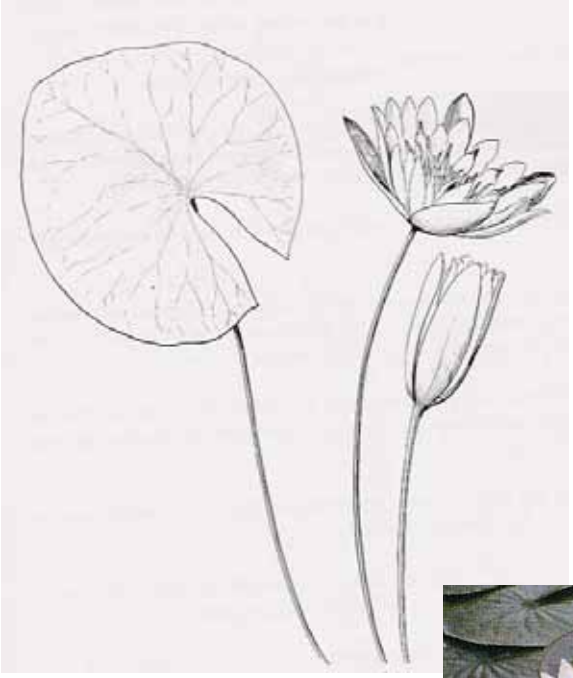
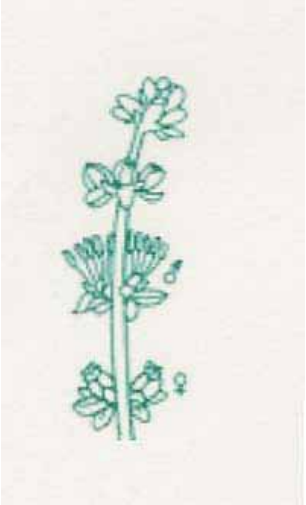
INTEGRATED AQUATIC VEGETATION MANAGEMENT PLAN

CITY OF ROCK ISLAND





ENVIROVISION CORPORATION

DECEMBER 2003

ACKNOWLEDGEMENTS

Envirovision wishes to acknowledge the support of the Lake Enhancement Committee for the City of Rock Island Integrated Aquatic Vegetation Management Plan. Members include Whitey Evenhus of the City of Rock Island, Ron Dragoo, Dane Keane, Mark Kulaas, and Joel Bender of Douglas County, Linda Remington and Ray Hyatt of the Chelan County Public Utility District, Joe Foster of the Washington Department of Fish and Wildlife, and citizen representatives Don Moos, Ray Pearson, and Charlie Mason.

Lisa Parks and Kris Hanson of Alliance Consulting Group, Inc. acted as project managers for this effort and provided valuable support in research and public meeting facilitation. Kay Jones of the City of Rock Island also contributed by disseminating draft versions of this Plan and soliciting input from committee members.

This project was funded in part by the Washington State Department of Ecology's Aquatic Weed Management Fund. Local match was provided by the Chelan County Public Utility District. In-kind services were provided by the City of Rock Island.

TABLE OF CONTENTS

PROJECT OVERVIEW 1
PUBLIC INVOLVEMENT 2
PROBLEM STATEMENT 3
WATERSHED AND LAKE CHARACTERISTICS 3
Watershed Characteristics 3
Lake Features 5
AQUATIC PLANT CHARACTERIZATION 12
Survey and Mapping Methods 12
Survey Results 13
BENEFICIAL USES 20
MANAGEMENT GOALS 21
INTEGRATED TREATMENT ACTION PLAN 21
Overview 21
Control Intensity 22
Selected Plant Control Methods 23
Lake Specific Control Strategy 28
General Considerations and Permitting 30
Monitoring and Evaluation 31
Public Education Program 33
Project Cost 36
Funding Strategy 36
IMPLEMENTATION STRATEGY 39
SUMMARY AND CONCLUSIONS 41
REFERENCES 42

LIST OF TABLES

TABLE 1. LAKE CHARACTERISTICS 5
TABLE 2. WARMWATER FISH SPECIES SUMMARY FOR LAKES 10
TABLE 3. SPECIES COMMON TO ROCK ISLAND LAKES AREA 11
TABLE 4. SUBMERGED AND EMERGENT AQUATIC PLANTS IN ROCK ISLAND LAKES..... 12
TABLE 5. TEN-YEAR PROJECT COST ESTIMATE 37

LIST OF FIGURES

FIGURE 1. WATERSHED BOUNDARY..... 4
FIGURE 2. CITY OF ROCK ISLAND AND AREA LAKES..... 7
FIGURE 3. BIG BOW LAKE AQUATIC PLANT COMMUNITY..... 14
FIGURE 4. HIDEAWAY LAKE AQUATIC PLANT COMMUNITY..... 16
FIGURE 5. PIT LAKE AQUATIC PLANT COMMUNITY 17
FIGURE 6. HAMMOND LAKE AQUATIC PLANT COMMUNITY 19

APPENDICES

APPENDIX A: LAKE ENHANCEMENT COMMITTEE MEMBERS
PUBLIC MEETING MINUTES AND NOTES
APPENDIX B: SUMMARY OF PLANT CONTROL TECHNIQUES
APPENDIX C: PERMITTING AND AQUATIC HERBICIDE INFORMATION
APPENDIX D: AQUATIC HERBICIDE LABELS

PROJECT OVERVIEW

The City of Rock Island Lakes (referred to as the lakes from here on) are located in and around the City of Rock Island in southwest Douglas County. The lakes covered by this plan include Big Bow, Hideaway, Pit, and Hammond. Big Bow, Hideaway, and Hammond are relatively small (<50 acres) shallow (<15 feet deep) lakes that were once sloughs left over from an oxbow of the Columbia River. A powerhouse built at the Rock Island Dam in the 1970's raised the water level of the reservoir adjacent to the City of Rock Island. The lakes are hydraulically connected to the reservoir through groundwater, and the water levels of the sloughs went up approximately six feet, creating larger lakes. Pit Lake is a small (5 acres) deep (70–80 feet) lake formed from a gravel mining operation that also experienced an increase in water level. There are no surface water inputs to the lakes and water levels are mainly a function of groundwater influences from the reservoir. Hammond Lake is indirectly connected to the Columbia River via two culverts, one connecting Hammond Lake to an un-named pond and the other connecting the un-named pond to the river. Big Bow, Hideaway, and Hammond lakes have public boat launches that are open to non-motorized boating, and all the lakes have historically been used for swimming, boating, and fishing, and provide aesthetic appeal and wildlife viewing opportunities for area residents. Some of the lakes have a lakeside trail system, and the City of Rock Island eventually intends to connect these lakes to each other and the downtown area through further trail development (City of Rock Island, 1995).

Presently the water quality in these eutrophic lakes is poor due to excessive amounts of aquatic vegetation, especially Eurasian watermilfoil, a state-listed noxious plant. Eurasian watermilfoil (*Myriophyllum spicatum*) has been present in these lakes for over a decade and is now so abundant it poses safety concerns for swimmers, inhibits fishing and boating, is negatively impacting fish and wildlife habitat, and has reduced the aesthetic appeal of the lakes and their surroundings (Evenhus, Pers. Comm.). The City of Rock Island Lake Enhancement Committee (LEC) was formed several years ago to address this problem and they applied for and received a grant from the Washington Department of Ecology in 2002 to develop an Integrated Aquatic Vegetation Management Plan (IAVMP). The principal reason to develop this IAVMP is to plan for long-term control of aquatic plants, with the primary goal of controlling Eurasian watermilfoil and Purple loosestrife (*Lythrum salicari*). A survey conducted as part of this planning effort found Eurasian watermilfoil to be the dominant plant in the lakes and likely excluding other native aquatic plants. To date, no control methods have been used to control Eurasian watermilfoil in the lakes. Purple loosestrife is controlled annually with an herbicide and a biological control agent and those efforts will continue in the future.

This report provides a description of the aquatic plant control plan developed for the City of Rock Island lakes. The aquatic plant control plan resulted from discussions held at several public meetings where all applicable aquatic plant control options were reviewed. The basic recommendations selected for aquatic plant control in the lakes are:

- Use of Reward® (active ingredient Diquat) to reduce the amount of Eurasian watermilfoil in Big Bow Lake over a two-year period.
- Use of DMA*4IVM® (active ingredient 2,4-D) to reduce the amount of Eurasian watermilfoil in Hideaway Lake in the first year.
- Stock grass carp in Big Bow, Hideaway, Pit, and Hammond lakes as a long-term control aquatic plant control option.
- Perform annual plant monitoring to determine the effectiveness of the aquatic plant control methods.
- Continue to control the amount of Purple loosestrife at all the lakes through the use of annual herbicide applications and biological control agents.
- Be prepared to restock grass carp and/or utilize herbicides to achieve desired level of control of aquatic plants.

Because the lakes covered under this Management Plan will be subjected to different control strategies, the LEC and lake residents will be able to compare and evaluate the response or success of the lake-specific control methods employed. The ability to perform a comparison and evaluation of control methods among the lakes was identified by the LEC as an important component of this Management Plan.

PUBLIC INVOLVEMENT

The City of Rock Island Lake Enhancement Committee was organized in early in 2000 to address the problem of noxious aquatic weeds in the lakes. The need to draft and adopt a Management Plan to combat this problem was recognized by the committee and three public meetings along with several steering committee meetings were held between August 2002 and July 2003. The agendas and attendance sheets for these public meetings are provided in Appendix A, as well as a list of the members of the Lake Enhancement Committee and the organizations they represent. During this time the LEC and lake residents:

- completed the problem statement,
- reviewed beneficial uses of the lakes,
- identified and developed management goals,
- reviewed aquatic plant survey results and control methods,
- selected an aquatic plant control scenario,

- and discussed and reviewed a long-term cost estimate and potential funding options.

