impacts to invertebrates and small fish,
- may actually release more nutrients through agitation of sediment and plant leaching than through removal of biomass
- high capital costs for machine purchase or use by management consultant

Costs of Mechanical Harvesting:

- $750 to $1500 per acre for contract commercial aquatic plant harvesters,
- $100,000 to $180,000 for harvester/off-loader purchase,
- cost of disposal not determined.

Appropriateness for Big Lake:
- This control method is not appropriate for Big Lake as harvesting Brazilian elodea likely will cause it to spread to other locations in the lake.

Rotovation: This plant control technique involves the use of a large underwater rototiller. Unlike mechanical harvesters, Rotovators dig down into the sediment seven to nine inches and grind up the lake bottom. This dislodges and plants and roots crowns. These plants then typically float to the surface. Mechanical harvesters may then be used to collect the plant material and transport it to shore for disposal. Rotovation provides for longer term control (1-3 years) than mechanical harvesters (weeks to months). Rotovation is not an effective option in areas with pioneering infestations of noxious plants that spread primarily by fragmentation. Also, rotovation is only effective on rooted aquatic plants and would not work well on freely-floating plants.

Advantages of Rotovation:
- provides longer control than mechanical harvesting,
- may stimulate growth of desirable native plants,
- removes entire plant including roots,
- in some instances can be used year-round.

Disadvantages of Rotovation:
- expensive with high maintenance costs,
- destroys habitat for bottom-dwelling organisms and fish,
- temporarily reduces water clarity, releases nutrients from sediment,
- need to check for underwater utilities.

Costs of Rotovation:
- $1,500 to $2,000 per acre.

Appropriateness for Big Lake:
- This control method is not appropriate for Big Lake as rotovating Brazilian elodea likely will cause it to spread to other locations in the lake, as well as impacting salmon habitat.

Diver Dredging: Diver dredging is a plant control method where divers use suction hoses to vacuum plants up from the lake bottom. The vacuum suction is caused by the operation of small pumps on a surface boat. The SCUBA divers dig up or pull the plants from the lake and feed them into the suction hose. On the barge, plant material is trapped by a screen and water is returned to the lake.

This plant removal technique is more effective when removing plants in areas of loose sediment. This allows for easier removal of the plants, whereas plants rooted in hard sediment are more difficult to dislodge. However, in areas of loose sediment, visibility can be reduced by

disturbing the lake bottom. This technique is best applied in areas with low levels of the plant(s) species to be removed. Although a screen collects the plant material, fragmentation of plants is also an issue.

It is inevitable that the discharge water from the surface boat will be cloudy from sucking up sediment. This temporarily reduces water clarity and may fuel plant and algae frowth through nutrient release. Sediment curtains are sometimes used to mitigate the drift of disturbed sediments, but there is no practical means to minimize nutrient release.

Advantages of Diver Suction Removal:
- useful in selectively removing target species,
- may be used in and around docks, boats, and other nearshore areas,
- feasible in areas where herbicides not an option.

Disadvantages of Diver Suction Removal:
- expensive, labor intensive, and relatively slow,
- disturbs the bottom, releases nutrients,
- large rocks, logs, etc. may limit.

Costs of Diver Dredging:
- $1,500 to $2,500 a day (includes divers and support personnel).

Appropriateness for Big Lake:
- This control method is not appropriate for Big Lake due to the high abundance of Brazilian elodea in the lake and the cost associated with removing by this method.

Currently Available Techniques - Biological Control

The biological control of an aquatic plant problem focuses on the selection of organisms that have an impact on the growth of a target plant. By stocking a lake with these organisms or "agents", the population of the target plant can be reduced and native plants can recover. Although there have been some successes with using biological control agents to control pests, not all have been effective. In some instances biological control has been detrimental to non-target organisms. Biological control is an area of active research yet many of the tools and techniques in this field are still in the experimental stages and have not been approved for use.

Biological control agents are classified as "Classic" or "General". Classic biological control agents are those which are host-specific and attack only those species targeted for control. These biological control agents typically do not completely eradicate their host. Instead, they eventually develop a typical "predator-prey" relationship where both populations fluctuate around a given population mean density. Therefore, classic control agents do not eliminate their target species but, if successful, maintain the target species at a lower population density. General biological control agents are not host-specific and will target many other organisms. These are of limited use when attempting to control specific species.

A third type of biological control agent is those that have not evolved with the target species but will degrade the target species if it is present. These control agents are less common but show some promise in controlling introduced species.

Grass Carp: Grass carp (or White Amur) are plant-consuming fish native to China and Siberia. They can be used as a (general) biological control agent to control aquatic plants. Although it is proposed that they have feeding preferences for certain plant species, if stocked at a high rate will feed on all plant species. The rate at which they are stocked depends primarily on the number of vegetated acres and secondarily on the desired level of control, climate, water temperature, and other site-specific conditions. The recommended maximum stocking rate in Washington is 25 fish per acre (Bonar et al. 2002). A study of grass carp usage in Washington has indicated that in most cases grass carp either eat all the vegetation in the lake or have a negligible impact on plant levels. Paradoxically, even in those lakes where they have had negligible impact on aquatic plants, surveys of lake residents indicate an overall high level of satisfaction with using the grass carp as a plant control method.

Only sterile (triploid) grass carp may be stocked in waters in the state of Washington. Imported from out-of-state, these fish must be certified as sterile and disease-free. In order to prevent escape, waters with inlets and outlets must be screened prior to stocking grass carp. Due to predation and natural mortality, grass carp must be restocked on a periodic basis.

Water quality may improve after stocking grass carp as dense areas of vegetation are reduced (WDFW 1990). However, if the majority of aquatic plants are removed, it is likely that algae may become very abundant due to the increased availability of light and nutrients. Moderate control of aquatic plants using grass carp is difficult to achieve, and they should be stocked only in waters were removal of all aquatic plants is and acceptable condition.

Advantages of Grass Carp:
- are a biological control option for plant control,
- are relatively inexpensive and may provide long-term plant control.

Disadvantages of Grass Carp:
- may take several years to achieve tangible and measurable decrease in plant biomass
- may alter composition of plant community without decreasing overall biomass,
- screening may be necessary to prevent escape and allow for salmonid migration,
- may decrease water clarity due to increases in algae growth.

Costs of Grass Carp:
- $10.00 to $15.00 per fish (plus delivery),
- typically $50 to $200 per acre,
- screening costs (if necessary) are site-specific.

Appropriateness for Big Lake:
- This control method is not appropriate for Big Lake due to the high cost of screening and potential conflicts with salmon habitat. This control method was not permitting by WDFW at Big Lake in the past.

Purple Loosestrife Biocontrol: In 1992 beetles were released in Washington. Their damaging impact on purple loosestrife populations was evident in the Winchester Wasteway area of Grant County in 1997 and 1998. Biological control agents may provide the long term success in controlling this noxious weed.

Galerucella calmariensis and G. pusilla are both leaf-feeding chrysomelids. These beetles defoliate and attack the terminal bud area, drastically reducing seed production. The mortality rate to purple loosestrife seedlings is high. Evidence of Galerucella ssp. damage are round holes in the leaves. Four to six eggs are laid on the stems, axils or leaf underside. The larvae feed constantly on the leaf underside, leaving only the thin cuticle layer on the top of the leaf. By 1996 populations of Galerucella ssp. visibly impacted purple loosestrife stands in the Winchester Wasteway.

Hylobius transversovittatus is a root-mining weevil that also eats leaves. This beetle eats from the leaf margins, working inward. The female crawls to the lower 2-3 inches of the stem then bores a hole to the pithy area of the stem where 1 -3 eggs are laid daily from July to September. Or, the female will dig through the soil to the root, and lay eggs in the soil near the root. The larvae then work their way to the root. H. transversovittatus damage is done when xylem and phloem tissue are severed, and the carbohydrate reserves in the root are depleted. Plant size is greatly reduced because of these depleted energy reserves in the root. The larvae evidence is the zig-zag patterns in the root.

Advantages of Purple Loosestrife Biocontrols:
- are a biological control option for plant control,
- are relatively inexpensive and may provide long-term plant control.

Disadvantages of Purple Loosestrife Biocontrols:
- may not control the purple loosestrife in and around the lakes to an acceptable level,
- may take several years to achieve tangible and measurable decrease in plant biomass,

Costs of Purple Loosestrife Biocontrols:
- relatively inexpensive (mostly volunteers),
- not labor intensive,
- can be used as a long-term control method if successful.

Appropriateness for Big Lake:
- This control method is not appropriate for Big Lake as purple loosestrife is not found there.

Currently Available Techniques - Chemical Control

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

Aquatic herbicides are sprayed directly onto floating or emergent aquatic plants or are applied to the water in either a liquid or pellet form. Systemic herbicides are capable of killing the entire plant. Contact herbicides cause the parts of the plant in contact with the herbicide to die back, leaving the roots alive and able to regrow. Non-selective, broad spectrum herbicides will generally affect all plants that they come in contact with. Selective herbicides will affect only some plants (often dicots - broad leafed plants like Eurasian watermilfoil (Myriophyllum spicatum) will be affected by selective herbicides whereas monocots like Brazilian elodea (Egeria densa) may not be affected). Most aquatic plants are monocots.

Because of environmental risks from improper application, aquatic herbicide application in Washington state waters is regulated and has the following restrictions:

- Applicators must be licensed by the Washington State Department of Agriculture.
- Because of a March 2001 court decision (federal 9th Circuit District Court), coverage under a discharge permit called a National Pollutant Elimination System Discharge (NPDES) permit must be obtained before aquatic herbicides can be applied to the waters of the state.
- Notification and posting are required and there may be additional mitigations proposed to protect rare plants or threatened and endangered species.

Ecology has developed a general NPDES permit for the management of noxious weeds growing in aquatic environments and a separate general permit for nuisance aquatic weeds (native plants) and algae control. For nuisance weeds (native species) and algae, applicators and the local sponsor of the project must obtain a NPDES permit from the Washington Department of Ecology before applying herbicides to Washington waterbodies. For noxious weed control, applicators and their sponsors can obtain coverage under the Washington Department of Agriculture NPDES permit for noxious weed control.

The Department of Ecology currently issues permits for five aquatic herbicides and one algaecide (as of 2003 treatment season) for aquatic weed treatment for lakes, rivers, and streams. Weed control in irrigation canals is covered under another permit. Other herbicides are undergoing review and it is likely that other chemicals may be approved for aquatic use in Washington in the future.

The two contact herbicides registered and approved for use in Washington State are Endothall and Diquat. The three systemic herbicides registered and approved for use in Washington are Fluridone, 2,4-D and Glyphosate.

The WDOE is currently reviewing an additional aquatic herbicide for future use in Washington called Triclopyr. Triclopyr is a systemic herbicide, which is effective in selectively controlling some emergent and submersed aquatic plants. This product is described below in the Developing Techniques section.

Fluridone: Fluridone is a slow-acting systemic herbicide used to control Eurasian watermilfoil and other underwater plants. It may be applied as a pellet or as a liquid. Fluridone can show good control of submersed plants where there is little water movement and an extended time for the treatment. Its use is most applicable to whole-lake or isolated bay treatments where dilution can

be minimized. It is not effective for spot treatments of areas less than five acres. It is slow-acting and may take six to twelve weeks before the dying plants fall to the sediment and decompose. When used to manage Eurasian watermilfoil in Washington, fluridone is applied several times during the spring/summer to maintain a low, but consistent concentration in the water. Although fluridone is considered to be a broad spectrum herbicide, when used at very low concentrations, it can be used to selectively remove Eurasian watermilfoil. Some native aquatic plants, especially pondweeds, are minimally affected by low concentrations of fluridone. Use of fluridone does not pose a threat to human health or to fish and wildlife when used according to the label (SePRO 2002). While there is a 14-day precaution when using treated waters for irrigation (potentially longer with multiple treatments), there are no other water use restrictions when using the liquid formulation of fluridone.

Advantages of Fluridone:
- systemic herbicide, will kill entire target plants,
- variety of plants are susceptible depending on treatment rates and timing,
- can be used to target specific species with correct application rates,
- no known toxicity to humans, fish, and wildlife,
- no water use restrictions for fishing, swimming.

Disadvantages of Fluridone:
- plants need exposure to herbicide for lengthy period of time,
- usually requires multiple treatments in a growing season,
- high potential for herbicide drift, which dilutes chemical and may affect non-target plants.

Costs of Fluridone:
- -$900 to $1,100 per acre

Appropriateness for Big Lake:
- This control method is appropriate for Big Lake and is included as a contingency plan in the Recommended Aquatic Plant Control Plan for Brazilian elodea.

2,4-D: There are two formulations of 2,4-D approved for aquatic use. The granular formulation contains the low-volatile butoxy-ethyl-ester formulation of 2,4-D (Trade names include: AquaKleen® and Navigate®). The liquid formulation contains the dimethylamine salt of 2,4-D (Trade name - DMA*4IVM). 2,4-D is a relatively fast-acting, systemic, selective herbicide used for the control of Eurasian watermilfoil and other broad-leaved species. Both the granular and liquid formulations can be effective for spot treatment of Eurasian watermilfoil. 2,4-D has been shown to be selective to Eurasian watermilfoil when used at the labeled rate, leaving native aquatic species relatively unaffected.

The mode of action of this chemical is primarily as a stimulant of plant elongation and cell division (WDOE 2001). This post-emergent herbicide is primarily used to control watermilfoil and water stargrass. This herbicide targets dicots (e.g. milfoils) and leaves monocots unharmed. Because most aquatic plants are monocots, 2,4-D can often be used for selective plant control.

As with most herbicides, effectiveness of the treatment is dependent upon the timing of the application and density of the target plant community. Repeat applications may be required in areas of dense plant growth. Susceptible plants will begin to show signs of herbicide damage in one to two weeks after treatment, followed by plant mortality and decomposition.

There are no fishing or swimming restriction associated with the use of 2,4-D although the WDOE recommends "that due to risk of dermal contact, a swimming advisory shall be posted advising swimmers to wait 24 hours before reentering directly treated areas to allow time for granules to disperse" (WDOE 2001). This herbicide cannot be used in waters used for irrigation, agricultural sprays, watering dairy animals or domestic water supplies (Applied Biochemists 2002) for three to five days after treatment. The recent risk assessment prepared for WDOE as part of the 2001 Final Supplemental Environmental Impact Statement for the aquatic plant management program (WDOE 2001) indicated that "no significant adverse impacts on fish, free swimming invertebrates or benthic invertebrates" should be expected from 2,4-D (either formulation) applications at appropriate label rates.

Advantages of 2,4-D:
- fast-acting systemic herbicide which is effective in removing selected plants,
- unlikely to damage non-target plants when applied at labeled rates,
- can be used on small to large scale,
- limited water use restrictions.

Disadvantages of 2,4-D:
- application must be conducted 0.5 miles or greater from active drinking/domestic water withdrawals (unless approved by WDOE),
- 24 hour swimming advisory imposed by WDOE,
- treatment windows apply to areas where Endangered Species Act (ESA) listed salmonids and certain gamefish are present (according to WDFW specifications).

Costs of 2,4-D:
- $275 - $700 per acre.

Appropriateness for Big Lake:
- This control method is not currently appropriate for Big Lake as it is primarily used for Eurasian watermilfoil control, and this noxious weed likely was eradicated in 2003. However, if Eurasian watermilfoil either survived treatment in 2003 or re-infests the lake in the future, this may be appropriate if physical control is not feasible or effective.

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

Glyphosate should be applied by experienced and state-licensed (and insured) personnel. A NPDES Noxious Weed permit is required to apply glyphosate. There are no water-use restrictions associated with spraying glyphosate. However, the applicator is responsible for applying the herbicide in compliance with the product label and the NPDES Noxious Weed permit.

Advantages of Glyphosate:
- fast acting injury to plant tissue,
- low toxicity,
- not persistent in environment,
- spot treatments possible.

Disadvantages of Glyphosate:
- repeat application often necessary
- non-target plant impacts sometimes difficult to mitigate as this is a fairly broad-spectrum.

Costs of Glyphosate:
- -$250.00 - 350.00 per treated acre,
- per acre costs higher when treated area < 5 acres.

Appropriateness for Big Lake:
- This control method is appropriate for the fragrant waterlilies and yellow flag iris at Big Lake and was included in the Recommended Aquatic Plant Control Plan.

Imazapyr: This systemic broad spectrum herbicide (trade names include Arsenal®, Chopper®, or Stalker®) is used to control grasses, broadleaves, vines, brambles, brush, and trees. It is generally applied as a liquid to the leaves. Imazapyr does not work on underwater plants such as Eurasian watermilfoil or plants that have a majority of there foliage underwater. Although Imazapyr is a broad spectrum, non-selective herbicide, a good applicator can somewhat selectively remove targeted plants by focusing the spray only on the plants to be removed. Plants can take several weeks to die and a repeat application is often necessary to remove plants that were missed during the first application.

Imazapyr should be applied by experienced and state-licensed (and insured) personnel. A NPDES Noxious Weed permit is required to apply imazapyr. There are no swimming or fishing water-use restrictions associated with spraying imazapyr. There is a 120-day irrigation restriction for waters treated with imazapyr unless concentration is less than 1.0 ppb. However, the applicator is responsible for applying the herbicide in compliance with the product label and the NPDES Noxious Weed permit.

Advantages of Imazapyr:
- fast acting injury to plant tissue,
- low toxicity,
- spot treatments possible.