There is a high level of support among the members of the LEC and the public to actively manage aquatic plants in the lakes. These stakeholders share a common vision of developing and implementing a Management Plan that addresses opportunities for fishing, boating, swimming, remote-control miniature boat racing, and wildlife viewing for the lakes. Members of the LEC and the public have reviewed a draft of this Plan and there is unanimous agreement to proceed with the proposed Integrated Treatment Action Plan.

PROBLEM STATEMENT

The City of Rock Island Lake Enhancement Committee members have held informal discussions about the ongoing aquatic plant growth and its control since the committee was formed early in 2000. The recent public meetings were held for the purpose of discussing the current levels of aquatic plant growth and to solicit input from the lake residents and property owners about aquatic plant management. From these it can be seen that the lakes are is currently experiencing excessive growth of Eurasian watermilfoil and other nuisance aquatic plants. The residents and property owners of these lakes are aware of the significant impacts that the Eurasian watermilfoil infestation has had on the ecology and beneficial uses of the lakes. All of the residents, property owners, and committee members are united in their desire to address these problems in the short and long-term. Because of the introduction of invasive, nonnative aquatic weeds to Big Bow, Hideaway, Pit, and Hammond Lakes the following list of problems was developed:

- Poor water quality, with associated negative environmental impacts such as oxygen deficiencies for fish and limited water flows and drainage
- Limitations on recreational uses (e.g. fishing, swimming, and boating)
- Potential negative public health and safety conditions due to increased drowning hazard and mosquito breeding
- Aesthetics such as odors and clarity of water

The Problem Statement developed for this Management Plan is “The lakes are experiencing an overabundance in the growth of Eurasian watermilfoil, which is significantly degrading the recreational and fish and wildlife uses of the lakes”.

WATERSHED AND LAKE CHARACTERISTICS

Watershed Characteristics

The Rock Island Lakes watershed is located in Douglas County, WA and is approximately eight miles south of Wenatchee (Figure 1). The Lakes watershed is contained within a floodplain area

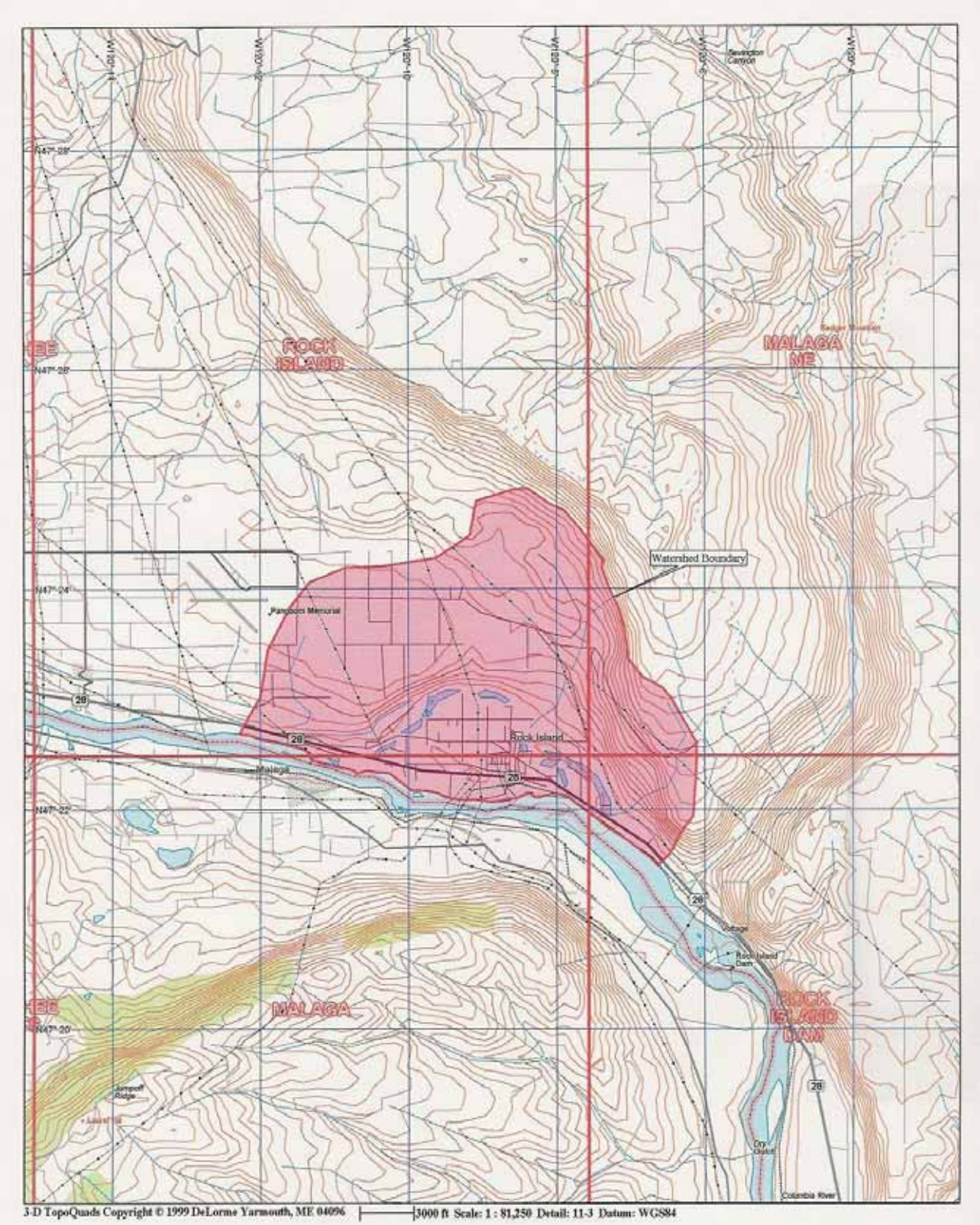


Figure 1: Watershed boundary (approximate) for the City of Rock Island Lakes.

along the Columbia River and comprises a small portion of the 730,029-acre Moses Coulee watershed (WDOE, 2002). The Rock Island lakes watershed is bound on the south and west by the Columbia River and by terraced escarpments to the north and east.

Glacial, fluvial, and volcanic events shaped the geology of the lakes watershed (WSU, 1974). The prominent terraces to the north and east are glacial and fluvial deposits, with stream (river) deposits mainly in the areas of lower elevation to the south and west. The soils in the City of Rock Island area are mainly composed of cobble, sand, and loam. These soils are fluvial (deposited by the surface river) in origin and are excessively drained (WSU, 1982). These types of well-drained soils allow for a high degree of connectivity between the Columbia River the lakes.

The lakes watershed receives a mean annual rainfall of approximately 9 inches (Pacific Groundwater Group, 2002). The watershed also receives water from groundwater inputs from the Columbia River and from the steeply sloped terraced hills to the north and east. Surface water is stored in several small lakes and a former gravel pit within the city limits (Table 1). No major rivers are within this watershed except the Columbia.

Table 1. Lake name, area, average width and length, and average and maximum depth**.**

Lake Name	Surface Area (acres)	Average Length (feet)	Average Width (feet)	Average Depth (feet)[1]	Max. Depth (feet)[1]
Big Bow	49	3795	735	6-8	15
Hammond	31	1931	434	5-7	12
Hideaway	18	3681	421	5-7	12-15
Pitt	5	518	385	Unknown	70-80

Note 1. Estimates only. Based on limited number of measurements due to lack of boat access or excessive submerged plant growth.

Water rights in the general vicinity of the watershed are mainly used for irrigation (64%) and account for roughly 90% of the allocated water in the area (Pacific Groundwater Group, 2002). Personnel from the Washington Department of Ecology's Water Rights Applications Tracking System conducted a water rights search in the areas encompassing the lakes (T22N, R21E, S23, 24, 25, 26, and T22N, R22E, S30). This search indicated that there are 18 certificates, permits, or claims for surface waters in these areas. Of these 18 surface water rights, 14 are classified as active. Seven of the water rights allow for water withdrawal from the Columbia River, five from sloughs, one from a swamp, and one from an infiltration ditch. It is likely that sloughs refer to the public or private lakes in the City of Rock Island area. However, the use or current validity of these 14 active surface water rights has not been determined.

Lake Features

The City of Rock Island Lakes to be considered in this Management Plan are Big Bow, Hideaway, Pit, and Hammond. They, and the other privately owned lakes (Blue Heron and Putter) in the immediate vicinity, are located near or within the City of Rock Island, Douglas

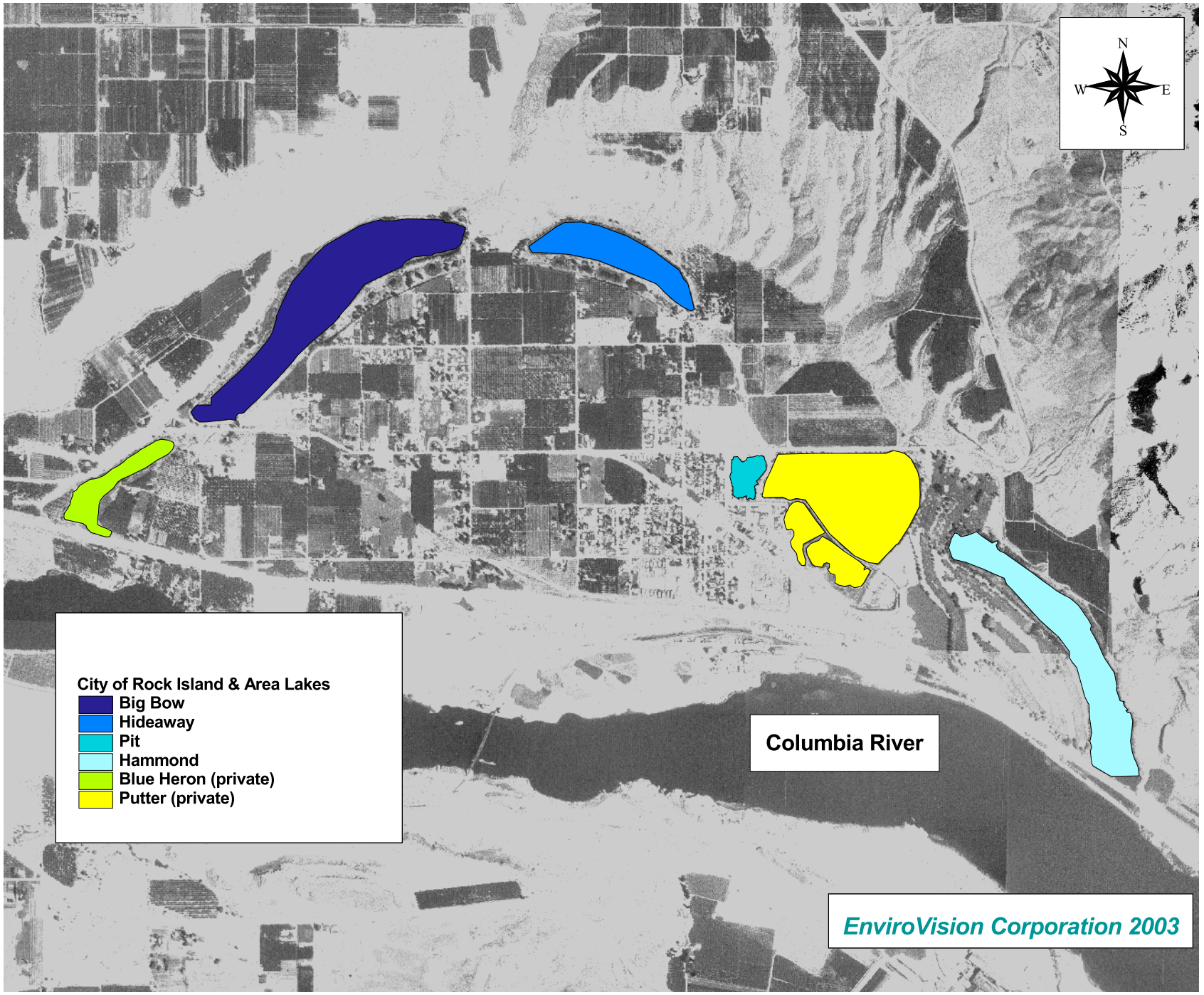
County, Washington (Figure 2). These waterbodies mainly reside in the old Columbia River floodplain along the northeastern edge of town at the base of steep escarpments.

The close proximity of the lakes to the Columbia River suggests that five of the six lakes were formed when the river abandoned an oxbow channel. At some point in the past and through ecological succession the lakes became filled with debris and sediment and developed into sloughs or shallow lakes. These sloughs were shallow, ranging in depth from four to ten feet and were dominated by cattails and bulrushes on the periphery and milfoil, pondweed, and smartweed (Foster et al., 1984) in deeper waters. The Chelan County Public Utility District No. 1 commissioned the building of a second powerhouse at the Rock Island Dam to increase electrical production, which began operation in 1978. When this second powerhouse was built it raised the water level of the existing reservoir by approximately 6 feet (Foster et al., 1984). This larger deeper reservoir significantly increased the elevation of groundwater in the area (WSU, 1982) and several individual ponds and sloughs merged to form the larger, deeper water bodies that are present today. In order to reduce the amount of shallow water (and mosquito breeding areas) that would have been created with the rising water levels, the lakes were excavated, which significantly increased their surface area. Big Bow Lake is the largest lake at 49 acres while Pit Lake is the smallest at 5 acres (Table 1). However, Pit Lake (presumably named as such because it is an old gravel "pit") is an old gravel quarry that filled up with water during excavation.

Although the lakes are no longer part of the Columbia River's main-stem, the river is still the primary hydrologic input to the lakes. In analyzing maps and aerial photographs and conducting an on-site survey, it appears that there are no direct surface water inputs to the Rock Island lakes, and that the lakes are not connected to each other through surface water streams or channels. Water inputs to the Lakes come from precipitation (average of 9 inches a year), surface water seeps, and groundwater. Groundwater pump tests indicate that the main groundwater into the City of Rock Island (and therefore the lakes) is from the northwest, with some additional localized inflow from the river (WSU, 1982). The only surface water connection to other waterbodies occurs at Hammond Lake, where a concrete culvert 24 inches in diameter extends from the lake to an un-named pond on the other side of state road 28. The un-named pond also has a culvert that connects it to the Columbia River.

Limited information is available concerning the water quality conditions of the lakes. A second powerhouse was installed at Rock Island Dam in the late 1970's (WSU, 1982). This increased the elevation of groundwater in the area by raising the water level in the reservoir by six feet. As part of the effort to document impacts of the second powerhouse, a pre and post floodwater quality investigation was conducted to determine changes in water quality in the Rock Island area. Data collected in 1987 (WSU, 1982) documented an increase in the amount of algae in the lakes after the water levels increased but the exact reason was unknown. The same study concluded that zooplankton communities were large enough to support a healthy fishery and that there did not appear to be any significant changes in the benthic invertebrate communities. In any event, the lakes were deemed to be highly productive and classified as eutrophic. This was based on chlorophyll a concentrations measured before and after the water level increase.

Figure 2. City of Rock Island and Area Lakes



0 0.6 1.2 1.8 2.4 Miles

Biologists with the Washington Department of Fish and Wildlife (WDFW) were scheduled to collect water quality data such as dissolved oxygen, temperature, pH, conductivity, and turbidity during their warmwater fish survey in 2000 (WDFW, 2003) but did not do so because of equipment failure. Fish kills were documented on several of the lakes in the 1980's. The most likely cause of the fish kills was postulated as low dissolved oxygen levels, presumably as a result of decomposing aquatic plants and filamentous algae.

Shoreland activities that have the potential to negatively impact water quality in the lakes include livestock grazing, runoff of fertilizers from local fruit orchards, and the golf course (WSU, 1982). Development can also impact water quality by increasing runoff and wastewater. The City of Rock Island has experienced a 44% growth rate since 1990 (RH2, 2002). However, deterioration of water quality in the lakes as a result of shoreland activities has not been studied or confirmed.

Aerial photos from the 1990's show few houses around the lakes, but many fields and orchards. Fruit orchards in this region are heavily dependent on irrigation. Big Bow Lake has relatively few (approximately five) residential homes on the western and eastern shores and has extensive orchards and fields used for agriculture along the northern and southern shorelines. Hideaway Lake has no residential development. The northern shore is comprised of a narrow riparian zone with bare hills behind it. The rest of the shoreline has a wider buffer zone of riparian vegetation that comprises a conservation area. Land beyond the conservation area is primarily used for agriculture and fruit orchards. Pit Lake is in a residential/commercial area, although no homes or businesses are located directly on the shoreline. The northern shore of the lake is vacant land with bare ground or shrubs and trees. Paved roads with homes and businesses border the western and southern shores of the lake. The eastern shore of the lake is bordered by a gravel path that separates Pit Lake from Putters Lake (private). A golf course is located along the western and southern shores of Hammond Lake. The northern and eastern shores of the lake are dominated by agricultural fields and fruit orchards. No residential homes or commercial buildings are located on Hammond Lake. In summary, these public lakes have very few residential homes or businesses located on them and are mainly bordered by agricultural fields and fruit orchards.

According to maps created from information gathered at recent public meetings and through a literature review, Big Bow Lake has two potentially active irrigation withdrawals. One potential water withdrawal site is located just east of the public boat ramp while the other is at a site on the northeastern part of the shore. Big Bow Lake is also located in section (23). This is the same section in which an active surface water right with a "swamp" as its source is located. It is possible that this active surface water right is coincident with one of the potentially active irrigation withdrawals. Hideaway Lake has had previous irrigation withdrawals (Johnston et al., 1982), although no active surface water rights are located in the vicinity. No wells or active irrigation withdrawals were documented in and around Pit Lake. The five active surface water rights that draw water from sloughs are located in the same section (T22N, R22E, S30) as Hammond Lake. However, no residential homes or commercial building are located on the lake. Putters Lake is also located in this section and may act as a surface water source for these water rights. Tests conducted by Washington State University indicate that irrigation withdrawals from near surface water in and around the City of Rock Island can affect both water level and

quality in the lakes (Johnston et al., 1982), although no negative impacts on water level or quality were reported during any of the public meetings.

Information on the use of the lakes by fish and wildlife was obtained through communications with various WDFW personnel and through documents obtained from the Foster Creek Conservation District. Regarding fish usage, warmwater fish (spiny-ray) are present in all four lakes while a cold water (rainbow trout) species has been stocked in the lakes throughout the 1990's. Warmwater species composition has been determined through WDFW surveys and the results of the 2000 survey are summarized in Table 2 below. Although the lakes primarily contain warmwater fish, the WDFW stocked these waterbodies with several thousand rainbow trout (both fingerlings and catchable size) annually from 1990 to 1998. Many of the lakes underwent "rehabilitation" prior to the onset of the trout stocking efforts (WDFW, 2001). Presumably rehabilitation means that non-native warmwater fish such as largemouth bass, bluegill, and yellow perch were removed from the lakes. There are no known native trout species in the lakes. In 1999, channel catfish were stocked in Big Bow Lake to provide an alternative game fish option for anglers. With the exception of Pit Lake, anglers are allowed to fish all of the City of Rock Island Lakes year-round. Fishing at Pit Lake is now limited to children 15 years old or younger.

Regional staff members from the WDFW were interviewed regarding the quality of the lakes fishery. They generally indicated that the fishery was currently "poor" and that some aquatic plant control methods needed to be implemented to improve it (Petersen, Pers. Com., and Viola, Pers. Com). The WDFW also stated that vegetation control measures should be considered for each of the lakes to increase the amount of dissolved oxygen in the water and facilitate the recruitment of larger game fish (WDFW, 2001). Joseph Foster, a member of the LEC who also represents the WDFW, has indicated that these lakes are severely impacted by Eurasian watermilfoil (Foster, Pers. Comm.).