Disadvantages of Imazapyr:
- repeat application often necessary
- non-target plant impacts sometimes difficult to mitigate as this is a fairly broad-spectrum.

Costs of Imazapyr:
- unknown at this time,
- per acre costs likely higher when treated area < 5 acres.

Appropriateness for Big Lake:
- This control method is somewhat appropriate for the fragrant waterlilies and yellow flag iris at Big Lake and should be considered if costs are determined to less than glyphosate and irrigation is not a concern.

Endothall: Endothall is a fast-acting non-selective contact herbicide which destroys the vegetative part of the plant but generally does not kill the roots. Endothall may be applied in a granular or liquid form. Typically endothall compounds are used primarily for short term (one season) control of a variety of aquatic plants. However, there has been some recent research that indicates that when used in low concentrations, endothall can be used to selectively remove exotic weeds; leaving some native species unaffected. Because it is fast acting, endothall can be used to treat smaller areas effectively. Endothall is not effective in controlling Canadian waterweed (Elodea canadensis) or Brazilian elodea.

There are several water-use restrictions associated with the use of Endothall. At application rates needed to control Eurasian watermilfoil (2.0 to 4.0 ppm) the water-use restrictions are: do not consume fish taken from treated areas for three days and do not use water from treated areas for watering livestock, preparing agricultural sprays for food crops, for irrigation or for domestic purposes for 14 days after application. There is no swimming restriction for Endothall products. However, the WDOE recommends waiting 24 hours after the herbicide treatment before swimming, although there is no official label restriction for swimming. Fish toxicity is not a factor, according to the product labels, at doses below 100 ppm (Cerexagri 2003).

Advantages of Endothall:
- fast acting injury to plant tissue,
- little or no off-target drift impacts,
- spot treatments possible.

Disadvantages of Endothall:
- only provides temporary reductions in plant biomass (does not kill plant roots),
- non-target plant impacts are difficult to mitigate as this is a fairly broad-spectrum ,
- higher water-use restrictions relative to other herbicides,

Costs of Endothall:
- -$650.00 per treated acre

Appropriateness for Big Lake:

- This control method is not appropriate for Big Lake as it is not as effective and more costly than another contact herbicide (diquat) when used to control Brazilian elodea.

Diquat: Diquat is applied as a liquid and is a fast-acting non-selective contact herbicide which destroys the vegetative part of the plant but does not kill the roots. Diquat is effective on a variety of submersed plants, including Eurasian watermilfoil, and also some types of filamentous algae. Diquat kills plants rapidly, potentially causing a depletion of oxygen and release of nutrients from plant decay into the water column. Typically diquat is used primarily for short term (one season) control of a variety of submersed aquatic plants. Herbicide drift is usually minimal and it can be used to treat specific areas of the water. However, diquat may be less effective if applied to murky or turbid waters or areas with dense algal blooms. Also, repeat applications may be necessary for season-long plant control.

Diquat has slight toxicity to most animals and freshwater fish. It is slightly too highly toxic to aquatic invertebrates. However, the WDOE approved Diquat for use in nuisance and noxious weed control (WDOE 2003) based on the completion of a Final Risk Assessment and the Final Supplemental Environmental Impact Statement for Diquat Bromide (WDOE 2002a and b).

Water use restrictions for the use of Diquat applications at a rate of two gallons Reward per surface acre (appropriate rate for Eurasian watermilfoil control) are three days for drinking water, one day for livestock drinking, three days for irrigation to turf and ornamental and five days for irrigation to food crops. There is no restriction for fishing or swimming in treated waters (Zeneca 1997).

Advantages of Diquat:
- rapid acting and effective against most plant species,
- does not bioaccumulate in aquatic organisms,
- no fishing or swimming restriction.

Disadvantages of Diquat:
- persistent, especially in sediments (although chemically inactive),
- some water-use restrictions in place,
- potentially toxic to aquatic organisms,
- repeat applications may be needed,
- rapid action may cause oxygen depletion and rapid release of nutrients into water.

Costs of Diquat:
- $300 - $400 per acre for Reward®

Appropriateness for Big Lake:
- This control method is appropriate for Big Lake and was identified in the Recommended Aquatic Plant Control Plan as the primary technique to be used to control Brazilian elodea.

Developing Techniques

Listed below are a few other aquatic plant control methods that are under development. Should these techniques become available for use in Washington, their use should be re-examined in the context of the Integrated Treatment Plan.

Triclopyr: This is a systemic herbicide with a water soluble triethylamine salt formulation containing three pounds of triclopyr acid equivalent per gallon. This is the first aquatic herbicide to receive registration since 1988 (SePRO 2003a) and should be registered in Washington in the near future.

Triclopyr is effective on broad-leafed (dicots) plants such as Eurasian watermilfoil and does not harm monocots. Therefore, it is used for the selective removal of many noxious aquatic weeds including Eurasian watermilfoil and purple loosestrife. Triclopyr is a liquid product with a contact time requirement of 24 to 48 hours and can be used to treat specific areas. Susceptible plants exhibit epinasty (bending and twisting of plant tissue) within one day after treatment and die shortly thereafter.

Triclopyr does not accumulate in lake sediments or bottom-feeding fish, and has a low toxicity potential (SePRO 2003b). The primary means be which triclopyr breaks down is through Photodegradation, with a typical half-life of 0.5 to 3 days. Water-use restrictions likely will be reviewed prior to registration for use in Washington.

Advantages of Triclopyr:
- selective for dicots,
- short contact time needed,
- kills entire target plant,
- potential for long-term control.

Disadvantages of Triclopyr:
- not currently approved for use in Washington,

Costs of Triclopyr:
- $1,700 per acre (assumes maximum label rate applied).

Appropriateness for Big Lake:
- This control method is not appropriate for Big Lake as the noxious weeds that currently reside in the lake are not affected by this herbicide. This control method would be appropriate if Eurasian watermilfoil becomes reestablished and is not able to be controlled through physical methods.

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). Within the state of Washington, milfoil weevils are more abundant in eastern side of the Cascade Mountains, and feeds on both Eurasian and Northern watermilfoil (M. sibiricum). This milfoil control technique has shown some promise, although it not currently employed. Researches have a firm understanding at how these weevils influence plant growth at the individual plant level, but are still investigating weevil-milfoil dynamics on a larger scale (Creed 2000). More

work is needed to determine which factors limit weevil densities and what lakes are suitable candidates for weevil usage in order to implement a cost effective control program.

The WDOE and the Pend Oreille County Noxious Weed Control Board are currently culturing Milfoil weevils for use in experimental treatments on M. spicatum control. Although some progress has been made using these weevils for milfoil control, there are still questions that need to be answered before they will be used as a primary means to control Eurasian watermilfoil.

Advantages of Milfoil Weevils:
- are a biological control option for milfoil control,
- likely to be relatively inexpensive and may provide long-term milfoil control,
- little to no disruption of native plant and animal communities.

Disadvantages of Milfoil Weevils:
- may not control milfoil to acceptable levels,
- may take several years to achieve tangible and measurable decrease in milfoil biomass,
- are susceptible to predation by small fishes,
- current success rate highly variable.

Costs of Milfoil Weevils:
- unknown at this time.

Appropriateness for Big Lake:
- This control method is not appropriate for Big Lake as Eurasian watermilfoil was either eradicated after the treatment in 2003 or is at such low levels that it could not sustain the weevils.

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APPENDIX C

PERMITTING INFORMATION

Most aquatic plant management tools can have an adverse impact on the environment if applied incorrectly or if too much vegetation is removed from a lake or river system. Because of this, there are a number of permits required to perform control work.

Prior to the mid 1990s, all aquatic plants were treated the same with respect to permitting. However, many local and state permit programs had different requirements for the management of noxious aquatic weeds. This resulted in confusion about permitting needs, redundancy in efforts, and often times greatly increased the cost of planning and control.

The 1996 legislation made two significant changes in the permitting requirements for management of noxious aquatic weeds with respect to these types of control efforts. The first is that it exempts control efforts conducted to manage noxious aquatic weeds from the State and any local shoreline ordinances. While there can still be a local permit requirement to clear aquatic plants not categorized as a noxious weed, any control efforts that focus on noxious weeds are exempt from these local permits and their requirements.

The second key change was that this legislation directed the Washington Department of Fish and Wildlife (WDFW) to develop an informational pamphlet that serves as the Hydraulic Permit Approval (HPA). Citizens, units of government, or private weed control firms can obtain this document from the Department. The pamphlet serves as a permit provided the conditions are read and followed. There is generally no need to submit any further paperwork. There are a number of general provisions that must be followed for all of the techniques described in this report. These include the following. (Note: Not all of these provisions are required for each control method. The following common technical provisions are applicable to numerous control techniques and are listed here to avoid repetition.)

Common Provisions from the HPA Pamphlet

- Removal of detached plants and plant fragments from the watercourse shall be as complete as possible. This is especially important when removing or controlling aquatic noxious weeds.
- Detached plants and plant fragments shall be disposed of at an upland site so as not to re-enter state waters.
- Work shall be conducted to minimize the release of sediment and sediment-laden water from the project site.
- Extreme care shall be taken to ensure that no petroleum products, hydraulic fluid or other deleterious material from equipment used are allowed to enter or leach into the watercourse.
- If at any time as a result of project activities or water quality problems, fish are observed in distress or a fish kill occurs, operations shall cease and both the Department of Fish and Wildlife and the Department of Ecology shall be notified of the problem immediately. The project shall not resume until further approval is given by the Department. Additional measures to mitigate impacts may be required.
- Every effort shall be made to avoid the spread of plant fragments through equipment contamination. Persons or firms using any equipment to remove or control aquatic plants shall thoroughly remove and properly dispose of all viable residual plants and viable plant parts from the equipment prior to the equipment's use in a body of water.

- Existing fish habitat components such as logs, stumps, and large boulders may be relocated within the watercourse if necessary to properly install the bottom barrier, screen, weed roller or to operate the equipment. These habitat components shall not be removed from the watercourse.
- Alteration or disturbance of the bank and bank vegetation shall be limited to that necessary to conduct the project. All disturbed areas shall be protected from erosion, within seven calendar days of completion of the project, using vegetation or other means. The banks shall be revegetated within one year with native or other approved woody species. Vegetative cuttings shall be planted at a maximum interval of three feet (on center), and maintained as necessary for three years to ensure 80% survival. Where proposed, planting densities and maintenance requirements for rooted stock will be determined on a site-specific basis. After prior authorization by the Department, the requirement to plant woody vegetation may be waived for areas where the potential for natural revegetation is adequate, or where other engineering or safety factors preclude them.
- Due to potential impacts to sockeye spawning areas, prior authorization by the Department shall be required for activities in Baker Lake and Lakes Osoyoos, Ozette, Pleasant, Quinault, Sammamish, Washington, and Wenatchee. Authorization may or may not be given for the activity, and if given, may require mitigation through a written agreement between the applicant and the Department for impacts by the activity to the spawning area. (This provision should be noted with respect to work performed in King County. Lakes Washington and Sammamish are included in this list of lakes where additional communication with the department is required. The other lakes in the County that are discussed in this report are exempt from this requirement.)

The discussion of permitting requirements is presented here according to categories of management tools; biological, mechanical and physical, and chemical. Within each management control tool, the discussion includes federal, state, and local government requirements.

BIOLOGICAL CONTROL PERMITTING

The primary operational tool that falls in this category at this point is the use of Triploid Grass Carp. The WDFW regulates the introduction of Triploid Grass Carp in Washington State. Triploid Grass Carp are sterile/non-reproducing fish and must be certified as such by the USFWS. There are two permit requirements that generally need to be met.

First, the user will need to apply to WDFW for a Grass Carp Stocking Permit. The applicant must include information on the size of the lake; the amount, location and type of aquatic vegetation present; the composition of ownership around the lake or pond; any inlet and/or outlet from the pond, and in some cases must provide additional documentation such as studies or plans for the water body. A SEPA checklist must also be prepared for each water body.

It is relatively easy to obtain a grass carp stocking permit for a small lake or pond with one owner and no outlet (or an outlet that can be screened). In cases where there is more than one property owner, there are additional requirements in the permit. A list of names and addresses of the property owners must be provided. There must also be an indication of whether the property

owner approves the stocking of this fish in the lake. This condition is generally used to ensure that one person or a small group of people do not implement activities that the majority of homeowners oppose. When the law and rules where developed for this permit process, the Department of Fish and Wildlife did not want to see large natural lakes stocked with this fish as a general practice. These lake systems are complex ecosystems and the introduction of grass carp could remove enough vegetation to alter fisheries or other environmental components. They developed a condition to protect these lake systems by requiring a much higher level of study prior to making a decision on permit issuance. This regulation used the presence of a public access as a trigger for the additional permitting requirements. The regulation indicates that a Phase One Lake Restoration Study must be performed that focuses specifically on the impacts of Grass Carp on the system prior to submittal of a permit application. The Department has in recent years relaxed this considerably. They now in some cases allow an Integrated Aquatic Vegetation Management Plan that has been developed and adopted substitute for the Phase One Study.

In many cases, the lake or pond to be stocked will have an inflow and/or outflow. If either of these conditions exist, fish screens need to be installed to keep the Grass Carp in the permitted waters and keep them from impacting other waters of the State. This is what would trigger the second permit which is an HPA from WDFW. An application and instructions can be found at this website: http://www.ecy.wa.gov/programs/sea/pac/jarpa.html

Many researchers are looking at other biological control agents to target various noxious aquatic plants. These programs are generally not considered operational as of this time. As they do become operational, most states will probably consider and develop a permit program. At this point the Department of Agriculture in Washington State oversees permitting for introduction of the Eurasian watermilfoil Weevil but there is no formal permit application. The Department of Agriculture should be contacted directly for information.

MECHANICAL AND PHYSICAL CONTROL PERMITTING

There are a number of mechanical control technologies used to manage aquatic plants. These include aquatic weed harvesting, rotovation, diver dredging, and bottom barrier placement. All of these activities require a HPA from the WDFW. The common provisions for an HPA were previously described, the following describes those specific to these control options.

Bottom barriers provisions from the HPA Pamphlet

- Prior authorization must be obtained from WDFW for bottom barrier placement in Lakes Washington and Sammamish.
- For removal and control of aquatic noxious weeds, bottom barrier or screen material shall not cover more than 50 percent of the length of the applicant's shoreline. Bottom barrier or screen projects covering a larger area shall require prior authorization by the Department.
- Bottom barrier or screen and anchor material consisting of biodegradable material may be left in place. Bottom barrier or screen and anchor material that is not biodegradable shall be completely removed within two years of placement to encourage recolonization of aquatic beneficial plants unless otherwise approved by the Department.
- To remove or control aquatic beneficial plants such that an access is maintained for boating or swimming, bottom barrier or screen and anchor material that is either biodegradable or non-biodegradable may be installed along a maximum length of 10 linear feet of the applicant's shoreline. Bottom barrier or screen projects for boating and swimming access which cover a larger area shall require prior authorization by the Department.
- Bottom barrier or screen material shall be securely anchored with pea-gravel filled bags, rock or similar mechanism to prevent billowing and movement offsite.
- Bottom barrier or screen and anchors shall be regularly maintained while in place to ensure the barrier or screen and anchors are functioning properly. Barriers or screens that have moved or are billowing shall immediately be securely reinstalled or removed from the watercourse.
- Bottom barrier applications in Lake Washington and Sammamish need additional prior approval from the Department. The Northwest Regional biologist located in Issaquah is responsible for approval of those proposed applications.

Aquatic weed harvesting provisions from the HPA Pamphlet

- Mechanical harvesters and cutters shall not be used to remove an aquatic noxious weed early infestation.
- If the intent of the project is to remove aquatic beneficial plants, prior authorization by the Department shall be required.
- Mechanical harvester and cutter operations shall only be conducted in waters of sufficient depth to avoid bottom contact with the cutter blades.
- Mechanical harvesters and cutters shall be operated at all times to cause the least adverse impact to fish life.
- Mechanical harvesters and cutters shall be well maintained and where practicable, food-grade oil in the hydraulic systems should be used.
- Fish life that may be entrained in the cut vegetation during mechanical harvester operations shall be immediately and safely returned to the watercourse.

Diver dredging provisions from the HPA Pamphlet

- If the intent of the project is to remove or control aquatic beneficial plants, prior authorization from the Department shall be required.
- Dredging shall be conducted at all times with dredge types and methods that cause the least adverse impact to fish life.

- Dredges shall be well maintained and where practicable, food-grade oil in the hydraulic system should be used.
- Upon completion of the dredging, the bed shall not contain pits, potholes, or large depressions to avoid stranding of fish.
- Removal of plants and plant fragments from the watercourse shall be as complete as possible. This is especially important when removing or controlling aquatic noxious weeds.
- Plants and plant fragments shall be removed from the dredge slurry prior to its return to the watercourse.
- Dredged bed materials, including detached plants and plant fragments, shall be disposed of at an upland disposal site so as not to reenter state waters.
- A hydraulic dredge shall only be operated with the intake at or below the surface of the material being removed. The intake shall only be raised a maximum of three feet above the bed for brief periods of purging or flushing the intake system.

Diver dredging targeting noxious weeds is approved under this section of the permit. All native plant control operations need additional approval from the Department.

Rotovation provisions from the HPA Pamphlet
An individual HPA is required for all rotovation projects. Technical provisions for rotovation projects can be found in WAC 220-110-336.