Wildlife and bird/waterfowl use of the lakes was documented as part of a study to determine the effects of building a second powerhouse and subsequent increase in the water level of the Rock Island Reservoir area of the Columbia River (Foster et al., 1984). Table 3 is a list of common mammals and waterfowl species observed in the area. At least 170 bird, 35 mammal, 7 reptile, and 3 amphibian species were documented in the general vicinity of the City of Rock Island in 1984 (Foster et al., 1984).

The Washington Department of Natural Resources Natural Heritage Program maintains a database for rare plant species, and the WDFW has a database for select rare animal species, and high quality wetland and terrestrial ecosystems in Washington. A search of these databases did not reveal any endangered, threatened, or sensitive plant species recorded for the City of Rock Island lakes, nor did it find the presence of any animal species tracked by their system (WDFW, 2003). In 1991 a Golden Eagle nesting site was located on the bluffs on the west side of the

Columbia River. The site is well over a mile away from the City of Rock Island on the opposite side of the river.

Table 2. Warmwater fish species composition summary for the lakes (from WDFW, 2001).

		by Weight		by Number		Size Range (mm)	
Lake	**Fish species**	**kg**	**%**	**No.**	**%**	**Min.**	**Max.**
Big Bow	Bluegill	7.26	62.04	246	94.62	95	169
	Channel catfish	0.69	5.90	2	0.77	216	407
	Largemouth bass	1.62	13.87	8	3.08	120	414
	Largescale sucker	2.02	17.22	1	0.38	565	565
	Pumpkinseed	0.04	0.36	2	0.77	105	107
	Yellow perch	0.07	0.61	1	0.38	188	188
Hideaway	Brown bullhead	57.68	90.49	2,868	97.85	101	132
	Bluegill	2.02	3.17	47	1.60	109	167
	Largemouth bass	3.64	5.71	4	0.14	325	426
	Pumpkinseed	0.40	0.63	12	0.41	99	149
Pit	Largemouth bass	0.02	9.09	1	16.67	122	122
	Pumpkinseed	0.06	35.81	3	50.00	102	109
	Yellow perch	0.10	55.10	2	33.33	165	171
Hammond	Bluegill	1.79	3.65	23	2.40	92	216
	Largemouth bass	14.99	30.68	195	20.33	118	478
	Pumpkinseed	16.28	33.31	370	38.58	94	154
	Rainbow trout	0.12	0.25	1	0.10	246	246
	Yellow perch	15.69	32.11	370	38.58	129	189

Table 3. Mammals, birds, and other species common to the City of Rock Island lakes area.

MAMMALS COMMON TO THE STUDY AREA:

Beaver	Least chipmunk	White tailed deer
Red squirrel	Ermine	Coyote
Muskrat	Yellow pine chipmunk	Striped skunk
Northern flying squirrel	Long-tailed weasel	Snowshoe hare
Mink	Black bear	Washington ground squirrel
	Raccoon	

Also: Bats, Mice, Moles, and Voles

MAMMALS SEEN INFREQUENTLY:

Moose	Mountain lion	Bobcat

OTHER SPECIES SEEN IN STUDY AREA:

Frogs	Turtles	Salamanders
Bullfrogs	Garter snakes	Crawdads
Toads	Rubber boas	

BIRDS COMMON TO THE STUDY AREA:

Great Blue heron	Ruffed grouse	Varied thrush
Canada goose	Spruce grouse	Cedar waxwing
Red-necked grebe	Blue grouse	Western bluebird
Mallard	Pileated woodpecker	Black-billed magpie
Wood duck	Common flicker	Western meadowlark
Canvasback	Red-breasted nuthatch	Winter wren
Green-winged teal	Violet-green swallow	Sparrows
Pintail	Tree swallow	Evening grosbeak
Redhead	Calliope hummingbird	
American coot	Allens hummingbird	
Common goldeneye	Red-winged blackbird	
Bufflehead	American crow	
Osprey	Yellow-headed blackbird	
Red-tailed hawk	American robin	
Coopers hawk	Steller's jay	
American kestrel	Gray jay	
American Bald eagle	Mountain chickadee	
Great horned owl	Black-capped chickadee	
Western gull	Oregon junco	
Killdeer	American goldfinch	
Belted kingfisher		
Common nighthawk		

AQUATIC PLANT CHARACTERIZATION

Survey and Mapping Methods

A survey was conducted on June 2 and 3, 2003 to identify aquatic plant communities in Big Bow, Hideaway, Pit, and Hammond Lakes and document plant coverage (Table 4). Using a small boat and canoe, field technicians completely surveyed the littoral zones of the lakes. The technicians noted the locations and relative densities of the different plant communities in the lakes and recorded the locations of the plant communities on a hard copy map. Additionally, transects were established in several of the lakes using Geographic Positioning Satellite (GPS) equipment. Detailed notes concerning the aquatic plants along these transects were recorded in order to accurately track future changes in the aquatic plant communities. Where possible, water depths were also noted along these transects.

Table 4. List of all submerged and emergent aquatic plants including their relative densities and distribution patterns found during survey conducted on July 1-2, 2003 at City of Rock Island Lakes, Douglas County.

Common Name	Scientific Name	**Big Bow**	**Hideaway**	**Pit**	**Hammond**
Eurasian watermilfoil	*Myriophyllum Spicatum*	4	4	4	4
Native milfoil	*Myriophyllum ssp.*	3	2	-	2
Coontail	*Ceratophyllum Demersum*	-	4	-	4
Sago pondweed	*Potamogeton Pectinatus*	-	3	-	3
Curly leaf pondweed	*Potamogeton Crispus*	-	2	-	2
Water smartweed	*Polygonum Amphibium*	2	2	-	-
Rushes	*Juncus ssp.*	3	3	3	3
Bulrushes	*Scirpus ssp.*	2	3	2	3
Sedges	*Carex ssp.*	2	3	-	3
Purple loosestrife	*Lythrum Salicaria*	2	3	2	3
Cattails	*Typha ssp.*	2	2	2	3
Willows	*Salix ssp.*	2	2	2	2
Cottonwoods	*Populus ssp.*	2	2	2	2

Note: Ecology distribution value definitions as follows: 1 = few plants in only one or a few locations, 2 = few plants, but with a wide patchy distribution, 3 = plants growing in large patches and co-dominant with other plants, 4 = plants in nearly mono-specific patches and dominant, 5 = thick growth covering the substrate at the exclusion of other species.

Data on plant community composition and lake depths was used to create aquatic plant community maps using Geographic Information Systems (GIS) computer software (ArcView 3.3). The GPS data for the reference transects was differentially corrected to sub-meter accuracy, downloaded into the GIS program, and displayed on a georeferenced aerial photograph of the lakes.

The maps simplify the coverage of submerged and emergent aquatic plants in the lakes to major growth zones. Although plant community composition can be unique to any given area of the lakes, the maps depict a reasonably accurate portrayal of the different locations of the plant communities in relation to each other and the shorelines.

Survey Results

Big Bow Lake

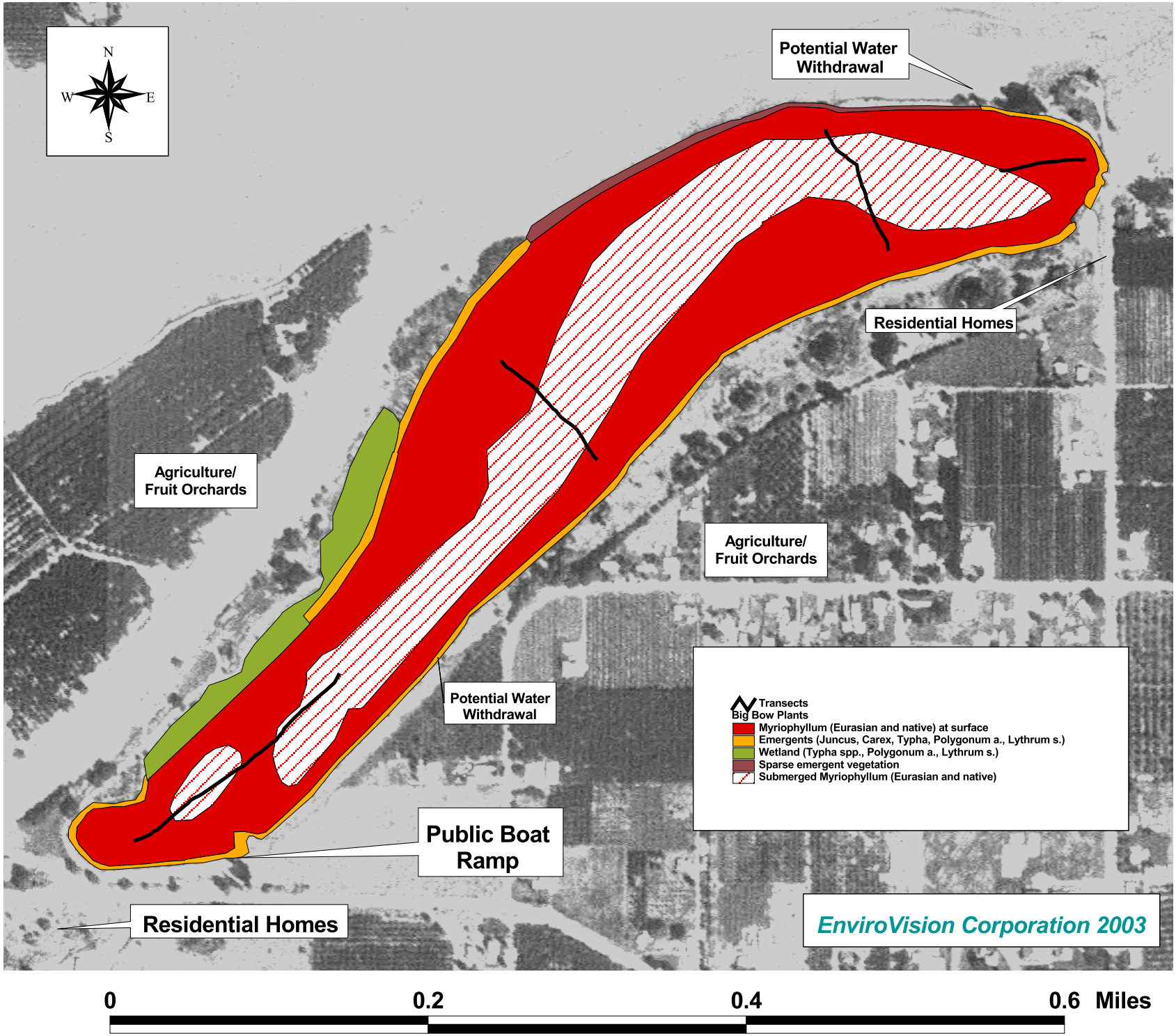
Big Bow Lake is a 49-acre shallow waterbody that has a maximum depth of 15 feet at the western end of the lake. This lake is heavily infested with Eurasian watermilfoil (*Myriophyllum spicatum)* and native milfoil species (Figure 3). Eurasian watermilfoil, a state-listed noxious weed, and the native milfoil plants form a thick stand of plant growth throughout the lake. Because most of the lake is 5-10 feet deep, the Eurasian watermilfoil reached the surface on over 50% of the lake and was flowering at the time of the survey. Although there was open water in the middle of the lake, Eurasian watermilfoil growth was very dense and only a few feet from the surface. The only area of the lake not dominated by submerged aquatic plants was located in the western end of the lake in waters 10-13 feet deep.

Water smartweed (*Polygonum amphibium*), rushes and bulrushes (*Juncus* and *Scirpus spp.*), sedges (*Carex spp.*), and cattails (*Typha spp.*) were growing in co-dominant patches in the nearshore areas (0-2 foot depths) of the lake. Purple loosestrife (*Lythrum salicaria*), another state-listed noxious weed, was also present in the nearshore and shoreline areas of the lake in scattered low-density patches. At the time of this survey some of these plants were beginning to flower. These shoreline emergent aquatic plants formed a relatively narrow band of vegetation approximately 5-30 feet wide between the lake and the surrounding orchards, farm fields, and hills.

A small cattail-dominated wetland was present along the northern shoreline on the western end of the lake. Purple loosestrife and water smartweed were also present in this area, along with willows on the periphery of the wetland.

Four transects were established in this lake; one perpendicular from the shoreline out towards the center of the lake in the eastern end, two others completely across the lake dividing the lake into three approximately equal areas, and a fourth transect perpendicular from the shore out towards the middle in the western end of the lake (Figure 3). Aquatic plant species richness and relative abundance were noted along these transects in the event that future monitoring efforts are undertaken after the implementation of plant control methods.

Figure 3. Big Bow Lake Aquatic Plant Community



Hideaway Lake

Hideaway Lake is a shallow, 18-acre waterbody that has an average estimated depth of 6-8 feet and is not deeper than 15 feet at any point as evidenced by dense growth of macrophytes throughout the entire lake (Figure 4). This heavy growth of submerged macrophytes, along with lack of access for a motorized boat (and therefore electronic depth measuring equipment utilization) was an impediment to more accurate depth estimation. Approximately 60% of the lake had thick patches of Eurasian watermilfoil, coontail (*Ceratophyllum demersum*), and sago pondweed (*Potamogeton pectinatus*) growing to the surface. These areas also had locations where filamentous algae formed thick mats by adhering to the "topped-out" aquatic vegetation. Much of the remaining area of the lake had dense patches of coontail and Eurasian watermilfoil although they were not growing to the surface. Other submerged aquatic plant species present in a patchy distribution at low densities included native milfoil and curly-leaf pondweed (*Potamogeton crispus*).

Three small patches of white water lilies (*Nympaea odorata*) were present in the eastern cove of the lake near the public access and were in flower. These plants had yellow-tinted flowers but exhibited morphological characteristics consistent with white water lilies and were identified as a possible hybrid between white water lilies and another water lily species. For control purposes, white water lilies and their hybrids are listed as noxious weeds in the State of Washington.

As with Big Bow Lake, water smartweed, rushes and bulrushes, sedges, and cattails were growing in co-dominant patches in the nearshore areas (0-2 foot depths). Purple loosestrife was also present along the shoreline of the lake in larger patches and in some areas was the dominant shoreline aquatic plant species. These shoreline emergent plants formed a narrow band of vegetation approximately 5-20 feet wide between the lake and the orchards and hills to the north and the larger habitat conservation area along the southern shoreline.

Two transects were established in this lake; both from the southern to northern shoreline dividing the lake into three approximately equal areas (Figure 4).

Pit Lake

Pit Lake was formerly part of a gravel mining operation and is approximately 4 acres in size with a maximum depth of approximately 70-80 feet. The lack of access for a motorized boat (and therefore the utilization of electronic depth measuring equipment) was an impediment to more accurate depth estimation. Eurasian watermilfoil was the only submerged aquatic plant found in this lake (Figure 5). It was growing to the surface in dense patches in a 10-20 foot band out from the shore, completely ringing the lake. It was evident from the growth pattern of the Eurasian watermilfoil that the lake bottom sloped sharply downward from the shoreline out towards the middle of the lake.

Rushes were the dominant plant along the shoreline, growing in thin bands before transitioning to upland plant species. Purple loosestrife was also relatively abundant, especially along the northern shore to the east of the swimming area. Cattails were also present in a patch in the northwestern part of the lake along the shore.

Figure 4. Hideaway Lake Aquatic Plant Community

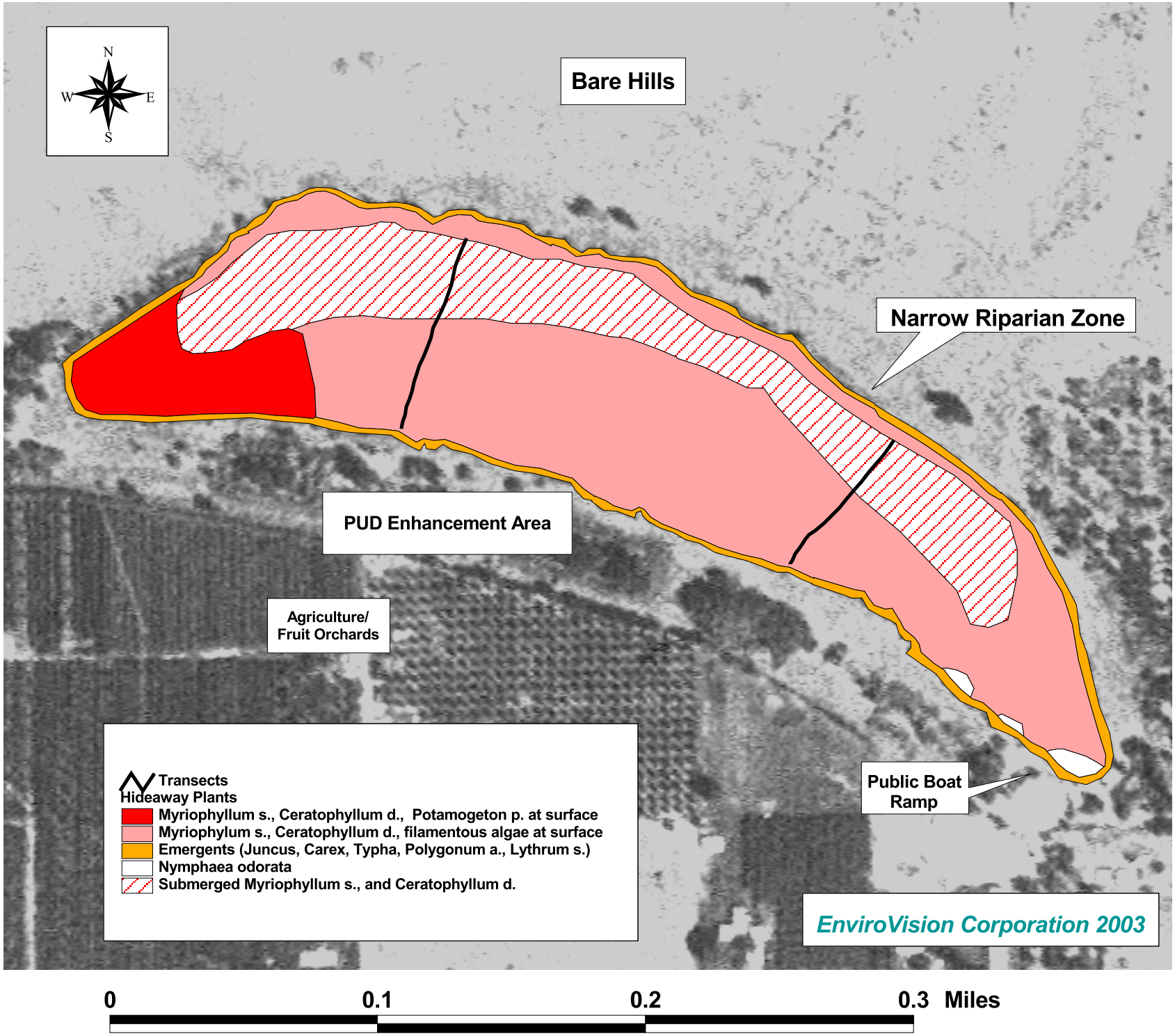
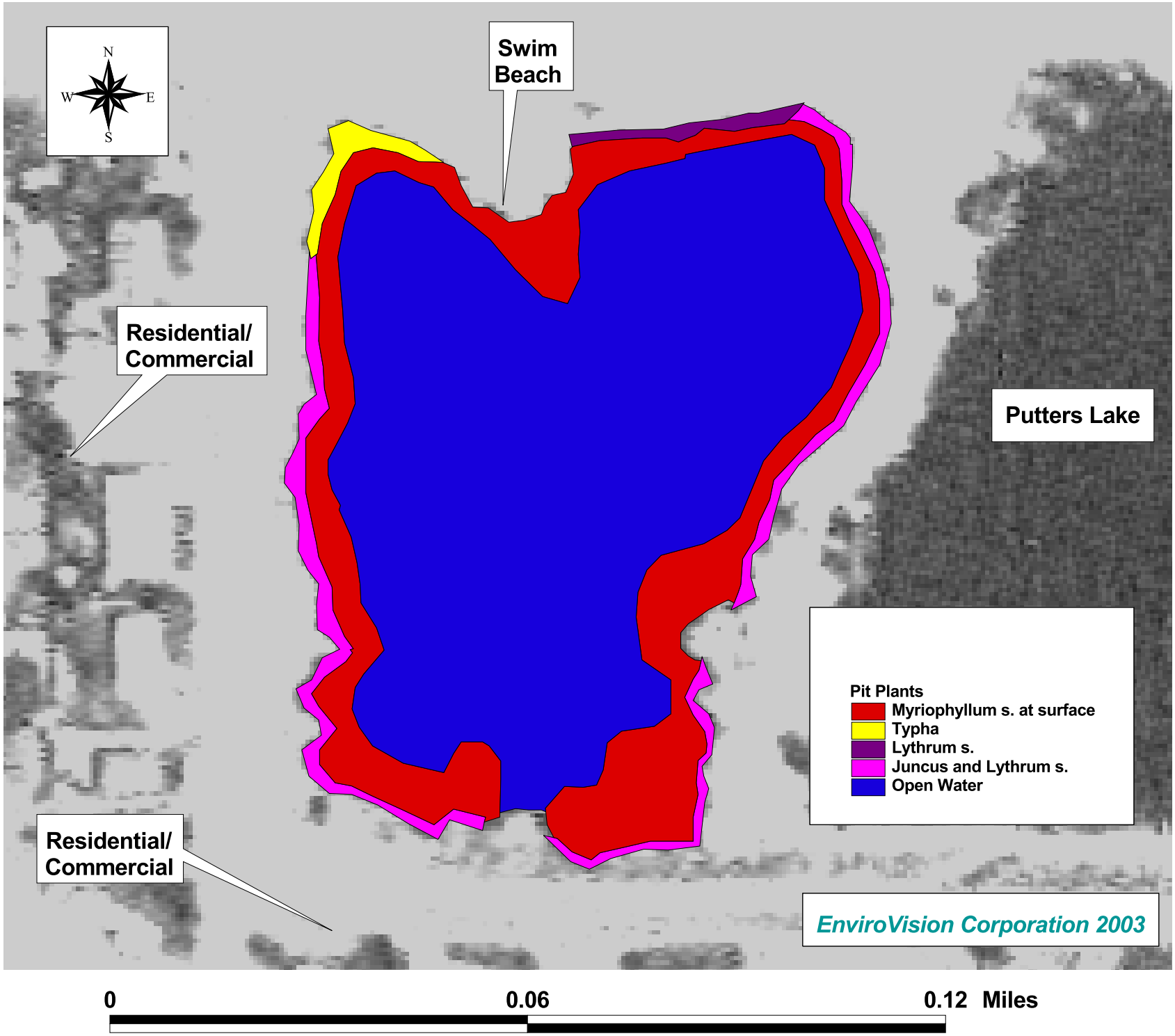