Aquatic Herbicide Application Permitting

Prior to the offer for sale of any aquatic herbicide, the manufacturer must have it registered through the Environmental Protection Agency (EPA). This requires a rigorous testing process in which registrants much demonstrate a wide range of safety to humans and compatibility with the environment in their intended use site. In addition to approval by the federal government a herbicide must also be registered for use in Washington State. The Washington Department of Agriculture (WDOA) regulates all pesticides within the State and the applicators that apply them. In Washington State, all aquatic herbicides have been classified as "restricted use materials". This set of regulations tightens sales requirements on all distributors of aquatic herbicides. It is illegal to sell a restricted use material to any person or business that does not have a commercial or private applicator's license. All of the registrations and approvals just described are not related to permitting for a specific project, but do affect the type of herbicides available for use and regulate who can apply them.

Project specific permitting is regulated through the WDOA's National Pollutant Discharge Elimination System (NPDES) General Permit. This NPDES permit is a federal permit granted to WDOA for discharges associated with the control of noxious vegetation. .This general permit applies to discharges to lakes, rivers, streams, riparian areas, ponds, estuaries, tidelands, ditches, and wetlands. The individual or lake group wishing to apply an aquatic herbicide must submit an application for coverage under Agriculture's NPDES permit. It sounds complex, but is actually easy. All of the instructions and permit information, as well as an online application can be found on the following website:

http://www.ecy.wa.gov/programs/wq/pesticides/final_pesticide_permits/noxious/noxious_index.htm

Table C-1. Agency Involvement and Permitting Requirements.

Method	Federal(1)	State	Local
Biological-Grass Carp	USFWS Triploid Certification (performed at the source hatchery by the USFWS)	WDFW Grass Carp Stocking Permit required for import and introduction of fish. HPA permit approval from the same department required for any screen necessary.	Noxious weeds are exempt from local permitting requirements.
Biological-Insects	Biocontrols from outside US require USDA approval for introduction. No insects for Eurasian milfoil control currently used or pending. Domestic insects are being used at the research level.	WDOA approval by letter necessary to import a biocontrol insect from another state.	Noxious weeds are exempt from local permitting requirements.
Mechanical Control-Bottom Barrier	No Federal involvement.	Obtain the WDFW Publication APF-1-95. This document, when directions are followed, is the required HPA. Additional approvals may be necessary from WDFW prior to operations in Lake Washington and Sammamish.	Noxious weeds are exempt from local permitting requirements.
Mechanical Control-Aquatic Plant Harvesting	No Federal involvement.	Obtain the WDFW Publication APF-1-95. This document, when directions are followed, is the required HPA. Additional approvals may be necessary from WDFW prior to operations in Lake Washington and Sammamish.	Noxious weeds are exempt from local permitting requirements.

(1)A Biological Assessment could be requested under some circumstances to meet the needs of the Endangered Species Act.

Table C-1. Agency Involvement and Permitting Requirements. (continued)

Method	Federal(1)	State	Local
Mechanical Control-Diver Dredging	May require a Section 404 permit from the Army Corps of Engineers.	Obtain the WDFW Publication APF-1-95. This document, when directions are followed, is the required HPA. Additional approvals may be necessary from WDFW prior to operations in Lake Washington and Sammamish.	Noxious weeds are exempt from local permitting requirements.
Mechanical Control-Rotovation	No Federal involvement.	An individual HPA is required for all rotovation projects. Technical provisions for rotovation projects can be found in WAC 220-110-336.	Noxious weeds are exempt from local permitting requirements.
Aquatic Herbicide Application	NPDES General Permit is required. This permit is held by WDOA.	Must apply for coverage under WDOA's NPDES Permit	Noxious weeds are exempt from local permitting requirements.

(1)A Biological Assessment could be requested under some circumstances to meet the needs of the Endangered Species Act.

APPENDIX D

HERBICIDE INFORMATION

PULL HERE TO OPEN ►

REWARD®

Landscape and Aquatic Herbicide

TO PREVENT ACCIDENTAL POISONING, NEVER PUT INTO FOOD, DRINK, OR OTHER CONTAINERS, AND USE STRICTLY IN ACCORDANCE WITH ENTIRE LABEL.

DO NOT USE THIS PRODUCT FOR REFORMULATION.

Active Ingredient:	
Diquat dibromide [6,7-dihydrodipyrido (1,2-a:2',1'-c) pyrazinediium dibromide]	37.3%
Other Ingredients:	62.7%
Total:	100.0%

Contains 2 lbs. diquat cation per gal. as 3.73 lbs. salt per gal.

KEEP OUT OF REACH OF CHILDREN.

WARNING/AVISO

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

See additional precautionary statements and directions for use inside booklet.

EPA Reg. No. 100-1091
EPA Est. 100-TX-001

Product of United Kingdom
Formulated in the USA

SCP 1091A-L2 0901

154290

2.5 gallons

U.S. Standard Measure

syngenta

SCP 130-1091A-L2

FIRST AID	
If swallowed	• Call a Poison Control Center or doctor immediately for treatment advice. • Immediately give water or milk to drink and induce vomiting by inserting finger in throat. • Do not induce vomiting or give anything by mouth to an unconscious person. • Take person and product container to the nearest hospital or physician fast. • PROMPT TREATMENT IS ESSENTIAL TO COUNTERACT POISONING and should be initiated before signs and symptoms of injury appear.
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 in eyes	• Hold eye open and rinse slowly and gently with water for 15-20 minutes. • Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye. • Call a Poison Control Center or doctor for treatment advice.
If 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.
NOTE TO PHYSICIAN **CALL SYNGENTA MEDICAL EMERGENCY ASSISTANCE 1-800-888-8372** at any hour to obtain toxicology information and a diquat analysis. To be effective, treatment for diquat poisoning must begin **IMMEDIATELY.** Treatment consists of binding diquat in the gut with suspensions of activated charcoal or bentonite clay, administration of cathartics to enhance elimination, and removal of diquat from the blood by charcoal hemoperfusion or continuous hemodialysis.	
Have the product container or label with you when calling a poison control center or doctor, or going for treatment.	
HOT LINE NUMBER For 24-Hour Medical Emergency Assistance (Human or Animal) or Chemical Emergency Assistance (Spill, Leak, Fire, or Accident), Call **1-800-888-8372**	

PRECAUTIONARY STATEMENTS

Hazards to Humans and Domestic Animals

WARNING/AVISO

May be fatal if absorbed through skin. Harmful if swallowed or inhaled. Causes substantial, but temporary, eye injury. Causes skin irritation. Contact with irritated skin, or a cut, or repeated contact with intact skin may result in poisoning. Do not get in eyes, on skin, or on clothing. Avoid breathing vapor or spray mist. Do not feed forage from treated crops to livestock. Keep livestock and pets out of treated fields and crop areas.

Personal Protective Equipment (PPE)

Applicators and other handlers must wear:

- Coveralls over short-sleeved shirt and short pants or coveralls over long-sleeved shirt and long pants
- Waterproof gloves
- Chemical-resistant footwear plus socks
- Protective eyewear
- Chemical-resistant headgear for overhead exposure
- Chemical-resistant apron when cleaning equipment, mixing, or loading

Exception: After this product has been diluted with at least 50 gallons of water, applicators for AQUATIC SURFACE APPLICATIONS must, at a minimum, wear (Note – Mixers and Loaders for this application method must still wear the Personal Protective Equipment (PPE) as described in the above section):

- Long-sleeved shirt and long pants
- Shoes plus socks
- Waterproof gloves
- Protective eyewear

Exception: At a minimum, applicators for AQUATIC SUBSURFACE APPLICATIONS must wear (Note – Mixers and Loaders for this application method must still wear the Personal Protective Equipment (PPE) as described in the above section):

- Short-sleeved shirt and short pants
- Waterproof gloves
- Chemical-resistant footwear plus socks

Discard clothing and other absorbent materials that have been drenched or heavily contaminated with this product's concentrate. Do not reuse them. Follow manufacturer's instructions for cleaning/maintaining PPE. If no such instructions for washables, use detergent and hot water. Keep and wash PPE separately from other laundry.

Engineering Control Statements

When handlers use closed systems, enclosed cabs, or aircraft in a manner that meets the requirements listed in the Worker Protection Standard (WPS) for agricultural pesticides [40 CFR 170.240(d)(4-6)], the handler PPE requirements may be reduced or modified as specified in the WPS. Mixers, loaders, and applicators using closed systems who meet these requirements may wear: long-sleeved shirt and long pants, protective eyewear, waterproof gloves, shoes plus socks, and a chemical-resistant apron when mixing, loading, or cleaning equipment. If handling tasks are performed from inside an enclosed cab or aircraft with enclosed cockpits that meet these requirements may wear: long-sleeved shirt, long pants, shoes and socks for the labeling-specified PPE. All labeling-specified PPE must be immediately available for use in an emergency. All applicable requirements as specified in 40 CFR 170.240(d)(4-6) must be followed.

User Safety Recommendations

Users should:

- Wash hands before eating, drinking, chewing gum, using tobacco, or using the toilet.
- Remove clothing immediately if pesticide gets inside. Then wash thoroughly and put on clean clothing.
- Remove PPE immediately after handling this product. Wash the outside of gloves before removing. As soon as possible, wash thoroughly and change into clean clothing.

Environmental Hazards (Terrestrial and Aquatic Uses)

This pesticide is toxic to aquatic invertebrates. **For Terrestrial Uses,** do not apply directly to water, or to areas where surface water is present, or to intertidal areas below the mean high water mark. Do not contaminate water when disposing of equipment wash waters. **For Aquatic Uses,** do not apply directly to water except as specified on this label. Treatment of dense weed areas may result in oxygen loss from decomposition of dead weeds. This loss of oxygen may cause fish suffocation. Therefore, treat only 1/3-1/2 of the water body area at one time, especially if dense areas of weeds and/or algae exist, and wait 14 days between treatments.

Necessary approval and/or permits should be obtained prior to application if required. Consult the responsible State Agencies (i.e., Fish and Game Agencies or Department of Natural Resources) before making applications to public waters.

CONDITIONS OF SALE AND LIMITATION OF WARRANTY AND LIABILITY

NOTICE: Read the entire Directions for Use and Conditions of Sale and Limitation of Warranty and Liability before buying or using this product. If the terms are not acceptable, return the product at once, unopened, and the purchase price will be refunded.

The Directions for Use of this product should be followed carefully. It is impossible to eliminate all risks inherently associated with the use of this product. Crop injury, ineffectiveness or other unintended consequences may result because of such factors as manner of use or application, weather or crop conditions, presence of other materials or other influencing factors in the use of the product, which are beyond the control of SYNGENTA CROP PROTECTION, Inc. or Seller. All such risks shall be assumed by Buyer and User, and Buyer and User agree to hold SYNGENTA and Seller harmless for any claims relating to such factors.

SYNGENTA warrants that this product conforms to the chemical description on the label and is reasonably fit for the purposes stated in the Directions for Use, subject to the inherent risks referred to above, when used in accordance with directions under normal use conditions. This warranty does not extend to the use of the product contrary to label instructions, or under abnormal conditions or under conditions not reasonably foreseeable to or beyond the control of Seller or SYNGENTA, and Buyer and User assume the risk of any such use. SYNGENTA MAKES NO WARRANTIES OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE NOR ANY OTHER EXPRESS OR IMPLIED WARRANTY EXCEPT AS STATED ABOVE.

In no event shall SYNGENTA or Seller be liable for any incidental, consequential or special damages resulting from the use or handling of this product. **THE EXCLUSIVE REMEDY OF THE USER OR BUYER, AND THE EXCLUSIVE LIABILITY OF SYNGENTA AND SELLER FOR ANY AND ALL CLAIMS, LOSSES, INJURIES OR DAMAGES (INCLUDING CLAIMS BASED ON BREACH OF WARRANTY, CONTRACT, NEGLIGENCE, TORT, STRICT LIABILITY OR OTHERWISE) RESULTING FROM THE USE OR HANDLING OF THIS PRODUCT, SHALL BE THE RETURN OF THE PURCHASE PRICE OF THE PRODUCT OR, AT THE ELECTION OF SYNGENTA OR SELLER, THE REPLACEMENT OF THE PRODUCT.**

SYNGENTA and Seller offer this product, and Buyer and User accept it, subject to the foregoing Conditions of Sale and Limitations of Warranty and of Liability, which may not be modified except by written agreement signed by a duly authorized representative of SYNGENTA.

DIRECTIONS FOR USE

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

Do not apply this product in a way that will contact workers or other persons, either directly or through drift. Only protected handlers may be in the area during application. For any requirements specific to your State or Tribe, consult the agency responsible for pesticide regulation.

READ ENTIRE LABEL. USE STRICTLY IN ACCORDANCE WITH PRECAUTIONARY STATEMENTS AND DIRECTIONS, AND WITH APPLICABLE STATE AND FEDERAL REGULATIONS.

DO NOT APPLY THIS PRODUCT THROUGH ANY TYPE OF IRRIGATION SYSTEM.

AGRICULTURAL USE REQUIREMENTS

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

Do not enter or allow worker entry into treated areas during the restricted-entry interval (REI) of 24 hours.

PPE required for early entry to treated areas that is permitted under the Worker Protection Standard and that involves contact with anything that has been treated, such as plants, soil, or water is:

- Coveralls over short-sleeved shirt and short pants, or coveralls over long-sleeved shirt and long pants
- Waterproof gloves
- Chemical-resistant footwear plus socks
- Protective eyewear
- Chemical-resistant headgear for overhead exposure

NON-AGRICULTURAL USE REQUIREMENTS

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

Keep all unprotected persons out of operating areas or vicinity where there may be drift.

For terrestrial uses, do not enter or allow entry of maintenance workers into treated areas, or allow contact with treated vegetation wet with spray, dew, or rain, without appropriate protective clothing until spray has dried.

For aquatic uses, do not enter treated areas while treatments are in progress.

STORAGE AND DISPOSAL

Prohibitions

Do not contaminate water, food, or feed by storage, disposal, or cleaning of equipment. Open dumping is prohibited.

Storage

Keep pesticide in original container. Do not put concentrate or dilute into food or drink containers. Do not contaminate feed, foodstuffs, or drinking water. Do not store or transport near feed or food. Store at temperatures above 32°F. For help with any spill, leak, fire, or exposure involving this material, call **1-800-888-8372.**

Pesticide Disposal

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

Container Disposal

Do not reuse container. Triple rinse (or equivalent). Then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or incineration, or if allowed by State and local authorities, by burning. If burned, stay out of smoke.

CONTAINER IS NOT SAFE FOR FOOD, FEED, OR DRINKING WATER!

DIRECTIONS

Reward Landscape and Aquatic Herbicide is a nonvolatile herbicidal chemical for use as a general herbicide to control weeds in noncrop and aquatic areas. Absorption and herbicidal action is usually quite rapid with effects visible in a few days. Reward Landscape and Aquatic Herbicide controls weeds by interfering with photosynthesis within green plant tissue. Weed plants should be succulent and actively growing for best results. Rinse all spray equipment thoroughly with water after use. Avoid Spray Drift to crops, ornamentals, and other desirable plants during application, as injury may result. Application to muddy water may result in reduced control. Minimize creating muddy water during application. Use of dirty or muddy water for Reward Landscape and Aquatic Herbicide dilution may result in reduced herbicidal activity. Avoid applying under conditions of high wind, water flow, or wave action.

Spray Drift Management

Avoiding spray drift at the application site is the responsibility of the applicator and the grower.

The interaction of many equipment- and weather-related factors determine the potential for spray drift. The applicator and the grower are responsible for considering all these factors when making decisions.

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

The distance of the outermost nozzles on the boom must not exceed 3/4 the length of the wingspan or rotor.

Nozzles must always point backward parallel with the air stream and never be pointed downward more than 45 degrees.

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

Droplet Size

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

Controlling Droplet Size

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

Boom Length

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

Application Height

Applications should not be made at a height greater than 10 ft. above the top of the target plants, unless a greater height is required for aircraft safety. Making applications at the lowest height that is safe reduces exposure of droplets to evaporation and wind.

Swath Adjustment

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

Wind

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

Temperature and Humidity

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

Temperature Inversions

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

Sensitive Areas

The pesticide should only be applied when the wind is blowing away from adjacent sensitive areas (e.g., residential areas, bodies of water, known habitat for threatened or endangered species, nontarget crops).

Commercial Greenhouses And Nurseries

For general weed control in commercial greenhouses (beneath benches), (field grown and container stock), and other similar areas, Reward Landscape and Aquatic Herbicide may be applied preplant or postplant preemergence in field grown ornamental nursery plantings or postemergence as a directed spray. Reward Landscape and Aquatic Herbicide may also be applied preemergence in ornamental seed crops (U.S., except CA). Avoid contact with desirable foliage as injury may occur. Do not use on food or feed crops.

Spot spray: 1-2 qts. Reward Landscape and Aquatic Herbicide plus the labeled rate of a 75% or greater nonionic surfactant per 100 gals. of water, or 0.75 oz. (22 mls.) Reward Landscape and Aquatic Herbicide plus the labeled rate of a 75% or greater nonionic surfactant per 1 gal. of water.

Broadcast: 1-2 pts. Reward Landscape and Aquatic Herbicide in a minimum of 15 gals. of water per acre. Add the labeled rate of a 75% or greater nonionic surfactant per 100 gals. of spray mixture. Use an adequate spray volume to insure good coverage.

Ornamental Seed Crops (Flowers, Bulbs, Etc.) U.S., Except CA

For preharvest desiccation of ornamental seed crops. NOT FOR FOOD OR FIBER CROPS.