Figure 5. Pit Lake Aquatic Plant Community



No transects were established in this lake due to the lack of boat access for the survey and the lack of aquatic vegetation growing 10-20 feet beyond the shoreline into the lake.

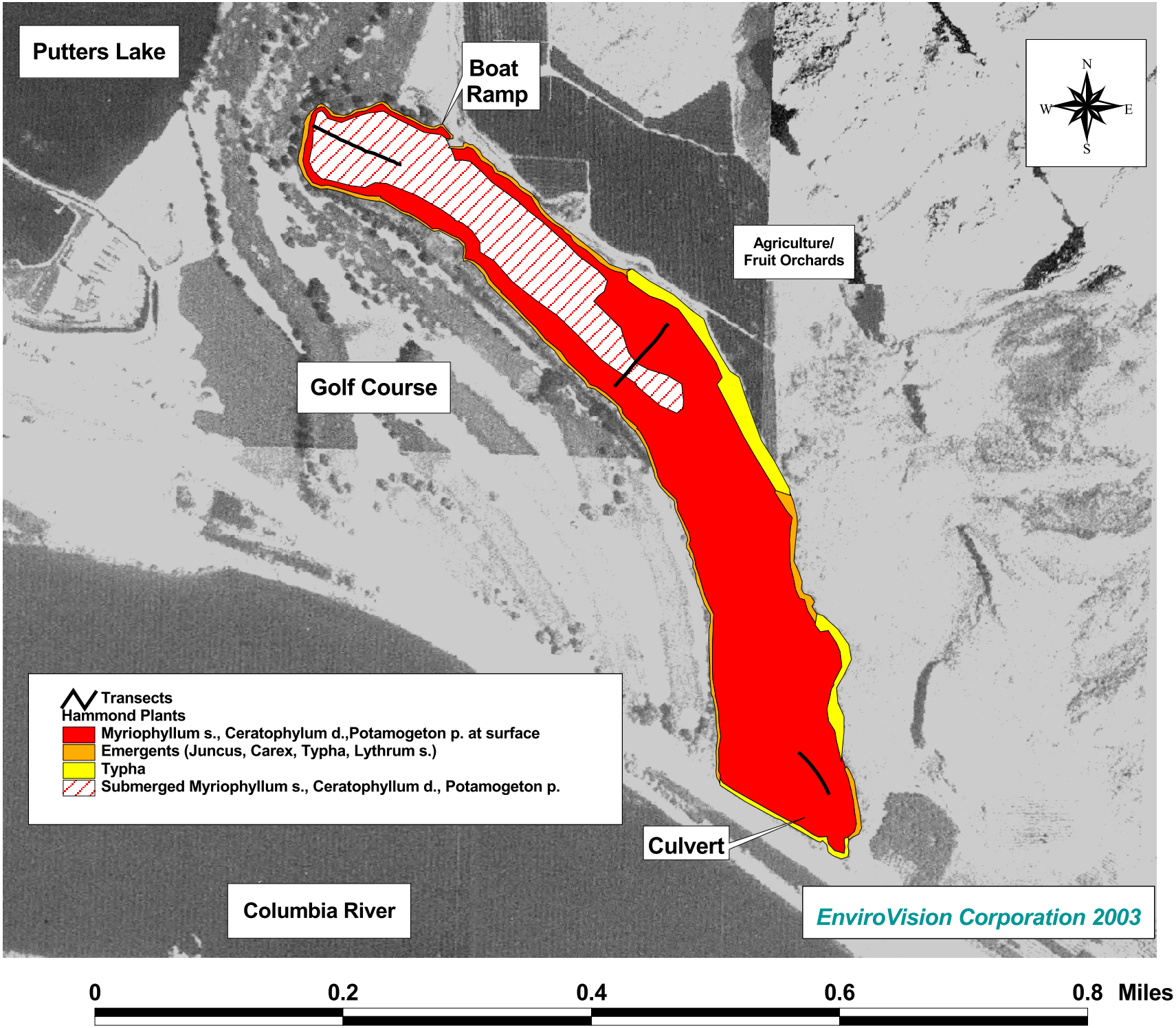
Hammond Lake

Hammond Lake is a shallow waterbody approximately 31 acres in size. The lake has a deeper area of 8-12 feet in the northern end, but is mostly less than 10 feet deep in the remaining areas. Like all of the other lakes surveyed, this waterbody is heavily infested with Eurasian watermilfoil (Figure 6). Eurasian watermilfoil and coontail were "topped-out" and growing in dense patches in a 50-70 foot band along the southern shore and in the whole southern half of the lake. Pondweeds were also interspersed within the milfoil and coontail beds, with sago pondweed growing in larger patches along the western side of the southern shore and curly-leaf pondweed growing in smaller more dispersed patches close to the boat ramp. In some areas of the lake, native milfoil was established in low densities within dense patches of Eurasian watermilfoil. The open water areas of the lake also had dense growth of milfoil, coontail, and sago pondweed although they did not reach the surface.

The dominant plants growing along the shoreline were rushes, sedges, cattails, and purple loosestrife. Larger patches of cattails were present along the southern half of the northern shoreline, while a relatively thin band (5-10 feet) consisting of an even distribution of rushes, sedges, and purple loosestrife was present along the rest of the shoreline.

Three transects were established in this lake; one perpendicular from the shoreline out in the southern end of the lake, another across the lake dividing the lake into two equal halves, and a third perpendicular from the shore out towards the middle in the northern end of the lake (Figure 6).

Figure 6. Hammond Lake Aquatic Plant Community



BENEFICIAL USES

The current beneficial uses of the lakes were identified by members of the Lake Enhancement Committee and area residents. These beneficial uses include:

- Recreational fishing and hunting
- Aesthetics
- Swimming
- Non-motorized boating
- Fish and wildlife habitat
- Venue for radio-control boats (racing)

Swimming, boating, fishing, aesthetics and fish and wildlife habitat are beneficial uses that are important in all areas of the lakes. Fishing is an especially important beneficial use in those areas that are only accessible from the shore. The Rock Island Comprehensive Plan identifies the formation of a trail system for these lakes that would incorporate trails that are currently in place and connect them with the downtown area (City of Rock Island, 1995).

The following beneficial uses for each individual lake were identified by members of the Rock Island Lake Enhancement Committee and lake residents:

Big Bow Lake:
- Fishing
- Boating (no gas-powered boats)
- Hunting
- Fish and wildlife habitat
- Has trail system for viewing wildlife
- Aesthetic appeal
- Water is used for agricultural purposes

Hideaway Lake:
- Fishing
- Boating (no gas-powered boats)
- Fish and wildlife habitat
- Has trail system for viewing wildlife
- Aesthetic appeal
- Used for remote control miniature boat races

Pit Lake:
- Fishing (for children 15 years old or younger only)
- Swimming
- Boating (no gas-powered boats)
- Has trail system for viewing wildlife
- Aesthetic appeal

Hammond Lake:

- Fishing
- Boating (no gas-powered boats)
- Hunting
- Fish and Wildlife habitat
- Has trail system for viewing wildlife
- Aesthetic appeal

MANAGEMENT GOALS

The development of the Problem Statement, the assessment of watershed and lake characteristics and the determination of desired beneficial uses have led to the following management goals for the lakes:

- Reduce and then maintain the nonnative aquatic weeds (primarily Eurasian watermilfoil) at as low a density as is environmentally and economically feasible.
- Seek a balanced approach for treatments, taking into consideration all beneficial uses including the recreational uses and the natural amenities associated with the lakes' environments.
- Develop and begin implementation of an educational plan that will reduce nonnative weed introduction to other lakes.
- Perform routine surveys of lake vegetation.
- Develop and implement a long-term water quality monitoring plan.
- Seek funding mechanisms in order to continue long-term control of invasive aquatic plants.

INTEGRATED TREATMENT ACTION PLAN

Overview

Integrated Aquatic Vegetation Management Plans (IAVMP's) are designed to be lake-specific management plans based on the type of plant problem and the needs of local water users and stakeholders. One of the purposes of an IAVMP is to review all relevant control options and with input from the stakeholders provide both short and long-term solutions to address the problem. An IAVMP is not a one-year management tool; it covers multiple years and is designed to be flexible and should allow for revisions in strategy as conditions in the lake change.

The four lakes considered under this Management Plan are heavily infested with Eurasian watermilfoil. Other lakes in close proximity that are not being considered under this Management Plan are also heavily infested with Eurasian watermilfoil. As a result of these two

factors, the City of Rock Island Lake Enhancement Committee recognizes that long-term eradication of Eurasian watermilfoil in the lakes is unlikely. Therefore, they have decided to focus on Eurasian watermilfoil control efforts rather than eradication.

Using Eurasian watermilfoil control and not eradication as a selection criterion, the lake residents, property owners, and other stakeholders associated with the lakes have reviewed all relevant plant control methods. After weighing the applicability, likely efficacy, and cost-effectiveness of each method, a combination of grass carp stocking and the use of the aquatic herbicides Reward® (active ingredient Diquat) and DMA*4IVM® (active ingredient 2,4-D) was selected as the preferred control strategy. A different combination of these strategies is recommended for each of the four lakes. While all of the four lakes will be stocked with grass carp, two of the four lakes will be treated with an aquatic herbicide. One lake (Big Bow) will be treated with diquat and another (Hideaway) will be treated with 2,4-D. A careful monitoring effort is also recommended to drive lake-specific changes, if necessary. Implementing different strategies in different lakes will also provide an opportunity to compare and evaluate the response of the lake-specific control methods. It is expected that employing this combination of aquatic plant control tools over both the short and long-term, in concert with annual surveys and monitoring, will improve the beneficial uses for all of the lakes.

These lakes also have moderate amounts of purple loosestrife present along their shorelines. The Public Utility District No. 1 of Chelan County (Chelan County PUD) has been active in efforts to reduce the amount of purple loosestrife in and around the lakes since 1998 (Fielder, Pers. Comm.). This work has been accomplished under a NPDES General Permit when herbicide applications were conducted. Treatment has consisted of contracting with a licensed applicator to spray purple loosestrife with glyphosate.

In 1999, the Chelan PUD coordinated with the Chelan County Noxious Weed Control Board in collecting and releasing a biological control agent to target purple loosestrife. These beetles (*Galerucella calmariensis*) were released around the mouth of Rock Island Creek, which is approximately 1/3 mile southeast of Hammond Lake. After four years of observation, there is little evidence that the beetles are impacting purple loosestrife in and around the lakes (Fielder, Pers. Comm.). It is postulated that the beetles have not been able to over-winter, mainly due to (Columbia) river fluctuations. The beetles over-winter in the soils near the river and spring floods may be contributing to their mortality.

Control Intensity

The current aquatic plant problems at the lakes are a consequence of the heavy infestation of the lakes by Eurasian watermilfoil. The littoral zones of these lakes are completely dominated by this noxious aquatic weed. As a result, preventative and high intensity controls are recommended for the short term and preventative and low intensity controls are recommended for the long term. These controls (detailed in the Selected Plant Control Methods section below) are:

• **Short Term (2004 - 2008)**

1. Reward® (active ingredient Diquat) in Big Bow Lake (complete littoral zone of lake to be treated over two-year period)
2. Use of DMA*4IVM® (active ingredient 2,4-D) to reduce the amount of Eurasian watermilfoil in Hideaway Lake in the first year.
3. Grass carp stocking in Big Bow, Hideaway, Pit, and Hammond Lakes at rate of 20 fish per (vegetated) acre
4. Continuation of the purple loosestrife control program through the use of glyphosate and biological control agents.
5. Annual aquatic plant surveys
6. Institute Education/Awareness Program and publish annual brochure/newsletter

• **Long Term (2008 – 2013)**

1. Continue Public Awareness and Involvement Program
2. Continue annual aquatic plant surveys
3. Restocking grass carp and/or additional herbicide applications to control Eurasian watermilfoil
4. Institute and continue a long-term funding mechanism for Eurasian watermilfoil control.

Selected Plant Control Methods

The aquatic plant control plan for the lakes utilizes different combinations of three different control methods: the herbicide diquat (Reward®), the herbicide 2,4-D (DMA*4IVM®), and grass carp. The herbicide glyphosate (Rodeo®) will also be used in combination with a biological control agent (beetle) to control purple loosestrife in the near vicinity of the lakes. Each of these methods is described in some detail in the following paragraphs. This is followed by lake-specific implementation details.

<u>Reward® (active ingredient Diquat)</u>
Diquat is a contact herbicide that after an extensive and complete review by the Department of Ecology (WDOE, 2002b) became available for use in Washington for noxious and nuisance weed control. As with any aquatic plant control efforts using herbicides, employing Diquat as a control method requires a National Pollution Discharge Elimination System (NPDES) permit. This herbicide, applied at a rate of two gallons per surface acre as suggested by the product label, should completely control all aquatic plants above the sediment it comes in contact with. However, 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. Additional treatments in the same season are not identified as part of this Management Plan.

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.

Residents of the City of Rock Island and the Lake Enhancement Committee have expressed concern about the potential contamination of drinking water by using Diquat to control aquatic plants. Although the soils in the Rock Island area have a high porosity, the extremely high capacity of Diquat to bind to sediment makes this scenario very unlikely. Diquat is deactivated rapidly when bound to sediment in lakes, especially if that sediment has a high proportion of clay (EPA, 1995). The sediments in the lakes are mainly comprised of sand, cobble, and gravel, yet retain a layer of fine organic and inorganic materials that act as substrate for aquatic plant growth (WSU, 1982). This layer has the capacity to bind any Diquat that remains after initial treatment and subsequent treatments thereafter.

Because the dense beds of Eurasian watermilfoil tend to inhibit water exchange 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.

Due to the need for the herbicide treatments to be performed by experienced and state- licensed (and insured) personnel, it will be necessary for the Rock Island Lake Enhancement Committee to contract with a licensed herbicide applicator for this work. The process to solicit the services of an applicator should be begun as early in the spring as possible (April or May) so that it can be completed and a contractor Agreement finalized by mid-June. The Rock Island LEC should consider obtaining the assistance of a local agency familiar with the treatment of noxious aquatic plants in reviewing submitted proposals.

There are water use restrictions indicated on the herbicide label that the lake residents, property owners, and lake users must be made aware of. A summary of the water use restrictions (# of days after application until water is safe for a particular use) for Reward® 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). Lastly, the Department of Fish and Wildlife has recently supplied the WDOE with a "Timing Table" that restricts the timing of certain aquatic herbicide applications to protect certain fish species during spawning and early development. See: http://www.ecy.wa.gov/programs/wq/pesticides/final_pesticide_permits/noxious/timingrestrictionslakes032503.doc for details. Although none of the lakes in and around Rock Island are

identified in this Timing Table, the LEC should consult the local WDFW fish biologist before conducting herbicide treatments in lakes.

DMA*4IVM® (active ingredient 2,4-D)
2,4-D is a selective herbicide that targets broadleaf plants while affecting few other aquatic plant species. A study conducted in Loon Lake Washington showed that Eurasian watermilfoil was the only aquatic plant whose growth was statistically reduced by the 2,4-D application (Parsons, et. al, 2001). In the Loon Lake study up to 98 percent of the Eurasian watermilfoil biomass in the treatment plots was removed after the July treatment. More recent Milfoil control (Lake Washington) and eradication (Spring Lake) efforts showed that DMA*4IVM® to target Milfoil was extremely effective. The monitoring results of these two projects can be reviewed at the following web address:
http://www.ecy.wa.gov/programs/wq/pesticides/final_pesticide_permits/noxious/monitoring_data/monitoring_index.html. Environmental and human health impacts of 2,4-D are addressed in Ecology's risk assessment of 2,4-D at the following web address:
http://www.ecy.wa.gov/biblio/0010043.html.