Broadcast (Air or Ground): 1.5-2 pts. Reward Landscape and Aquatic Herbicide plus the labeled rate of a 75% or greater nonionic surfactant per acre in sufficient water (minimum of 5 gals. by air; 15 gals. by ground) for desiccation and weed burndown. Repeat as needed at no less than 5-day intervals up to three applications. Do not use seed, screenings, or waste as feed or for consumption.

Directions For Landscape, Industrial, Recreational, Commercial, Residential, and Public Areas

Reward Landscape and Aquatic Herbicide provides fast control of broadleaf and grassy weeds in industrial, recreational, golf course, commercial, residential, and public areas.

Reward Landscape and Aquatic Herbicide is a nonselective herbicide that rapidly kills undesirable above ground weed growth in 24-36 hours. Avoid application of Reward Landscape and Aquatic Herbicide to desirable plants.

Reward Landscape and Aquatic Herbicide is a contact/desiccant herbicide; it is essential to obtain complete coverage of the target weeds to get good control. Improper application technique and/or application to stressed weeds may result in unacceptable weed control. For best results, apply to actively growing, young weeds.

Difficult weeds (such as perennial or deeply-rooted weeds) can often be controlled by tank mixing Reward Landscape and Aquatic Herbicide with other systemic-type herbicides. Refer to other product labels for specific application directions.

For residual weed control, tank mix Reward Landscape and Aquatic Herbicide with a pre-emergent herbicide labeled for the intended use site. When mixing Reward Landscape and Aquatic Herbicide with another herbicide, it is recommended to mix just a small amount first to determine if the mixture is physically compatible before proceeding with larger volumes.

Syngenta has not tested all possible tank mixtures with other herbicides for compatibility, efficacy or other adverse effects. Before mixing with other herbicides Syngenta recommends you first consult your state experimental station, state university or extension agent.

Grounds maintenance weed control: Reward Landscape and Aquatic Herbicide can be used as a spot or broadcast spray to control weeds in public, commercial and residential landscapes, including landscape beds, lawns, golf courses and roadsides. Reward Landscape and Aquatic Herbicide can also be used for weed control around the edges and nonflooded portions of ponds, lakes and ditches.

Trim and edge weed control: Reward Landscape and Aquatic Herbicide can be used to eliminate undesired grass and broadleaf plant growth in a narrow band along driveways, walkways, patios, cart paths, fence lines, and around trees, ornamental gardens, buildings, other structures, and beneath noncommercial greenhouse benches. Vegetation control with Reward Landscape and Aquatic Herbicide is limited to the spray application width. Do not exceed the labeled rate of Reward Landscape and Aquatic Herbicide as excessive rates may result in staining of concrete-based materials.

Reward Landscape and Aquatic Herbicide, since it does not translocate systemically, can be used as an edging or pruning tool when precisely applied to select areas of grass or to undesirable growth on desirable ornamental bedding plants, ground covers, etc.

Industrial weed control: Reward Landscape and Aquatic Herbicide can be used as a spot or broadcast spray either alone or in combination with other herbicides as a fast burndown or control weeds in rights-of-ways, railroad beds/yards, highways, roads, dividers and medians, parking lots, pipelines, pumping stations, public utility lines, transformer stations and substations, electric utilities, storage yards, and other noncrop areas.

Spot spray: 1-2 qts. of Reward Landscape and Aquatic Herbicide plus the labeled rate of a 75% or greater nonionic surfactant per 100 gals. Water, or 0.75 oz. (22 mls) Reward Landscape and Aquatic Herbicide plus the labeled rate of a 75% or greater nonionic surfactant per 1 gal. of water.

Broadcast: 1-2 pts. Reward Landscape and Aquatic Herbicide in a minimum of 15 gals. of water per acre. Add the labeled rate of 75% or greater nonionic surfactant per 100 gals. spray mixture. Use an adequate spray volume to insure good coverage. Greater water volumes are necessary if the target plants are tall and/or dense. It is recommended that 60 gals. or greater water volume be used to obtain good coverage of dense weeds.

Turf Renovation (All Turf Areas Except Commercial Sod Farms)

To desiccate golf course turf and other turf areas prior to renovation, apply 1-2 pts. of Reward Landscape and Aquatic Herbicide per acre plus the labeled rate of a 75% or greater nonionic surfactant in 20-100 gals. of water (4 teaspoons of Reward Landscape and Aquatic Herbicide plus the labeled rate of a 75% or greater nonionic surfactant per 1 gal. of water) using ground spray equipment. Apply for full coverage and thorough contact with the turfgrass. Apply only when the turf is dry, free from dew and incidental moisture. For enhanced turf desiccation, especially in the case of thick turfgrass, water volumes should approach 100 gals. of water per acre.

For **suppression** of regrowth and quick desiccation of treated turfgrass, Reward Landscape and Aquatic Herbicide may be mixed with other systemic nonselective or systemic postemergence grassy weed herbicides. Refer to other product labels for specific application directions and restrictions.

Avoid spray contact with, or spray drift to, foliage of ornamental plants or food crops.

Do not graze livestock on treated turf or feed treated thatch to livestock.

Dormant Established Turfgrass (Bermudagrass, Zoysiagrass), Nonfood or Feed Crop

For control of emerged annual broadleaf and grass weeds, including Little Barley*, Annual Bluegrass, Bromes including Rescuegrass, Sixweeks fescue, Henbit, Buttercup, and Carolina Geranium in established dormant bermudagrass lawns, parks, golf courses, etc.

Apply 1-2 pts. Reward Landscape and Aquatic Herbicide per acre in 20-100 gals. of spray mix by ground as a broadcast application. Add the labeled rate of a 75% or greater nonionic surfactant per 100 gals. of spray mixture.

Bermudagrass must be dormant at application. Application to actively growing bermudagrass may cause delay or permanent injury. Users in the extreme Southern areas should be attentive to the extent of dormancy at the time of application.

*For control of Little Barley, apply Reward Landscape and Aquatic Herbicide prior to the mid-boot stage.

Aquatic Use Directions

New York – Not for Sale or Use in New York State without Supplemental Special Local Needs Labeling.

Necessary approval and/or permits should be obtained prior to application if required. Consult the responsible State Agencies (i.e., Fish and Game Agencies or Department of Natural Resources). Treatment of dense weed areas may result in oxygen loss from decomposition of dead weeds. This loss of oxygen may cause fish suffocation. Therefore, treat only 1/3-1/2 of the water body area at one time and wait 14 days between treatments.

For application only to **still water** (i.e. ponds, lakes, and drainage ditches) where there is minimal or no outflow to public waters.

and/or

For applications to **public waters** in ponds, lakes, reservoirs, marshes, bayous, drainage ditches, canals, streams, rivers, and other slow-moving or quiescent bodies of water for control of aquatic weeds. For use by:

- Corps of Engineers; or
- Federal or State Public Agencies (i.e., Water Management District personnel, municipal officials); or
- Applicators and/or Licensees (certified for aquatic pest control) that are authorized by the State or Local government.

Treated water may be used according to the following table or until such time as an approved assay (example: PAM II Spectromatic Method) shows that the water does not contain more than the designated maximum contaminant level goal (MCLG) of 0.02 mg./l. (ppm) of diquat dibromide (calculated as the cation):

Water Use Restrictions Following Applications With Reward Landscape And Aquatic Herbicide (Days)

Application Rate	Drinking	Fishing and Swimming	Livestock Consumption	Spray Tank Applications** and Irrigation to Turf and Ornamentals	Spray Tank Applications** and Irrigation to Food Crops
2 gals./surface acre	3 days	0	1 day	3 days	5 days
1 gal./surface acre	2 days	0	1 day	2 days	5 days
0.75 gal./surface acre	2 days	0	1 day	2 days	5 days
0.50 gal./surface acre	1 day	0	1 day	1 day	5 days
Spot Spray* (< 0.5 gal./surface acre)	1 day	0	1 day	1 day	5 days

*Rates refer to total surface area.

**For preparing agricultural sprays for food crops, turf or ornamentals (to prevent phytotoxicity), do not use water treated with Reward Landscape and Aquatic Herbicide before the specified time period.

When the contents of more than one spray tank is necessary to complete a single aquatic application, no water holding restrictions apply between the consecutive spray tanks.

No applications are to be made in areas where commercial processing of fish, resulting in the production of fish protein concentrate or fish meal, is practiced. Before application, coordination and approval of local and/or State authorities must be obtained.

Apply Reward Landscape and Aquatic Herbicide in Accordance With the Following Table

Weed Species	Subsurface or Bottom Placement Gals./Surface Acre*	Surface Gals./Surface Acre*
Bladderwort (*Utricularia* spp.)	1-2	2
Coontail (*Ceratophyllum demersum*)	2	2
Elodea (*Elodea* spp.)	2	2
Naiad (*Najas* spp.)	1-2	2
Pondweeds[1] (*Potamogeton* spp.)	2	2
Watermilfoils (*Myriophyllum* spp.)	1-2	2
Hydrilla (*Hydrilla verticillata*)	2	2
Waterlettuce[2] (*Pistia Stratiotes*)	NA	0.5 - 0.75
Waterhyacinth[2] (*Eichhornia crassipes*)	NA	0.5 - 0.75
Pennywort[3] (*Hydrocotyle* spp.)	NA	0.5 - 0.75
Frog's Bit[6] (*Limnobium spongia*)	NA	0.5 - 0.75
Salvinia[2] (*Salvinia* spp.)	NA	0.5 - 0.75
Duckweed[4] (*Lemna* spp.)	NA	1
Cattails[3] (*Typha* spp.)	NA	1-2
Algae[5] (*Spirogyra* spp. & *Pithophora* spp.)	1-2	2

*For water less than or equal to 2 ft. in average depth of treatment area, use a maximum of 1 gal. Reward Landscape and Aquatic Herbicide per surface acre. Lowest rates should be used in shallow areas where the water depth is considerably less than the average depth of the entire treatment area, for example, shallow shoreline areas. At water temperatures below 50°-60°F, efficacy and immediacy of results may be reduced.

[1]Reward Landscape and Aquatic Herbicide controls *Potamogetan* species except Richardson's pondweed (*P. richardsonii*). For control of *P. robbinsii,* applications must be made when the plants are in the early stages of growth such as in Spring and early Summer.

[2]For salvinia, waterlettuce, and water hyacinth, use the labeled rate of Reward Landscape and Aquatic Herbicide in 75-200 gals. water plus the labeled rate of a 75% or greater nonionic surfactant per acre for surface sprays, and for aerial application for waterlettuce and water hyacinth control, apply the labeled rate of Reward Landscape and Aquatic Herbicide in 10-24 gals. of water plus the labeled rate of a 75% or greater nonionic surfactant per acre.

[3]For Pennywort and cattail control, apply in 50-150 gals. of water plus the labeled rate of a 75% or greater nonionic surfactant per acre for full coverage and thorough weed contact. Repeat treatments may be necessary to control regrowth. For best results, apply before flowering (cattail).

[4]For duckweed control, apply as an overall spray in 50-150 gals. of water plus the labeled rate of a 75% or greater nonionic surfactant per acre. Retreatment may be necessary for plants missed in previous applications and regrowth.
[5]For suppression of certain filamentous algae species including *Spirogyra* and *Pithophora,* apply according to the submersed use directions.
[6]Not for use in California.

Application: In mixed weed populations, use the high rate of application as indicated by weeds present.

Subsurface Applications: Where the submersed weed growth, especially Hydrilla, has reached the water surface, apply either in a water carrier or an invert emulsion through boom trailing hoses carrying nozzle tips to apply the dilute spray below the water surface to insure adequate coverage.

Bottom Placement: Where the submersed weeds, especially Hydrilla, Bladderwort, and Coontail growth, have reached the water surface or where water is slowly moving through the submersed weed growth that has reached the water surface, especially Hydrilla, Bladderwort, and Coontail, control may be enhanced when applied in an invert emulsion carrier injecting diluted Reward Landscape and Aquatic Herbicide near the bottom with weighted hoses. The addition of a copper-based algaecide will improve control. Where algae are present along with the submersed weeds, pretreatment with copper-based algaecide at recommended rates is advised for best results.

Surface Application: For submerged aquatic weeds, apply Reward Landscape and Aquatic Herbicide either as concentrate slowly poured directly from the container in strips or as a spray in sufficient carrier. Applications should be made to ensure complete coverage of the weed areas. In mixed weed populations, use the high rate of application as indicated by weeds present.

If posting is required by your state or tribe – consult the agency responsible for pesticide regulations for specific details.

General Recommendations for "Posting Notification"*

- **Flowing water:** "post" the restricted area (within/at 1,600 ft. downstream of treatment) for the duration of the water use restriction.
- **Standing water:** "post" the restricted area (within/at 1/4 mile of treatment) for the duration of the water use restriction.
- **No "posting" is necessary where water use is greater than 1,600 feet downstream of treated water in flowing water bodies or where water use is greater than 1/4 mile from treated water in standing water bodies.**

*"Posting" should be removed at the end of the restriction period.

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For non-emergency (e.g., current product information), call
Syngenta Crop Protection at 1-800-334-9481.

Product of United Kingdom
Formulated in the USA

Syngenta Crop Protection, Inc.
Greensboro, North Carolina 27409
www.syngenta-us.com
SCP 1091A-L2 0901
154290

REWARD®

Landscape and Aquatic Herbicide

TO PREVENT ACCIDENTAL POISONING, NEVER PUT INTO FOOD, DRINK, OR OTHER CONTAINERS, AND USE STRICTLY IN ACCORDANCE WITH ENTIRE LABEL.

DO NOT USE THIS PRODUCT FOR REFORMULATION.

Active Ingredient:	
Diquat dibromide [6,7-dihydrodipyrido (1,2-a:2',1'-c)pyrazinediium dibromide]	37.3%
Other Ingredients:	62.7%
Total:	100.0%

Contains 2 lbs. diquat cation per gal. as 3.73 lbs. salt per gal.

See directions for use in attached booklet.

AGRICULTURAL USE REQUIREMENTS

Use this product only in accordance with its labeling and with the Worker Protection Standard, 40 CFR part 170. Refer to supplemental labeling under "Agricultural Use Requirements" in the Directions for Use section for information about this standard.

EPA Reg. No. 100-1091
EPA Est. 100-TX-001

Product of United Kingdom
Formulated in the USA

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154290

KEEP OUT OF REACH OF CHILDREN.

WARNING/AVISO

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

Precautionary Statements

Hazards to Humans and Domestic Animals

May be fatal if absorbed through skin. Harmful if swallowed or inhaled. Causes substantial, but temporary, eye injury. Causes skin irritation. Contact with irritated skin, or a cut, or repeated contact with intact skin may result in poisoning. Do not get in eyes, on skin, or on clothing. Avoid breathing vapor or spray mist. Do not feed forage from treated crops to livestock. Keep livestock and pets out of treated fields and crop areas.

FIRST AID

If swallowed: Call a Poison Control Center or doctor immediately for treatment advice. Immediately give water or milk to drink and induce vomiting by inserting finger in throat. Do not induce vomiting or give anything by mouth to an unconscious person. Take person and product container to the nearest hospital or physician fast. PROMPT TREATMENT IS ESSENTIAL TO COUNTERACT POISONING and should be initiated before signs and symptoms of injury appear.

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 in eyes: Hold eye open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye. Call a Poison Control Center or doctor for treatment advice.

If 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.

NOTE TO PHYSICIAN: CALL SYNGENTA MEDICAL EMERGENCY ASSISTANCE 1-800-888-8372 at any hour to obtain toxicology information and a diquat analysis. To be effective, treatment for diquat poisoning must begin IMMEDIATELY. Treatment consists of binding diquat in the gut with suspensions of activated charcoal or bentonite clay, administration of cathartics to enhance elimination, and removal of diquat from the blood by charcoal hemoperfusion or continuous hemodialysis.

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

HOT LINE NUMBER: For 24-Hour Medical Emergency Assistance (Human or Animal) or Chemical Emergency Assistance (Spill, Leak, Fire, or Accident), Call **1-800-888-8372**

Environmental Hazards (Terrestrial and Aquatic Uses)

This pesticide is toxic to aquatic invertebrates. For **Terrestrial Uses,** do not apply directly to water, or to areas where surface water is present, or to intertidal areas below the mean high water mark. Do not contaminate water when disposing of equipment wash waters. For **Aquatic Uses,** do not apply directly to water except as specified on this label. Treatment of dense weed areas may result in oxygen loss from decomposition of dead weeds. This loss of oxygen may cause fish suffocation. Therefore, treat only $^{1}/_{3}$-$^{1}/_{2}$ of the water body area at one time, especially if dense areas of weeds and/or algae exist, and wait 14 days between treatments.

Necessary approval and/or permits should be obtained prior to application if required. Consult the responsible State Agencies (i.e., Fish and Game Agencies or Department of Natural Resources) before making applications to public waters.

STORAGE AND DISPOSAL

Prohibitions

Do not contaminate water, food, or feed by storage, disposal, or cleaning of equipment. Open dumping is prohibited.

Container Disposal

Do not reuse container. Triple rinse (or equivalent). Then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or incineration, or if allowed by State and local authorities, by burning. If burned, stay out of smoke.

CONTAINER IS NOT SAFE FOR FOOD, FEED, OR DRINKING WATER!

2.5 gallons
U.S. Standard Measure

syngenta

syngenta

MATERIAL SAFETY DATA SHEET

Syngenta Crop Protection, Inc.
Post Office Box 18300
Greensboro, NC 27419

In Case of Emergency, Call
1-800-888-8372

1. PRODUCT IDENTIFICATION

Product Name: **REWARD LANDSCAPE AND AQUATIC HERBICIDE** Product No.: A12872A

EPA Signal Word: Warning

Active Ingredient(%): Diquat dibromide (37.3%) CAS No.: 85-00-7

Chemical Name: [6,7-dihydrodipyrido(1,2-a:2',1'-c)pyrazinediium dibromide]

Chemical Class: Bipyridilium (dipyridilium) contact herbicide

EPA Registration Number(s): 100-1091 (formerly 10182-404) **Section(s) Revised: 15**

2. COMPOSITION/INFORMATION ON INGREDIENTS

Material	OSHA PEL	ACGIH TLV	Other	NTP/IARC/OSHA Carcinogen
Diquat dibromide (37.3%)	Not Established	0.5 mg/m³ TWA (total dust); 0.08 mg/m³ TWA (respirable dust)	0.5 mg/m³ TWA**	No

** recommended by NIOSH

Ingredients not precisely identified are proprietary or non-hazardous. Values are not product specifications.

3. HAZARDS IDENTIFICATION

Symptoms of Acute Exposure

May cause eye irritation. Toxic if inhaled, swallowed or absorbed through the skin.

Hazardous Decomposition Products

Flammable hydrogen gas may be formed on contact with aluminum. See "Conditions to Avoid", Section 10.

Can decompose at high temperatures forming toxic gases.

Physical Properties

Appearance: Dark brown liquid

Odor: Odorless

Unusual Fire, Explosion and Reactivity Hazards

This product may form flammable and explosive hydrogen gas when in contact with aluminum.

During a fire, irritating and possibly toxic gases may be generated by thermal decomposition or combustion.

4. FIRST AID MEASURES

Have the product container, label or Material Safety Data Sheet with you when calling Syngenta (800-888-8372), a poison contol center or doctor, or going for treatment.

Ingestion: If swallowed: Call Syngenta (800-888-8372), a poison control center or doctor immediately for treatment

advice. Have the person sip a glass of water if able to swallow. Do not induce vomiting unless told to do so after calling 800-888-8372 or by a poison control center or doctor. Do not give anything by mouth to an unconscious person.

Eye Contact: If in eyes: Hold eye open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after 5 minutes, then continue rinsing eye. Call Syngenta (800-888-8372), a poison control center or doctor for treatment advice.

Skin Contact: If on skin or clothing: Take off contaminated clothing. Rinse skin immediately with plenty of water for 15-20 minutes. Call Syngenta (800-888-8372), a poison control center or doctor for treatment advice.

Inhalation: 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 Syngenta (800-888-8372), a poison control center or doctor for further treatment advice.

Notes to Physician

To be effective, treatment for ingestion of the product must begin IMMEDIATELY. Treatment consists of binding the active ingredient, diquat, in the gut with suspensions of activated charcoal or bentonite clay, administration of cathartics to enhance elimination and removal of diquat from the blood by charcoal hemoperfusion or continuous hemodialysis.

Medical Condition Likely to be Aggravated by Exposure

None known.

5. FIRE FIGHTING MEASURES

Fire and Explosion

Flash Point (Test Method):	Not Applicable	
Flammable Limits (% in Air):	Lower: % Not Applicable	Upper: % Not Applicable
Autoignition Temperature:	Not Applicable	
Flammability:	Not Applicable	

Unusual Fire, Explosion and Reactivity Hazards

This product may form flammable and explosive hydrogen gas when in contact with aluminum.

During a fire, irritating and possibly toxic gases may be generated by thermal decomposition or combustion.

In Case of Fire

Use dry chemical, foam or CO2 extinguishing media. Wear full protective clothing and self-contained breathing apparatus. Evacuate nonessential personnel from the area to prevent human exposure to fire, smoke, fumes or products of combustion. Prevent use of contaminated buildings, area, and equipment until decontaminated. Water runoff can cause environmental damage. If water is used to fight fire, dike and collect runoff.

6. ACCIDENTAL RELEASE MEASURES

In Case of Spill or Leak

Control the spill at its source. Contain the spill to prevent from spreading or contaminating soil or from entering sewage and drainage systems or any body of water. Clean up spills immediately, observing precautions outlined in Section 8. Cover entire spill with absorbing material and place into compatible disposal container. Scrub area with hard water detergent (e.g. commercial products such as Tide, Joy, Spic and Span). Pick up wash liquid with additional absorbent and place into compatible disposal container. Once all material is cleaned up and placed in a disposal container, seal container and arrange for disposition.

7. HANDLING AND STORAGE

This product reacts with aluminum to produce flammable hydrogen gas. Do not mix or store in containers or systems made of aluminum or having aluminum fittings.

Store the material in a well-ventilated, secure area out of reach of children and domestic animals. Do not store food, beverages or tobacco products in the storage area. Prevent eating, drinking, tobacco use, and cosmetic application in areas where there is a potential for exposure to the material. Wash thoroughly with soap and water after handling.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

THE FOLLOWING RECOMMENDATIONS FOR EXPOSURE CONTROLS/PERSONAL PROTECTION ARE INTENDED FOR THE MANUFACTURE, FORMULATION, PACKAGING AND USE OF THIS PRODUCT.

FOR COMMERCIAL APPLICATIONS AND/OR ON-FARM APPLICATIONS CONSULT THE PRODUCT LABEL.

Ingestion:	Prevent eating, drinking, tobacco usage and cosmetic application in areas where there is a potential for exposure to the material. Wash thoroughly with soap and water after handling.
Eye Contact:	Where eye contact is likely, use chemical splash goggles. Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower.
Skin Contact:	Where contact is likely, wear chemical-resistant (such as nitrile or butyl) gloves, coveralls, socks and chemical-resistant footwear. For overhead exposure, wear chemical-resistant headgear.
Inhalation:	Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below exposure limits. A NIOSH-certified combination air-purifying respirator with an N, P or R 95 or HE class filter and an organic vapor cartridge may be permissible under certain circumstances where airborne concentrations are expected to exceed exposure limits. Protection provided by air-purifying respirators is limited. Use a pressure demand atmosphere-supplying respirator if there is any potential for uncontrolled release, exposure levels are not known, or under any other circumstances where air-purifying respirators may not provide adequate protection.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance:	Dark brown liquid
Odor:	Odorless
Melting Point:	Not Available
Boiling Point:	Not Available
Specific Gravity/Density:	1.20 g/ml @ 68°F (20°C)
pH:	4 - 6

Solubility in H2O

Diquat dibromide:	718,000 mg/l @ 68°F (20°C) and pH 7.2

Vapor Pressure

Diquat dibromide:	< 10(-8) mmHg @ 77°F (25°C)

10. STABILITY AND REACTIVITY

Stability:	Stable under normal use and storage conditions.
Hazardous Polymerization:	Will not occur.
Conditions to Avoid:	Concentrate should not be stored in aluminum containers. Spray solutions should not be mixed, stored or applied in containers other than plastic, plastic-lined steel, stainless steel or fiberglass.
Materials to Avoid:	Strong alkalis and anionic wetting agents (e.g., alkyl and alkylaryl sulfonates). Corrosive to aluminum.
Hazardous Decomposition Products:	Flammable hydrogen gas may be formed on contact with aluminum. See "Conditions to Avoid", Section 10. Can decompose at high temperatures forming toxic gases.

11. TOXICOLOGICAL INFORMATION

Acute Toxicity/Irritation Studies (Finished Product)

Ingestion:	Slightly Toxic	
	Oral (LD50 Rat) :	= 600 mg/kg body weight
Dermal:	Moderately Toxic	
	Dermal (LD50 Rabbit) :	= 260 mg/kg body weight
Inhalation:	Moderately Toxic	
	Inhalation (LC50 Rat) :	= 0.121 mg/l air - 4 hours
Eye Contact:	Irritant	

Skin Contact: Not Available
Skin Sensitization: Not Available

Reproductive/Developmental Effects

Diquat dibromide: Mutagenicity: No evidence in in vivo assays.
Development Toxicity: In rabbit studies a small percentage of fetuses had minor defects at 3 and 10 mg ion/kg/d.

Chronic/Subchronic Toxicity Studies

Diquat dibromide: Kidney weight decreases and cataracts seen in dogs at 12.5 mg ion/kg/d.
No evidence for neurotoxic effects in rats dosed up to 400 ppm ion in the diet for 13 weeks.

Carcinogenicity

Diquat dibromide: No evidence of carcinogenicity in rat and mouse studies.

Other Toxicity Information

None

Toxicity of Other Components

Not Applicable

Target Organs

Active Ingredients

Diquat dibromide: Eye, kidney

Inert Ingredients

: Not Applicable

12. ECOLOGICAL INFORMATION

Summary of Effects

Diquat dibromide:

This material is slightly toxic to fish. Toxic to invertebrates and birds. Practically non-toxic to bees.

Eco-Acute Toxicity

Diquat dibromide: Bees LC50/EC50 47 - 100 ug/bee
Invertebrates (Water Flea) LC50/EC50 0.77 - 1.19 ppm
Fish (Trout) LC50/EC50 14.8 ppm
Fish (Bluegill) LC50/EC50 13.9 ppm
Birds (8-day dietary - Bobwhite Quail) LC50/EC50 106 ppm
Birds (8-day dietary - Mallard Duck) LC50/EC50 980 ppm

Eco-Chronic Toxicity

Diquat dibromide: Not Available

Environmental Fate

Diquat dibromide:

No data available for the formulation. The information presented here is for the active ingredient, diquat debromide. Stable in soil and water. Immobile in soil. Sinks in water (after 24 h).

13. DISPOSAL CONSIDERATIONS

Disposal

Do not reuse product containers. Dispose of product containers, waste containers, and residues according to local, state, and federal health and environmental regulations.

Characteristic Waste: Not Applicable

Listed Waste: Not Applicable

14. TRANSPORT INFORMATION

DOT Classification

Corrosive Liquid, N.O.S. (Diquat Dibromide, 37.3%), 8, UN1760, PGIII

B/L Freight Classification

Herbicides, NOIBN

Comments

International Transportation

Corrosive Liquid, N.O.S. (Diquat Dibromide, 37.3%), Class 8, UN1760, PGIII

15. REGULATORY INFORMATION

EPCRA SARA Title III Classification

Section 311/312 Hazard Classes: Acute Health Hazard
Chronic Health Hazard

Section 313 Toxic Chemicals: Not Applicable

California Proposition 65

None

CERCLA/SARA 302 Reportable Quantity (RQ)

Report product spills >= 268 gal. (based on diquat [RQ = 1,000 lbs.] content in the formulation)

RCRA Hazardous Waste Classification (40 CFR 261)

Not Applicable

TSCA Status

Exempt from TSCA, subject to FIFRA

16. OTHER INFORMATION

NFPA Hazard Ratings		HMIS Hazard Ratings	
Health:	2	Health:	2
Flammability:	1	Flammability:	1
Instability:	0	Reactivity:	0

0	Minimal
1	Slight
2	Moderate
3	Serious
4	Extreme

For non-emergency questions about this product call:

1-800-334-9481

Original Issued Date: 04/11/2002
Revision Date: 10/13/2003 Replaces: 10/06/2003

The information and recommendations contained herein are based upon data believed to be correct. However, no guarantee or warranty of any kind, expressed or implied, is made with respect to the information contained herein.

RSVP# : SCP-955-00349C

End of MSDS

Specimen Label

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. No. 39578-TX-1
FPL 091802 SPC-342142

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.

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.

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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.

• **NEW YORK STATE:** Application of Sonar PR is not permitted in waters less than two (2) feet deep.

• **Hydroponic Farming:** Do not use Sonar PR treated water for hydroponic farming.

• **Greenhouse and Nursery Plants:** Do not use Sonar PR treated water for irrigating greenhouse or nursery plants. Use of an approved assay should confirm that residues are <1 ppb.

• **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	See irrigation instructions below

†Note below, under Potable Water Intakes, the information for application of Sonar PR within ¼ miles (1320) feet of a functioning potable water intake.
†† Note below, under Irrigation, specific time frames or fluridone residues that provide the widest safety margin for irrigating with fluridone treated water.

• **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 or water assay requirements presented in the table below. These time frames and assay recommendations 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	Assay required
Canals	7	7	Assay required
Rivers	7	7	Assay required
††Lakes and Reservoirs	7	7	Assay required

†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 assay 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 crops or newly seeded grasses such as overseeded golf course greens, do not use Sonar PR treated water if concentration are greater than 5 ppb. Furthermore, when rotating crops, do not plant members of the Solanaceae family in land that has been previously irrigated with fluridone concentrations in excess of 5 ppb. It is recommended that an aquatic specialist be consulted prior to commencing irrigation of these sites.**

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	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		5
2	1.7		10
3	2.6		15
4	3.5		20
5	4.3		25
6	5.2		30
7	6.0		34
8	6.9		39
9	7.8		44
10	8.6		49
11	9.5		54
12	10.4		59
13	11.2		64
14	12.1		68
15	13.0		73
16	13.8		78
17	14.7		83
18	15.6		88
19	16.4		93
20	17.3		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 applied 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 the product conforms to the chemical description on the label and is reasonably fit for the purposes stated on the label when used in strict accordance with the directions, subject to the inherent risks set forth below. SEPRO CORPORATION MAKES NO OTHER EXPRESS OR IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR ANY OTHER EXPRESS OR IMPLIED WARRANTY.

INHERENT RISKS OF USE

It is impossible to eliminate all risks associated with use of this product. Plant injury, lack of performance, or other unintended consequences may result because of such factors as use of the product contrary to label instructions (including conditions noted on the label such as unfavorable temperatures, soil conditions, etc.), abnormal conditions (such as excessive rainfall, drought, tornadoes, hurricanes), presence of other materials, the manner of application, or other factors, all of which are beyond the control of SePRO Corporation as the seller. All such risks shall be assumed by buyer.

LIMITATION OF REMEDIES

The exclusive remedy for losses or damages resulting from this product (including claims based on contract, negligence, strict liability, or other legal theories) shall be limited to, at SePRO Corporation's election, one of the following:
(1) Refund of purchase price paid by buyer or user for product bought, or
(2) Replacement of amount of product used.

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

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

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Material Safety Data Sheet

SePRO

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

EPA Reg. Number: 67690-12
Effective Date: 10/20/01

Sonar* PR Precision Release* Herbicide

SePRO Corporation Carmel, IN 46032

1. PRODUCT AND COMPANY IDENTIFICATION

PRODUCT: Sonar* PR Precision Release Herbicide

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

2. COMPOSITION / INFORMATION ON INGREDIENTS

Fluridone: 1-Methyl-3-phenyl-5-(3-(Trifluoro-methyl)phenyl)-4(1H)-Pyridinone	CAS # 059756-60-4	5%
Inert Ingredients, Total, Including Clay (Crystalline Silica)	CAS # 001332-58-7	95%

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

3. HAZARDOUS IDENTIFICATIONS

EMERGENCY OVERVIEW
Dark gray to dark brown pellet with a faint musty odor. May cause eye irritation. LD_{50} for skin absorption in rabbits is >2000 mg/kg. Oral LD_{50} for rats is >5000 mg/kg.
EMERGENCY PHONE NUMBER: 800-535-5053

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

EYE: May cause slight eye irritation and/or slight transient (temporary) corneal injury.

SKIN: Essentially non-irritating to skin. A single prolonged exposure is not likely to result in the material being absorbed through the skin in harmful amounts. The LD_{50} for skin absorption in rabbits is >2000 mg/kg. Fluridone did not cause allergic skin reactions when tested in guinea pigs.

INGESTION: Single dose oral toxicity is extremely low. The oral LD_{50} for rats is >5000 mg/kg. No hazards anticipated from swallowing small amounts incidental to normal handling operations.

INHALATION: Single exposure to dust is not likely to be hazardous. Dust may cause irritation to upper respiratory tract (nose and throat).

SYSTEMIC (OTHER TARGET ORGAN) EFFECTS: Fluridone, in animals, has been shown to cause liver and kidney effects. Repeated excessive exposure to crystalline silica may cause silicosis, a progressive and disabling disease of the lungs. Some evidence suggests that kidney effects may result from excessive exposures also.

CANCER INFORMATION: Fluridone did not cause cancer in laboratory animals. This product contains clay that has naturally occurring crystalline silica as quartz. Crystalline silica is listed by IARC and NTP as a carcinogen for hazard communication purposes under OSHA Standard 29 CFR Part 1910.1200.7. Inhalation of excessive concentrations of any dust, including this material, may lead to lung injury.

TERATOLOGY (BIRTH DEFECTS): Fluridone did not cause birth defects; other fetal effects occurred only at doses toxic to the mother.

REPRODUCTIVE EFFECTS: Fluridone did not interfere with reproduction in animal studies.

4. FIRST AID

EYE: Hold eyes 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 eyes. Call a poison control center or doctor for treatment advice.

SKIN: 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.

INGESTION: Call a poison control center or doctor immediately for treatment advice. Have person sip a glass of water if able to swallow. Do not induce vomiting unless told to do so by the poison control center or doctor. Never give anything by mouth to an unconscious person.

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

NOTE TO PHYSICIAN: No specific antidote. Treatment of exposure should be directed at the control of symptoms and the clinical condition of the patient.

5. FIRE FIGHTING MEASURES

FLASH POINT: Not applicable
METHOD USED: Not applicable

FLAMMABLE LIMITS:
LFL: Not applicable
UFL: Not applicable

AUTO-IGNITION TEMPERATURE: No ignition up to 1382°F (750°C)

EXTINGUISHING MEDIA: Use water, CO_2, or dry chemicals.

FIRE AND EXPLOSION HAZARDS: Will emit toxic vapors as it burns.

FIREFIGHTING EQUIPMENT: Wear positive-pressure, self-contained breathing apparatus and full protective clothing.

6. ACCIDENTAL RELEASE MEASURES

ACTION TO TAKE FOR SPILLS AND LEAKS: Contain and sweep up small spills and dispose as waste. Report large spills to INFOTRAC and consult SePRO Corporation for assistance. Prevent runoff.

7. HANDLING AND STORAGE

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE: Keep out of reach of children. Harmful if swallowed, absorbed through the skin, or inhaled. Avoid breathing dust or contact with skin, eyes, or clothing. Wash thoroughly with soap and water after handling. Wash exposed clothing before reuse.

8. EXPOSURE CONTROL/PERSONAL PROTECTION

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

EXPOSURE GUIDELINES: Crystalline silica: ACGIH TLV is 0.05 mg/M^3 for quartz, tripoli, and fused silica; 0.05 mg/M^3 (respirable) for cristobalite and tridymite. OSHA PEL is 10/%SiO2 + 2 mg/M^3 (respirable) for quartz, tripoli, and fused silica; 1/2 the value calculated from the respirable dust formula for quartz for cristobalite and tridymite.

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

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

RECOMMENDATIONS FOR MANUFACTURING, COMMERCIAL BLENDING, AND PACKAGING WORKERS:

RESPIRATORY PROTECTION: Atmospheric levels should be maintained below the exposure guidelines. In dusty atmospheres, use a NIOSH approved dust respirator.

SKIN PROTECTION: Use gloves impervious to this material.

EYE/FACE PROTECTION: Use safety glasses.

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

9. PHYSICAL AND CHEMICAL PROPERTIES

SOLUBILITY IN WATER: Insoluble (disintegrates in water)

APPEARANCE: Dark gray or dark brown pellet

ODOR: Faint musty

pH: (aqueous 50/50) 3.5

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10. STABILITY AND REACTIVITY

STABILITY: Stable under normal storage conditions.

INCOMPATIBILITY: (Specific materials to avoid)
Not determined.

HAZARDOUS DECOMPOSITION PRODUCTS:
None known.

HAZARDOUS POLYMERIZATION: Not known to occur.

11. TOXICOLOGICAL INFORMATION

MUTAGENICITY: For fluridone, in-vitro mutagenicity studies were predominantly negative and animal mutagenicity studies were negative.

12. ECOLOGICAL INFORMATION

Follow label use directions carefully so as to avoid adverse effects on non-target 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. Fire and wildlife Service before making applications. Do not contaminate water when disposing of equipment wash waters. Trees and shrubs growing in water treated with Sonar PR Precision Release may be injured. Do not apply in tidewater or brackish waters.

13. DISPOSAL CONSIDERATIONS

DISPOSAL: Do not contaminate water, food, or feed by storage or disposal. Wastes resulting from the use of this product may be disposed of on site per label use directions or at an approved waste disposal facility. Follow all local, state, and federal requirements for disposal.

14. TRANSPORT INFORMATION

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

15. REGULATORY INFORMATION

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

U.S. REGULATIONS

SARA TITLE III, SECTION 313: To the best of our knowledge, this product contains no chemical subject to SARA Title III, Section 313 supplier notification requirements.

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

An Immediate Health Hazard
A Delayed Health Hazard

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA 701):
(4=Extreme; 3=High; 2=Moderate; 0=Insignificant)

Health	1
Flammability	0
Reactivity:	0

STATE RIGHT-TO-KNOW: The following product components are cited on certain state lists as mentioned. Non-listed components may be shown in Section 1 of the MSDS.

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Chemical Name	CAS Number	List
Crystalline Silica	001332-58-7	NJ3, PA1

NJ3=New Jersey Workplace Hazardous Substance (present at >/= to 1.0%).
PA1=Pennsylvania Hazardous Substance (present at >/= to 1.0%).

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

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

16. OTHER INFORMATION

MSDS STATUS: New

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

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Specimen Label

Dow AgroSciences

Rodeo®

Herbicide

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

Avoid contact of herbicide with foliage, green stems, exposed non-woody roots or fruit of crops, desirable plants and trees, because severe injury or destruction may result.

Active Ingredient(s):	
glyphosate[1]: N-(phosphonomethyl)glycine, isopropylamine salt	53.8%
Inert Ingredients	46.2%
Total Ingredients	100.0%

[1]Contains 5.4 pounds per gallon glyphosate, isopropylamine salt (4 pounds per gallon glyphosate acid).

EPA Reg. No. 62719-324

Keep Out of Reach of Children

CAUTION PRECAUCION

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

Precautionary Statements

Hazards to Humans and Domestic Animals

Harmful If Inhaled

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

Personal Protective Equipment (PPE)

Applicators and other handlers must wear:

- Long-sleeved shirt and long pants
- Shoes plus socks.

Follow manufacturer's instructions for cleaning/maintaining PPE (Personal Protective Equipment). If no such instructions for washables, use detergent and hot water. Keep and wash PPE separately from other laundry.

Engineering Controls

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

User Safety Recommendations

Users should:

- Wash hands before eating, drinking, chewing gum, using tobacco, or using the toilet.
- Remove clothing immediately if pesticide gets inside. Then wash thoroughly and put on clean clothing.

First Aid

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

Environmental Hazards

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

In case of leak or spill, soak up and remove to a landfill.

Physical or Chemical Hazards

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

Do not mix, store or apply this product or spray solutions of this product in galvanized steel or unlined steel (except stainless steel) containers or spray tanks. This product or spray solutions of this product react with such containers and tanks to produce hydrogen gas, which may form a highly combustible gas mixture. This gas mixture could flash or explode, causing serious personal injury, if ignited by open flame, spark, welder's torch, lighted cigarette or other ignition source.

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

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

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

Directions for Use

It is a violation of Federal law to use this product in a manner inconsistent with its labeling.
Read all Directions for Use carefully before applying.

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

Do not apply this product in a way that will contact workers or other persons, either directly or through drift. Only protected handlers may be in the area during application. For any requirements specific to your state or tribe, consult the agency responsible for pesticide regulation.

Agricultural Use Requirements

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

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

PPE required for early entry to treated areas that is permitted under the Worker Protection Standard and that involves contact with anything that has been treated, such as plants, soil, or water, is:

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

Storage and Disposal

Do not contaminate water, food, feed or seed by storage or disposal.
Storage: Store above 10°F (-12°C) to keep product from crystallizing. Crystals will settle to the bottom. If allowed to crystallize, place in a warm room 68°F (20°C) for several days to redissolve and roll or shake container or recirculate in mini-bulk containers to mix well before using.
Pesticide Disposal: Wastes resulting from use of this product that cannot be used or chemically reprocessed should be disposed of in a landfill approved for pesticide disposal or in accordance with applicable Federal, state or local procedures.
Container Disposal: Emptied container retains vapor and product residue. Observe all labeled safeguards until container is cleaned, reconditioned or destroyed. Do not reuse this container. Triple rinse (or equivalent). Then puncture and dispose of in a sanitary landfill, or by incineration, or, if allowed by state and local authorities, by burning. If burned, stay out of smoke.

General Information
(How this product works)

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

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

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

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

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

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

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

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

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

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

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

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

Do not allow the herbicide solution to mist, drip, drift or splash onto desirable vegetation since minute quantities of this product can cause severe damage or destruction to the crop, plants or other areas on which treatment was not intended. The likelihood of plant or crop injury occurring from the use of this product is greatest when winds are gusty or in excess of 5 miles per hour or when other conditions, including lesser wind velocities, will allow spray drift to occur. When spraying, avoid combinations of pressure and nozzle type that will result in splatter or fine particles (mist) which are likely to drift. **Avoid applying at excessive speed or pressure.**

Mixing and Application Instructions

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

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

Mixing

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

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

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

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

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

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

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

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

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

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

Application Equipment and Techniques

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

Do not allow the herbicide solution to mist, drip, drift, or splash onto desirable vegetation since minute quantities of this product can cause severe damage or destruction to crops, plants, or other areas on which the treatment was not intended. The likelihood of plant or crop injury occurring from the use of this product is greatest when winds are gusty or in excess of 5 miles per hour or when other conditions, including lesser wind velocities, will allow spray drift to occur. When spraying, avoid combinations of pressure and nozzle type that will result in splatter or fine particles (mist) which are likely to drift. AVOID APPLYING AT EXCESSIVE SPEED OR PRESSURE.

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

Spray Drift Management

Avoiding spray drift at the application site is the responsibility of the applicator. The interaction of many equipment-and-weather-related factors determine the potential for spray drift. The applicator and the grower are responsible for considering all these factors when making decisions. The following drift management requirements must be followed to avoid off-target drift movement from aerial applications to agricultural field crops. These requirements do not apply to forestry applications, public health uses or to applications using dry formulations.

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

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

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

Controlling Droplet Size: Volume-Use high flow rate nozzles to apply the highest practical spray volume. Nozzles with higher rated flows product larger droplets.

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

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

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

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

Boom Length-For some use patterns, reducing the effective boom length to less than ¾ of the wingspan or rotor length may further reduce drift without reducing swath width.

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

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

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

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

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

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

Aerial Equipment

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

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

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

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

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

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

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

Ground Broadcast Equipment

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

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

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

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

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

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

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

Spray Solution

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

2 tablespoons = 1 fluid ounce

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

Wiper Applications

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

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

Aquatic and Other Noncrop Sites

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

Aquatic Sites

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

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

- **Rodeo does not control plants which are completely submerged or have a majority of their foliage under water.**
- There is no restriction on the use of treated water for irrigation, recreation or domestic purposes.
- Consult local state fish and game agency and water control authorities before applying this product to public water. Permits may be required to treat such water.

- **NOTE:** Do not apply this product directly to water within 1/2 mile upstream of an active potable water intake in flowing water (i.e., river, stream, etc.) or within 1/2 mile of an active potable water intake in a standing body of water such as lake, pond or reservoir. To make aquatic applications around and within 1/2 mile of active potable water intakes, the water intake must be turned off for a minimum period of 48 hours after the application. The water intake may be turned on prior to 48 hours if the glyphosate level in the intake water is below 0.7 parts per million as determined by laboratory analysis. These aquatic applications may be made **only** in those cases where there are alternative water sources or holding ponds which would permit the turning off of an active potable water intake for a minimum period of 48 hours after the applications. This restriction does not apply to intermittent inadvertent overspray of water in terrestrial use sites.
- For treatments after drawdown of water or in dry ditches, allow 7 or more days after treatment before reintroduction of water to achieve maximum weed control. Apply this product within 1 day after drawdown to ensure application to actively growing weeds.
- Floating mats of vegetation may require retreatment. Avoid wash-off of sprayed foliage by spray boat or recreational boat backwash or by rainfall within 6 hours of application. Do not re-treat within 24 hours following the initial treatment.
- Applications made to moving bodies of water must be made while traveling upstream to prevent concentration of this herbicide in water. When making any bankside applications, do not overlap more than 1 foot into open water. Do not spray in bodies of water where weeds do not exist. The maximum application rate of 7 1/2 pints per acre must not be exceeded in any single broadcast application that is being made over water.
- When emerged infestations require treatment of the total surface area of impounded water, treating the area in strips may avoid oxygen depletion due to decaying vegetation. Oxygen depletion may result in fish kill.

Other Noncrop Sites

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

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

Cut Stump Application

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

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

Common Name	Scientific Name
Alder	*Alnus spp.*
Coyote brush [1]	*Baccharis consanguinea*
Dogwood [1]	*Cornus spp.*
Eucalyptus	*Eucalyptus spp.*
Hickory [1]	*Carya spp.*
Madrone	*Arbutus menziesii*
Maple [1]	*Acer spp.*
Oak	*Quercus spp.*
Poplar [1]	*Populus spp.*
Reed, giant	*Arundo donax*
Salt cedar	*Tamarix spp.*
Sweet gum [1]	*Liquidambar styraciflua*
Sycamore [1]	*Platanus occidentalis*
Tan oak	*Lithocarpus densiflorus*
Willow	*Salix spp.*

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

Wildlife Habitat Restoration and Management Areas

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

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

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

Injection and Frill Applications

Woody vegetation may be controlled by injection or frill application of this product. Apply this product using suitable equipment which must penetrate into living tissue. Apply the equivalent of 1 ml of this product per 2 to 3 inches of trunk diameter. This is best achieved by applying 25 to 100 percent concentration of this product either to a continuous frill around the tree or as cuts evenly spaced around the tree below all branches. As tree diameter increases in size, better results are achieved by applying dilute material to a continuous frill or more closely spaced cuttings. Avoid application techniques that allow runoff to occur from frill or cut areas in species that exude sap freely after frills or cutting. In species such as these, make frill or cut at an oblique angle so as to produce a cupping effect and use undiluted material. For best results, applications should be made during periods of active growth and full leaf expansion.

This treatment will control the following woody species:

Common Name	Scientific Name
Oak	*Quercus spp.*
Poplar	*Populus spp.*
Sweet gum	*Liquidambar styraciflua*
Sycamore	*Platanus occidentalis*

This treatment will suppress the following woody species:

Common Name	Scientific Name
Black gum [†]	*Nyssa sylvatica*
Dogwood	*Cornus spp.*
Hickory	*Carya spp.*
Maple, red	*Acer rubrum*

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

Release of Bermudagrass or Bahiagrass on Noncrop Sites

Release Of Dormant Bermudagrass and Bahiagrass

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

For best results on winter annuals, treat when weeds are in an early growth stage (below 6 inches in height) after most have germinated. For best results on tall fescue, treat when fescue is in or beyond the 4 to 6-leaf stage.

Weeds Controlled

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

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

Weeds Controlled or Suppressed [†]

Note: C = Controlled; S = Suppressed

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

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

Release of Actively Growing Bermudagrass

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

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

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

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

Bahiagrass	Johnsongrass [1]
Dallisgrass	Trumpetcreeper [11]
Fescue (tall)	Vaseygrass

[1] Johnsongrass is controlled at the higher rate.
[11] Suppression at the higher rate only.

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

Bahiagrass Seedhead and Vegetative Suppression

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

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

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

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

Annual Grass Growth Suppression

For growth suppression of some annual grasses, such as annual ryegrass, wild barley and wild oats growing in coarse turf on roadsides or other industrial areas, apply 3 to 4 ounces of this product in 10 to 40 gallons of spray solution per acre. Mix 2 quarts of a nonionic surfactant per 100 gallons of spray solution. Applications should be made when annual grasses are actively growing and before the seedheads are in the boot stage of development. Treatments made after seedhead emergence may cause injury to the desired grasses.

Weeds Controlled

Annual Weeds

Apply to actively growing annual grasses and broadleaf weeds.

Allow at least 3 days after application before disturbing treated vegetation. After this period the weeds may be mowed, tilled or burned. See "Directions for Use," "General Information" and "Mixing and Application Instructions" for labeled uses and specific application instructions.

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

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

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

Common Name	Scientific Name
Balsamapple [1]	*Momordica charantia*
Barley	*Hordeum vulgare*
Barnyardgrass	*Echinochloa crus-galli*
Bassia, fivehook	*Bassia hyssopifolia*
Bluegrass, annual	*Poa annua*
Bluegrass, bulbous	*Poa bulbosa*
Brome	*Bromus spp.*
Buttercup	*Ranunculus spp.*
Cheat	*Bromus secalinus*
Chickweed, mouseear	*Cerastium vulgatum*
Cocklebur	*Xanthium strumarium*
Corn, volunteer	*Zea mays*
Crabgrass	*Digitaria spp.*
Dwarfdandelion	*Krigia cespitosa*
Falseflax, smallseed	*Camelina microcarpa*
Fiddleneck	*Amsinckia spp.*
Flaxleaf fleabane	*Conyza bonariensis*
Fleabane	*Erigeron spp.*
Foxtail	*Setaria spp.*
Foxtail, Carolina	*Alopecurus carolinianus*
Groundsel, common	*Senecio vulgaris*
Horseweed/Marestail	*Conyza canadensis*
Kochia	*Kochia scoparia*
Lambsquarters, common	*Chenopodium album*
Lettuce, prickly	*Lactuca serriola*
Morningglory	*Ipomoea spp.*
Mustard, blue	*Chorispora tenella*
Mustard, tansy	*Descurainia pinnata*
Mustard, tumble	*Sisymbrium altissimum*
Mustard, wild	*Sinapis arvensis*
Oats, wild	*Avena fatua*
Panicum	*Panicum spp.*
Pennycress, field	*Thlaspi arvense*
Pigweed, redroot	*Amaranthus retroflexus*
Pigweed, smooth	*Amaranthus hybridus*
Ragweed, common	*Ambrosia artemisiifolia*
Ragweed, giant	*Ambrosia trifida*
Rocket, London	*Sisymbrium irio*
Rye	*Secale cereale*
Ryegrass, Italian [11]	*Lolium multiflorum*
Sandbur, field	*Cenchrus spp.*
Shattercane	*Sorghum bicolor*
Shepherd's-purse	*Capsella bursa-pastoris*
Signalgrass, broadleaf	*Brachiaria platyphylla*
Smartweed, Pennsylvania	*Polygonum pensylvanicum*
Sowthistle, annual	*Sonchus oleraceus*

Spanishneedles [††]	*Bidens bipinnata*
Stinkgrass	*Eragrostis cilianensis*
Sunflower	*Helianthus annuus*
Thistle, Russian	*Salsola kali*
Spurry, umbrella	*Holosteum umbellatum*
Velvetleaf	*Abutilon theophrasti*
Wheat	*Triticum aestivum*
Witchgrass	*Panicum capillare*

[†]Apply with hand-held equipment only.
[††]Apply 3 pints of this product per acre.

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

Perennial Weeds

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

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

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

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

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

Common Name	Scientific Name
Alfalfa (31)	*Medicago sativa*
Alligatorweed [†] (1)	*Alternanthera philoxeroides*
Anise/Fennel (31)	*Foeniculum vulgare*
Artichoke, Jerusalem (31)	*Helianthus tuberosus*
Bahiagrass (31)	*Paspalum notatum*
Bermudagrass (2)	*Cynodon dactylon*
Bindweed, field (3)	*Convolvulus arvensis*
Bluegrass, Kentucky (12)	*Poa pratensis*
Blueweed, Texas (3)	*Helianthus ciliaris*
Brackenfern (4)	*Pteridium spp.*
Bromegrass, smooth (12)	*Bromus inermis*
Canarygrass, reed (12)	*Phalaris arundinacea*
Cattail (5)	*Typha spp.*
Clover, red (31)	*Trifolium pratense*
Clover, white (31)	*Trifolium repens*
Cogongrass (6)	*Imperata clylindrica*
Cordgrass (7)	*Spartina spp.*
Cutgrass, giant [†] (8)	*Zizaniopsis miliacea*
Dallisgrass (31)	*Paspalum dilatatum*
Dandelion (31)	*Taraxacum officinale*
Dock, curly (31)	*Rumex crispus*
Dogbane, hemp (9)	*Apocynum cannabinum*
Fescue (31)	*Festuca spp.*
Fescue, tall (10)	*Festuca arundinacea*
Guineagrass (11)	*Panicum maximum*
Hemlock, poison (31)	*Conium maculatum*
Horsenettle (31)	*Solanum carolinense*
Horseradish (9)	*Armoracia rusticana*
Ice Plant (22)	*Mesembryanthemum crystallinum*
Johnsongrass (12)	*Sorghum halepense*
Kikuyugrass (21)	*Pennisetum clandestinum*
Knapweed (9)	*Centaurea repens*
Lantana (13)	*Lantana camara*
Lespedeza, common (31)	*Lespedeza striata*
Lespedeza, sericea (31)	*Lespedeza cuneata*
Loosestrife, purple (14)	*Lythrum salicaria*
Lotus, American (15)	*Nelumbo lutea*
Maidencane (16)	*Panicum hematomon*
Milkweed (17)	*Asclepias spp.*
Muhly, wirestem (21)	*Muhlenbergia frondosa*
Mullein, common (31)	*Verbascum thapsus*
Napiergrass (31)	*Pennisetum purpureum*
Nightshade, silverleaf (3)	*Solanum elaeagnifolium*
Nutsedge, purple (18)	*Cyperus rotundus*
Nutsedge, yellow (18)	*Cyperus esculentus*
Orchardgrass (12)	*Dactylis glomerata*
Pampasgrass (19)	*Cortaderia jubata*
Paragrass (16)	*Brachiaria mutica*
Phragmites [††] (20)	*Phragmites spp.*
Quackgrass (21)	*Agropyron repens*
Reed, giant (22)	*Arundo donax*
Ryegrass, perennial (12)	*Lolium perenne*
Smartweed, swamp (31)	*Polygonum coccineum*
Spatterdock (23)	*Nuphar luteum*
Starthistle, yellow (31)	*Centaurea solstitialis*
Sweet potato, wild [†] (24)	*Ipomoea pandurata*
Thistle, artichoke (25)	*Cynara cardunculus*
Thistle, Canada (25)	*Cirsium arvense*
Timothy (12)	*Phleum pratense*
Torpedograss [†] (26)	*Panicum repens*
Tules, common (27)	*Scirpus acutus*
Vaseygrass (31)	*Paspalum urvillei*
Velvetgrass (31)	*Holcus spp.*
Waterhyacinth (28)	*Eichornia crassipes*
Waterlettuce (29)	*Pistia stratiotes*
Waterprimrose (30)	*Ludwigia spp.*
Wheatgrass, western (12)	*Agropyron smithii*

[†]Partial control.
[††]Partial control in southeastern states. See "Specific Weed Control Recommendations" below.

Specific Perennial Weed Control Recommendations:

1. **Alligatorweed:** Apply 6 pints of this product per acre as a broadcast spray or as a 1 1/4 percent solution with hand-held equipment to provide partial control of alligatorweed. Apply when most of the target plants are in bloom. Repeat applications will be required to maintain such control.
2. **Bermudagrass:** Apply 7 1/2 pints of this product per acre as a broadcast spray or as a 1 1/2 percent solution with hand-held equipment. Apply when target plants are actively growing and when seedheads appear.
3. **Bindweed, field / Silverleaf Nightshade / Texas Blueweed:** Apply 6 to 7 1/2 pints of this product per acre as a broadcast spray west of the Mississippi River and 4 1/2 to 6 pints of this product per acre east of the Mississippi River. With hand-held equipment, use a 1 1/2 percent solution. Apply when target plants are actively growing and are at or beyond full bloom. For silverleaf nightshade, best results can be obtained when application is made after berries are formed. Do not treat when weeds are under drought stress. New leaf development indicates active growth. For best results apply in late summer or fall.
4. **Brackenfern:** Apply 4 1/2 to 6 pints of this product per acre as a broadcast spray or as a 3/4 to 1 percent solution with hand-held equipment. Apply to fully expanded fronds which are at least 18 inches long.
5. **Cattail:** Apply 4 1/2 to 6 pints of this product per acre as a broadcast spray or as a 3/4 percent solution with hand-held equipment. Apply when target plants are actively growing and are at or beyond the early-to-full bloom stage of growth. Best results are achieved when application is made during the summer or fall months.
6. **Cogongrass:** Apply 4 1/2 to 7 1/2 pints of this product per acre as a broadcast spray. Apply when cogongrass is at least 18 inches tall and actively growing in late summer or fall. Allow 7 or more days after application before tillage or mowing. Due to uneven stages of growth and the dense nature of vegetation preventing good spray coverage, repeat treatments may be necessary to maintain control.
7. **Cordgrass:** Apply 4 1/2 to 7 1/2 pints of this product per acre as a broadcast spray or as a 1 to 2 percent solution with hand-held equipment. Schedule applications in order to allow 6 hours before treated plants are covered by tidewater. The presence of debris and silt on the cordgrass plants will reduce performance. It may be necessary to wash targeted plants prior to application to improve uptake of this product into the plant.
8. **Cutgrass, giant:** Apply 6 pints of this product per acre as a broadcast spray or as a 1 percent solution with hand-held equipment to provide partial control of giant cutgrass. Repeat applications will be required to maintain such control, especially where vegetation is partially submerged in water. Allow for substantial regrowth to the 7 to 10-leaf stage prior to retreatment.
9. **Dogbane, hemp / Knapweed / Horseradish:** Apply 6 pints of this product per acre as a broadcast spray or as a 1 1/2 percent solution with hand-held equipment. Apply when target plants are actively growing and most have reached the late bud-to-flower stage of growth. For best results, apply in late summer or fall.
10. **Fescue, tall:** Apply 4 1/2 pints of this product per acre as a broadcast spray or as a 1 percent solution with hand-held equipment. Apply when target plants are actively growing and most have reached the boot-to-head stage of growth. When applied prior to the boot stage, less desirable control may be obtained.
11. **Guineagrass:** Apply 4 1/2 pints of this product per acre as a broadcast spray or as a 3/4 percent solution with hand-held equipment. Apply when target plants are actively growing and when most have reached at least the 7-leaf stage of growth.
12. **Johnsongrass / Bluegrass, Kentucky / Bromegrass, smooth / Canarygrass, reed / Orchardgrass / Ryegrass, perennial / Timothy / Wheatgrass, western:** Apply 3 to 4 1/2 pints of this product per acre as a broadcast spray or as a 3/4 percent solution with hand-held equipment. Apply when target plants are actively growing and most have reached the boot-to-head stage of growth. When applied prior to the boot stage, less desirable control may be obtained. In the fall, apply before plants have turned brown.
13. **Lantana:** Apply this product as a 3/4 to 1 percent solution with hand-held equipment. Apply to actively growing lantana at or beyond the bloom stage of growth. Use the higher application rate for plants that have reached the woody stage of growth.
14. **Loosestrife, purple:** Apply 4 pints of this product per acre as a broadcast spray or as a 1 to 1 1/2 percent solution using hand-held equipment. Treat when plants are actively growing at or beyond the bloom stage of growth. Best results are achieved when application is made during summer or fall months. Fall treatments must be applied before a killing frost.
15. **Lotus, American:** Apply 4 pints of this product per acre as a broadcast spray or as a 3/4 percent solution with hand-held equipment. Treat when plants are actively growing at or beyond the bloom stage of growth. Best results are achieved when application is made during summer or fall months. Fall treatments must be applied before a killing frost. Repeat treatment may be necessary to control regrowth from underground parts and seeds.
16. **Maidencane / Paragrass:** Apply 6 pints of this product per acre as a broadcast spray or as a 3/4 percent solution with hand-held equipment. Repeat treatments will be required, especially to vegetation partially submerged in water. Under these conditions, allow for regrowth to the 7 to 10-leaf stage prior to retreatment.
17. **Milkweed, common:** Apply 4 1/2 pints of this product per acre as a broadcast spray or as a 1 1/2 percent solution with hand-held equipment. Apply when target plants are actively growing and most have reached the late bud-to-flower stage of growth.
18. **Nutsedge: purple, yellow:** Apply 4 1/2 pints of this product per acre as a broadcast spray, or as a 3/4 percent solution with hand-held equipment to control existing nutsedge plants and immature nutlets attached to treated plants. Apply when target plants are in flower or when new nutlets can be found at rhizome tips. Nutlets which have not germinated will not be controlled and may germinate following treatment. Repeat treatments will be required for long-term control.
19. **Pampasgrass:** Apply a 1 1/2 percent solution of this product with hand-held equipment when plants are actively growing.
20. **Phragmites:** For partial control of phragmites in Florida and the counties of other states bordering the Gulf of Mexico, apply 7 1/2 pints per acre as a broadcast spray or apply a 1 1/2 percent solution with hand-held equipment. In other areas of the U.S., apply 4 to 6 pints per acre as a broadcast spray or apply a 3/4 percent solution with hand-held equipment for partial control. For best results, treat during late summer of fall months when plants are actively growing and in full bloom. Due to the dense nature of the vegetation, which may prevent good spray coverage and uneven stages of growth, repeat treatments may be necessary to maintain control. Visual control symptoms will be slow to develop.
21. **Quackgrass / Kikuyugrass / Muhly, wirestern:** Apply 3 to 4 1/2 pints of this product per acre as a broadcast spray or as a 3/4 percent solution with hand-held equipment when most quackgrass or wirestem muhly is at least 8 inches in height (3 to 4-leaf stage of growth) and actively growing. Allow 3 or more days after application before tillage.
22. **Reed, giant / ice plant:** For control of giant reed and ice plant, apply a 1 1/2 percent solution of this product with hand-held equipment when plants are actively growing. For giant reed, best results are obtained when applications are made in late summer to fall.

23. **Spatterdock:** Apply 6 pints of this product per acre as a broadcast spray or as a 3/4 percent solution with hand-held equipment. Apply when most plants are in full bloom. For best results, apply during the summer or fall months.
24. **Sweet potato, wild:** Apply this product as a 1 1/2 percent solution using hand-held equipment. Apply to actively growing weeds that are at or beyond the bloom stage of growth. Repeat applications will be required. Allow the plant to reach the recommended stage of growth before retreatment.
25. **Thistle, Canada / artichoke:** Apply 3 to 4 1/2 pints of this product per acre as a broadcast spray or as a 1 1/2 percent solution with hand-held equipment for Canada thistle. To control artichoke thistle, apply a 2 percent solution as a spray-to-wet application. Apply when target plants are actively growing and are at or beyond the bud stage of growth.
26. **Torpedograss:** Apply 6 to 7 1/2 pints of this product per acre as a broadcast spray or as a 3/4 to 1 1/2 percent solution with hand-held equipment to provide partial control of torpedograss. Use the lower rates under terrestrial conditions, and the higher rates under partially submerged or a floating mat condition. Repeat treatments will be required to maintain such control.
27. **Tules, common:** Apply this product as a 1 1/2 percent solution with hand-held equipment. Apply to actively growing plants at or beyond the seedhead stage of growth. After application, visual symptoms will be slow to appear and may not occur for 3 or more weeks.
28. **Waterhyacinth:** Apply 5 to 6 pints of this product per acre as a broadcast spray or apply a 3/4 to 1 percent solution with hand-held equipment. Apply when target plants are actively growing and at or beyond the early bloom stage of growth. After application, visual symptoms may require 3 or more weeks to appear with complete necrosis and decomposition usually occurring within 60 to 90 days. Use the higher rates when more rapid visual effects are desired.
29. **Waterlettuce:** For control, apply a 3/4 to 1 percent solution of this product with hand-held equipment to actively growing plants. Use higher rates where infestations are heavy. Best results are obtained from mid-summer through winter applications. Spring applications may require retreatment.
30. **Waterprimrose:** Apply this product as a 3/4 percent solution using hand-held equipment. Apply to plants that are actively growing at or beyond the bloom stage of growth, but before fall color changes occur. Thorough coverage is necessary for best control.
31. **Other perennial weeds listed above:** Apply 4 1/2 to 7 1/2 pints of Rodeo per acre as a broadcast spray or apply as a 3/4 to 1 1/2 percent solution with hand-held equipment.

Woody Brush and Trees

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

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

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

For woody brush and trees, apply the recommended rate plus 2 or more quarts of a nonionic surfactant per 100 gallons of spray solution when plants are actively growing and, unless otherwise directed, after full-leaf expansion. Use the higher rate for larger plants and/or dense areas of growth. On vines, use the higher rate for plants that have reached the woody stage of growth. Best results are obtained when application is made in late summer or fall after fruit formation.

In arid areas, best results are obtained when application is made in the spring or early summer when brush species are at high moisture content and are flowering. Ensure thorough coverage when using hand-held equipment. Symptoms may not appear prior to frost or senescence with fall treatments.

Allow 7 or more days after application before tillage, mowing or removal. Repeat treatments may be necessary to control plants regenerating from underground parts or seed. Some autumn colors on undesirable deciduous species are acceptable provided no major leaf drop has occurred. Reduced performance may result if fall treatments are made following a frost.

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

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

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

[1] Partial control (See below for control or partial control instructions.)

Specific Brush or Tree Control Recommendations:

1. **Alder / Blackberry / Dewberry / Honeysuckle / Oak, Post / Raspberry:** For control, apply 4 1/2 to 6 pints per acre as a broadcast spray or as a 3/4 to 1 1/4 percent solution with hand-held equipment.
2. **Aspen, Quaking / Hawthorn / Trumpetcreeper:** For control, apply 3 to 4 1/4 pints of this product per acre as a broadcast spray or as a 3/4 to 1 1/4 percent solution with hand-held equipment.
3. **Birch / Elderberry / Hazel / Salmonberry / Thimbleberry:** For control, apply 3 pints per acre of this product as a broadcast spray or as a 3/4 percent solution with hand-held equipment.
4. **Broom, French / Broom, Scotch:** For control, apply a 1 1/4 to 1 1/2 percent solution with hand-held equipment.
5. **Buckwheat, California / Hasardia / Monkey flower / Tobacco, tree:** For partial control of these species, apply a 3/4 to 1 1/2 percent solution of this product as a foliar spray with hand-held equipment. Thorough coverage of foliage is necessary for best results.
6. **Catsclaw:** For partial control, apply a 1 1/4 to 1 1/2 percent solution with hand-held equipment when at least 50 percent of the new leaves are fully developed.
7. **Cherry, bitter / Cherry, black / Cherry, pin / Oak, southern red / Sweetgum / Prunus:** For control, apply 3 to 7 1/2 pints of this product per acre as a broadcast spray or as a 1 to 1 1/2 percent solution with hand-held equipment.
8. **Coyote brush:** For control, apply a 1 1/4 to 1 1/2 percent solution with hand-held equipment when at least 50 percent of the new leaves are fully developed.
9. **Dogwood / Hickory / Salt cedar:** For partial control, apply a 1 to 2 percent solution of this product with hand-held equipment or 6 to 7 1/2 pints per acre as a broadcast spray.
10. **Eucalyptus, bluegum:** For control of eucalyptus resprouts, apply a 1 1/2 percent solution of this product with hand-held equipment when resprouts are 6 to 12-feet tall. Ensure complete coverage. Apply when plants are actively growing. Avoid application to drought-stressed plants.
11. **Holly, Florida / Waxmyrtle, southern:** For partial control, apply this product as a 1 1/2 percent solution with hand-held equipment.
12. **Kudzu:** For control, apply 6 pints of this product per acre as a broadcast spray or as a 1 1/2 percent solution with hand-held equipment. Repeat applications will be required to maintain control.
13. **Maple, red:** For control, apply as a 3/4 to 1 1/4 percent solution with hand-held equipment when leaves are fully developed. For partial control, apply 2 to 7 1/2 pints of this product per acre as a broadcast spray.
14. **Maple, sugar / Oak: northern pin / Oak, red:** For control, apply as a 3/4 to 1 1/4 percent solution with hand-held equipment when at least 50 percent of the new leaves are fully developed.
15. **Poison-ivy / Poison-oak:** For control, apply 6 to 7 1/2 pints of this product per acre as a broadcast spray or as a 1 1/2 percent solution with hand-held equipment. Repeat applications may be required to maintain control. Fall treatments must be applied before leaves lose green color.
16. **Rose, multiflora:** For control, apply 3 pints of this product per acre as a broadcast spray or as a 3/4 percent solution with hand-held equipment. Treatments should be made prior to leaf deterioration by leaf-feeding insects.
17. **Sage, black / Sagebrush, California / Chamise / Tallowtree, Chinese:** For control of these species, apply a 3/4 percent solution of this product as a foliar spray with hand-held equipment. Thorough coverage of foliage is necessary for best results.
18. **Saltbush, sea myrtle:** For control, apply this product as a 1 percent solution with hand-held equipment.
19. **Willow:** For control, apply 4 1/2 pints of this product per acre as a broadcast spray or as a 3/4 percent solution with hand-held equipment.
20. **Other woody brush and trees listed above:** For partial control, apply 3 to 7 1/2 pints of this product per acre as a broadcast spray or as a 3/4 to 1 1/2 percent solution with hand-held equipment.

Warranty Disclaimer

Dow AgroSciences warrants that this product conforms to the chemical description on the label and is reasonably fit for the purposes stated on the label when used in strict accordance with the directions, subject to the inherent risks set forth below. Dow AgroSciences MAKES NO OTHER EXPRESS OR IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR ANY OTHER EXPRESS OR IMPLIED WARRANTY.

Inherent Risks of Use

It is impossible to eliminate all risks associated with use of this product. Crop injury, lack of performance, or other unintended consequences may result because of such factors as use of the product contrary to label instructions (including conditions noted on the label, such as unfavorable temperatures, soil conditions, etc.), abnormal conditions (such as excessive rainfall, drought, tornadoes, hurricanes), presence of other materials, the manner of application, or other factors, all of which are beyond the control of Dow AgroSciences or the seller. All such risks shall be assumed by buyer.

Limitation of Remedies

The exclusive remedy for losses or damages resulting from this product (including claims based on contract, negligence, strict liability, or other legal theories), shall be limited to, at Dow AgroSciences' election, one of the following:

(1) Refund of purchase price paid by buyer or user for product bought, or
(2) Replacement of amount of product used.

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

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

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

EPA-accepted 05/15/2002

Revisions:

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

MONSANTO Company
Material Safety Data Sheet
Commercial Product

1. PRODUCT AND COMPANY IDENTIFICATION

Product name
RODEO® Emerged Aquatic Weed and Brush Herbicide

EPA Reg. No.
524-343
Product use
Herbicide
Chemical name
Not applicable
Synonyms
None
Company
MONSANTO Company, 800 N. Lindbergh Blvd., St. Louis, MO, 63167
Telephone: 800-332-3111, **Fax:** 314-694-5557
Emergency numbers
FOR CHEMICAL EMERGENCY, SPILL LEAK, FIRE, EXPOSURE, OR ACCIDENT Call CHEMTREC - Day or Night: 1-800-424-9300 toll free in the continental U.S., Puerto Rico, Canada, or Virgin Islands. For calls originating elsewhere: 703-527-3887 (collect calls accepted).
FOR MEDICAL EMERGENCY - Day or Night: 314-694-4000 (collect calls accepted).

2. COMPOSITION/INFORMATION ON INGREDIENTS

Active ingredient
Isopropylamine salt of N-(phosphonomethyl)glycine; {Isopropylamine salt of glyphosate}

Composition

COMPONENT	CAS No.	% by weight (approximate)
Isopropylamine salt of glyphosate	38641-94-0	53.5
Water	7732-18-5	46.5

OSHA Status
This product is not hazardous according to the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

3. HAZARDS IDENTIFICATION

Emergency overview
Appearance and odour (colour/form/odour): Colourless - Amber / Liquid, (viscous) / Odourless

CAUTION!

Potential health effects
Likely routes of exposure
Skin contact, eye contact, inhalation
Eye contact, short term
Not expected to produce significant adverse effects when recommended use instructions are followed.
Skin contact, short term
Not expected to produce significant adverse effects when recommended use instructions are followed.
Inhalation, short term

Not expected to produce significant adverse effects when recommended use instructions are followed.

Refer to section 11 for toxicological and section 12 for environmental information

4. FIRST AID MEASURES

Eye contact
Immediately flush with plenty of water.
If easy to do, remove contact lenses.

Skin contact
Take off contaminated clothing, wristwatch, jewellery.
Wash affected skin with plenty of water.
Wash clothes before re-use.

Inhalation
Remove to fresh air.

Ingestion
Immediately offer water to drink.
Do NOT induce vomiting unless directed by medical personnel.
If symptoms occur, get medical attention.

Advice to doctors
This product is not an inhibitor of cholinesterase.

Antidote
Treatment with atropine and oximes is not indicated.

5. FIRE FIGHTING MEASURES

Flash point
None.

Extinguishing media
Recommended: Water, foam, dry chemical, carbon dioxide (CO2)

Unusual fire and explosion hazards
None.
Environmental precautions: see section 6.

Hazardous products of combustion
Carbon monoxide (CO), phosphorus oxides (PxOy), nitrogen oxides (NOx)

Fire fighting equipment
Self-contained breathing apparatus.
Equipment should be thoroughly decontaminated after use.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions
Use personal protection recommended in section 8.

Environmental precautions
SMALL QUANTITIES:
Low environmental hazard.

LARGE QUANTITIES:
Minimize spread.
Keep out of drains, sewers, ditches and water ways.
Notify authorities.

Methods for cleaning up
SMALL QUANTITIES:
Flush spill area with water.
LARGE QUANTITIES:
Absorb in earth, sand or absorbent material.
Dig up heavily contaminated soil.
Collect in containers for disposal.
Refer to section 7 for types of containers.
Flush residues with small quantities of water.
Minimize use of water to prevent environmental contamination.

Refer to section 13 for disposal of spilled material.

7. HANDLING AND STORAGE

Handling
Good industrial practice in housekeeping and personal hygiene should be followed.
Avoid contact with skin and eyes.
When using do not eat, drink or smoke.
Wash hands thoroughly after handling or contact.
Thoroughly clean equipment after use.
Do not contaminate drains, sewers and water ways when disposing of equipment rinse water.
Refer to section 13 for disposal of rinse water.
Emptied containers retain vapour and product residue.
Observe all labelled safeguards until container is cleaned, reconditioned or destroyed.

Storage
Minimum storage temperature: -15 °C
Maximum storage temperature: 50 °C
Compatible materials for storage: stainless steel, aluminium, fibreglass, plastic, glass lining
Incompatible materials for storage: galvanised steel, unlined mild steel, see section 10.
Keep out of reach of children.
Keep away from food, drink and animal feed.
Keep only in the original container.
Partial crystallization may occur on prolonged storage below the minimum storage temperature.
If frozen, place in warm room and shake frequently to put back into solution.
Minimum shelf life: 5 years.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Airborne exposure limits

Components	Exposure Guidelines
Isopropylamine salt of glyphosate	No specific occupational exposure limit has been established.
Water	No specific occupational exposure limit has been established.

Engineering controls
No special requirement when used as recommended.

Eye protection
No special requirement when used as recommended.

Skin protection
No special requirement when used as recommended.

Respiratory protection
No special requirement when used as recommended.

When recommended, consult manufacturer of personal protective equipment for the appropriate type of equipment for a given application.

9. PHYSICAL AND CHEMICAL PROPERTIES

These physical data are typical values based on material tested but may vary from sample to sample. Typical values should not be construed as a guaranteed analysis of any specific lot or as specifications for the product.

Colour/colour range:	Colourless - Amber
Form:	Liquid (viscous)
Odour:	Odourless
Flash point:	None.
Specific gravity:	1.206 @ 20 °C / 15.6 °C
Solubility:	Water: Completely miscible.
pH:	4.6 - 4.8 @ 63 g/l
Partition coefficient (log Pow):	< 0.000 (active ingredient)

10. STABILITY AND REACTIVITY

Stability
Stable under normal conditions of handling and storage.

Hazardous decomposition
Thermal decomposition: Hazardous products of combustion: see section 5.

Materials to avoid/Reactivity
Reacts with galvanised steel or unlined mild steel to produce hydrogen, a highly flammable gas that could explode.

11. TOXICOLOGICAL INFORMATION

This section is intended for use by toxicologists and other health professionals.

Data obtained on product and components are summarized below.

Acute inhalation toxicity
Rat, LC50, 4 hours, aerosol: > 1.3 mg/L
Slightly toxic.
FIFRA category III.

Skin sensitization
Guinea pig, 9-induction Buehler test:
Positive incidence: 0 %

Mutagenicity
Micronucleus test(s):
Not mutagenic.
Ames test(s):
Not mutagenic with and without metabolic activation.

Isopropylamine salt of glyphosate (62%)

Acute oral toxicity
Rat, LD50 (limit test): > 5,000 mg/kg body weight
Practically non-toxic.
FIFRA category IV.
No mortality.
Mouse, LD50 (limit test): > 5,000 mg/kg body weight
Practically non-toxic.
FIFRA category IV.
No mortality.

Acute dermal toxicity
Rabbit, LD50 (limit test): > 5,000 mg/kg body weight
Practically non-toxic.
FIFRA category IV.
No mortality.

Skin irritation
Rabbit, 6 animals, Draize test:
Days to heal: 3
Primary Irritation Index (PII): 0.0/8.0
Essentially non irritating.
FIFRA category IV.

Eye irritation
Rabbit, 6 animals , OECD 405 test:
Days to heal: 0
FIFRA category IV.

Acute inhalation toxicity
Rat, LC50, 4 hours, aerosol: > 4.24 mg/L
Practically non-toxic.
FIFRA category IV.
No mortality. Maximum attainable concentration.

Repeated dose toxicity
Dog, oral, 6 months:
LOAEL toxicity: > 300 mg/kg diet
Target organs/systems: None.
Other effects: decrease of body weight gain

N-(phosphonomethyl)glycine; {glyphosate}

Mutagenicity
In vitro and in vivo mutagenicity test(s):
Not mutagenic.

Repeated dose toxicity
Rabbit, dermal, 21 days:
NOAEL toxicity: > 5,000 mg/kg body weight/day
Target organs/systems: None.
Other effects: None.
Rat, oral, 3 months:
NOAEL toxicity: > 20,000 mg/kg diet
Target organs/systems: None.
Other effects: None.

Carcinogenicity
Mouse, oral, 24 months:
NOEL tumour: > 30,000 mg/kg diet
NOAEL toxicity: ~ 5,000 mg/kg diet
Tumours: None.
Target organs/systems: liver
Other effects: decrease of body weight gain, histopathologic effects
Rat, oral, 24 months:

NOEL tumour: > 20,000 mg/kg diet
NOAEL toxicity: ~ 8,000 mg/kg diet
Tumours: None.
Target organs/systems: eyes
Other effects: decrease of body weight gain, histopathologic effects

Toxicity to reproduction/fertility

Rat, oral, 3 generations:
NOAEL toxicity: > 30 mg/kg body weight
NOAEL reproduction: > 30 mg/kg body weight
Target organs/systems in parents: None.
Other effects in parents: None.
Target organs/systems in pups: None.
Other effects in pups: None.

Developmental toxicity/teratogenicity

Rat, oral, 6 - 19 days of gestation:
NOAEL toxicity: 1,000 mg/kg body weight
NOAEL development: 1,000 mg/kg body weight
Other effects in mother animal: decrease of body weight gain, decrease of survival
Developmental effects: weight loss, post-implantation loss, delayed ossification
Effects on offspring only observed with maternal toxicity.

Rabbit, oral, 6 - 27 days of gestation:
NOAEL toxicity: 175 mg/kg body weight
NOAEL development: 175 mg/kg body weight
Target organs/systems in mother animal: None.
Other effects in mother animal: decrease of survival
Developmental effects: None.

12. ECOLOGICAL INFORMATION

This section is intended for use by ecotoxicologists and other environmental specialists.

Data obtained on components are summarized below.

Isopropylamine salt of glyphosate (62%)

Aquatic toxicity, fish

Bluegill sunfish (Lepomis macrochirus):
Acute toxicity (limit test), 96 hours, static, LC50: > 1,000 mg/L
practically non-toxic

Rainbow trout (Oncorhynchus mykiss):
Acute toxicity (limit test), 96 hours, static, LC50: > 1,000 mg/L
practically non-toxic

Aquatic toxicity, invertebrates

Water flea (Daphnia magna):
Acute toxicity (limit test), 48 hours, static, EC50: 930 mg/L
practically non-toxic

Aquatic toxicity, algae/aquatic plants

Green algae (Scenedesmus subspicatus):
Acute toxicity, 72 hours, static, EbC50 (biomass): 72.9 mg/L
slightly toxic

Soil organism toxicity, invertebrates

Earthworm (Eisenia foetida):
Acute toxicity, 14 days, LC50: > 5,000 mg/kg dry soil
practically non-toxic

N-(phosphonomethyl)glycine; {glyphosate}

Avian toxicity

Bobwhite quail (Colinus virginianus):
Dietary toxicity (limit test), 5 days, LC50: > 4,640 mg/kg diet
practically non-toxic

Mallard duck (Anas platyrhynchos):
Dietary toxicity (limit test), 5 days, LC50: > 4,640 mg/kg diet
practically non-toxic

Bobwhite quail (Colinus virginianus):
Acute oral toxicity (limit test), LD50: > 3,851 mg/kg body weight
practically non-toxic

Mallard duck (Anas platyrhynchos):
Reproductive toxicity, 16 weeks, NOEC: >= 1,000 mg/kg diet

Bobwhite quail (Colinus virginianus):
Reproductive toxicity, 17 weeks, NOEC: >= 1,000 mg/kg diet

Arthropod toxicity

Honey bee (Apis mellifera):
Oral/contact, 48 hours, LD50: > 100 µg/bee
practically non-toxic

Bioaccumulation

Bluegill sunfish (Lepomis macrochirus):
Whole fish: BCF: < 1
No significant bioaccumulation is expected.

Dissipation

Soil, field:
Half life: 2 - 174 days
Koc: 884 - 60,000 L/kg
Binds strongly to soil.

Water, aerobic:
Half life: < 7 days

13. DISPOSAL CONSIDERATIONS

Product

Not classified as hazardous waste by the Resource, Conservation and Recovery Act (RCRA), 40 CFR 261.
Recycle if appropriate facilities/equipment available.
Burn in special, controlled high temperature incinerator.
Keep out of drains, sewers, ditches and water ways.
Follow all local/regional/national regulations.
Consult your attorney or appropriate regulatory officials for information on disposal.

Container

Triple rinse empty containers.
Pour rinse water into spray tank.
Store for collection by approved waste disposal service.
Dispose of as non hazardous industrial waste.
Do NOT re-use containers.
Follow all local/regional/national regulations.

14. TRANSPORT INFORMATION

The data provided in this section is for information only. Please apply the appropriate regulations to properly classify your shipment for transportation.

Not hazardous under the applicable DOT, ICAO/IATA, IMO, TDG and Mexican regulations.

15. REGULATORY INFORMATION

TSCA Inventory
All components are on the US EPA's TSCA Inventory

SARA Title III Rules
Section 311/312 Hazard Categories
Not applicable.
Section 302 Extremely Hazardous Substances
Not applicable.
Section 313 Toxic Chemical(s)
Not applicable.

CERCLA Reportable quantity
Not applicable.

16. OTHER INFORMATION

The information given here is not necessarily exhaustive but is representative of relevant, reliable data.
For more information refer to product label.
Please consult Monsanto if further information is needed.
Follow all local/regional/national regulations.
In this document the British spelling was applied.
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Full denomination of most frequently used acronyms. BCF (Bioconcentration Factor), BOD (Biochemical Oxygen Demand), COD (Chemical Oxygen Demand), EC50 (50% effect concentration), ED50 (50% effect dose), I.M. (intramuscular), I.P. (intraperitoneal), I.V. (intravenous), Koc (Soil adsorption coefficient), LC50 (50% lethality concentration), LD50 (50% lethality dose), LDLo (Lower limit of lethal dosage), LEL (Lower Explosion Limit), LOAEC (Lowest Observed Adverse Effect Concentration), LOAEL (Lowest Observed Adverse Effect Level), LOEC (Lowest Observed Effect Concentration), LOEL (Lowest Observed Effect Level), MEL (Maximum Exposure limit), MTD (Maximum Tolerated Dose), NOAEC (No Observed Adverse Effect Concentration), NOAEL (No Observed Adverse Effect Level), NOEC (No Observed Effect Concentration), NOEL (No Observed Effect Level), OEL (Occupational Exposure Limit), PEL (Permissible Exposure Limit), PII (Primary Irritation Index), Pow (Partition coefficient n-octanol/water), S.C. (subcutaneous), STEL (Short-Term Exposure Limit), TLV-C (Threshold Limit Value-Ceiling), TLV-TWA (Threshold Limit Value - Time Weighted Average), UEL (Upper Explosion Limit)

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