A few days after the 2,4-D treatment, observers will see the growing tips of milfoil plants twist and look abnormal. These plants will sink to the sediments usually within one to two weeks of treatment. Unless treatment takes place in dense beds of milfoil, it is unlikely for low oxygen conditions to develop. For the best results 2,4-D should be applied in the spring while the Milfoil is actively growing and before it becomes overly abundant. Results of spot treatment may be variable depending on water movement, size of treatment plot, density of milfoil, weather conditions, underwater springs, etc.

Sites suitable for treatment include lakes or ponds partially infested with Eurasian watermilfoil such as waterbodies where milfoil has recently invaded, but where the extent of the infestation is beyond what can be removed by hand pulling or bottom screening. In these situations an herbicide, like 2,4-D, that is effective for spot treatment can be used to reduce the amount of milfoil so that hand pulling can remove any milfoil plants that are not killed. 2,4-D is suitable for spot treatment because it is a fast-acting herbicide that only needs a 48-hour contact time with the plant. 2,4-D can be used for milfoil control in heavily infested lakes, but it does not provide the nearly 100 percent kill of the herbicide fluridone. Because many plants remain alive and scattered throughout the littoral zone after 2,4-D treatment, hand pulling extensive areas after treatment may not be effective in heavily infested lakes. Lake residents must be willing to fund the follow-up activities necessary to ensure continued milfoil eradication (e.g. stocking grass carp to provide long-term control of aquatic plants).

Follow-up is essential to ensure the success of the milfoil control or eradication effort. Used alone, 2,4-D is not an eradication tool. Some plants survive the treatment and regrow, so these plants must be removed by other means. Surveys done in Minnesota indicated that, 2,4-D use did not result in eradication of milfoil over the long-term (Crowell, 1999). Treated lakes for which there was no follow up survey work or treatment eventually ended up with milfoil throughout the littoral zone.

There are water use restrictions indicated on the herbicide label that the lake residents, property owners, and lake users must be made aware of. A summary of the water use restrictions (# of days after application until water is safe for a particular use) for 2,4-D when used to treat aquatic plants at a rate of 1.5 gallons per acre-foot is as follows:

- drinking water – 3 to 5 days ([2,4-D] $\leq$ 70 ppb),
- fishing and swimming – 0 days (no restriction),
- irrigation for turf and ornamentals – 3 to 5 days ([2,4-D] $\leq$ 100 ppb),

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). Lastly, the Department of Fish and Wildlife has recently supplied the WDOE with a "Timing Table" that restricts the timing of certain aquatic herbicide applications to protect certain fish species during spawning and early development. See: http://www.ecy.wa.gov/programs/wq/pesticides/final_pesticide_permits/noxious/timingrestrictionslakes032503.doc for details. Although none of the lakes in and around Rock Island are identified in this Timing Table, the LEC should consult the local WDFW fish biologist before conducting herbicide treatments in lakes.

<u>Grass Carp</u>
All of the lakes will also be stocked with grass carp as a long-term strategy to control excessive aquatic plant growth. The stocking rate will be determined by the WDFW through a permitting process. A staff member from the local WDFW office (also a member of the LEC) has reviewed this Management Plan and supports using grass carp as preferred method of aquatic plant control (Foster, Pers. Comm.). It is recommended that grass carp be stocked at a rate of at least 20 fish per acre to achieve measurable results within a reasonable period (approximately 2-3 years after initial stocking). Restocking grass carp at a rate of 7 fish per acre (1/3 the original stocking rate) is recommended approximately five years after the initial stocking to compensate for fish predation and natural mortality. It is advisable (although perhaps not necessary) that a technical memo with an explanation of the suggested grass carp stocking rate be prepared and presented at a meeting with the regional fish biologist from the WDFW. The stocking rate is determined by the WDFW during the permitting process. The regional fish biologist has indicated that he is willing to negotiate the initial stocking rate and will strongly consider the recommendation of this Management Plan (Foster, Pers. Comm.). Making sure that they understand the plant control objectives of the LEC for the lakes will ensure that a stocking rate of at least 20 fish per acre receives consideration.

There is some evidence that Eurasian watermilfoil is not a preferred food source for grass carp, although they will consume it when other submerged aquatic plants are no longer available. In the case of these lakes, plants for which grass carp have a higher preference are either not present or at very low densities. Therefore, it is reasonable to assume that grass carp would primarily forage on the Eurasian watermilfoil.

Grass carp have been shown to control and potentially completely eradicate Eurasian watermilfoil when it is their primary source of food. Due to the failure of repeated herbicide treatments to eradicate Eurasian watermilfoil in a 17-acre lake in Lewis County in the mid-

1990's, grass carp were stocked at a rate of approximately 25 fish per vegetated acre in 1997 (Wamsley, Pers. Comm.). Some grazing of the Eurasian watermilfoil was documented after the stocking effort and in 1999 grass carp were again stocked at a rate of 14 fish per vegetated acre. By 2002 the Eurasian watermilfoil in the lake was completely eradicated or at undetectable levels.

Grass carp generally feed on aquatic plants from the top down and do not disturb lake sediments. However, in instances where they have significantly reduced or eliminated all submerged vegetation, lakes can become more turbid with lower visibility due to re-suspension of sediments. This occurs as a result of the grass carp foraging in the sediments for organic material or through wind stirring up the bottom.

The eradication of all submerged aquatic plants would have direct and indirect impacts on the fish communities in the lakes. Large fish often flourish initially when all submerged plants are removed, as they are able to feed on little fish and insects more effectively. However, as their food source becomes depleted their overall abundance and size becomes diminished. The installation of fish structures may help to ameliorate this problem by providing habitat for fish.

Several permits need to be completed and approved prior to stocking grass carp in the lakes. At a minimum, a grass carp stocking permit and State Environmental Protection Act (SEPA) checklist would need to be filled out for each lake. Completing a SEPA checklist for each lake ensures wider public scrutiny of lake management activities and provides evidence of careful deliberation of the proposed activities in the event of future litigation. A Hydraulic Project Approval (HPA) Permit would be required to install screening material over the concrete culvert connecting Hammond Lake to a small pond on the other side of state road 28. The screen should be constructed of a corrosion resistant material and have openings equal to or less than 1 ¼ inches wide. The City of Rock Island would be responsible for construction and installation of the screen. A WDFW regional fish biologist would then inspect the screen after installation. The costs for completing the permits, fish screen, and working with the WDFW are included in the overall Project Cost.

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

Glyphosate should be applied by experienced and state-licensed (and insured) personnel. Therefore, it will be necessary for the Rock Island Lake Enhancement Committee and/or the Chelan County PUD to contract with a licensed herbicide applicator for this work. The process to solicit the services of an applicator should be begun as early in the spring as possible (April or May) so that it can be completed and a contractor Agreement finalized by mid-June. The Rock

Island LEC should consider obtaining the assistance of a local agency familiar with the treatment of noxious aquatic plants in reviewing submitted proposals.

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.

Purple Loosestrife Biological Controls
In 1992 three beetles were released in Washington. See: http://www.ecy.wa.gov/programs/wq/plants/weeds/aqua009.html for a detailed history. 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.

In 2004, the Chelan PUD will coordinate with the Chelan County Noxious Weed Control Board and make additional releases of *Galerucella calmariensis* into purple loosestrife infestations along Big Bow and Hideaway lakes within the Rock Island Lakes complex (Fielder, Pers. Comm.). It is anticipated that the lesser fluctuations of the water levels in these lakes will allow the beetles to over-winter and survive. The anticipated releases of beetles or other bio-control agents in the future will be coordinated with continuing herbicide (glyphosate) applications to areas of purple loosestrife to continue an integrated weed control program.

Lake-Specific Control Strategy

Big Bow Lake: This 49-acre lake is heavily infested with Eurasian watermilfoil. Due to its shallow nature, the entire lake is available as habitat for submerged aquatic plants, and Eurasian watermilfoil communities have colonized most of that area. This lake at one time was heavily

utilized for fishing, boating, and swimming, and also provided excellent habitat for wildlife. Therefore, the LEC has decided to use the aquatic herbicide Diquat to provide immediate relief from the Eurasian watermilfoil problem, followed by the stocking of grass carp to provide ongoing control of the aquatic plant community.

Half of the littoral zone (24.5 acres) will be treated with Diquat in the spring of 2004, as well as the stocking of grass carp. The 2004 diquat treatment will be focused on the western half of the lake, with the eastern half of the lake to be treated in 2005. Areas such as the public boat ramp should be considered for treatment both years. The treatments should be geared toward providing immediate relief from the Eurasian watermilfoil in those areas used for fishing, boating, and swimming. The herbicide treatment will also allow the grass carp to improve or enhance their effectiveness by removing extensive areas of plant biomass. The grass carp will be able to graze on the remaining vegetation (up to 25 acres) in the lake as well as new plant growth in the treated areas. The remainder of the lake will be treated in the spring of 2005 to again provide immediate relief and to provide the grass carp with the opportunity to forage solely on new plant growth.

Two potential irrigation water withdrawal sites were identified at this lake during the public meeting process. Also, a water rights investigation revealed that there is an active surface water right in the vicinity of Big Bow Lake that has a "swamp" as its source. It is likely that at least one of the potential water withdrawal sites is coincident with this water source. All lake residents and property owners on this lake should be contacted prior to the use of herbicides to ensure that treatments do not conflict with water withdrawal for irrigation.

In the event that the WDFW does not allow grass carp to be stocked at an initial rate of at least 20 fish per vegetated acre, the City of Rock Island may want to consider a whole-lake treatment using 2,4-D in the first year. This contingency plant control method for Big Bow Lake should greatly reduce the amount of Eurasian watermilfoil and allow the LEC to re-evaluate other long-term control methods. This herbicide applied to the entire lake would result in a much greater reduction in plant biomass and may help to compensate for lower stocking rates.

Hideaway Lake: Like Big Bow Lake, this 18-acre waterbody is heavily infested with Eurasian watermilfoil. This lake also is used for remote-control boat racing, fishing, boating, and swimming, and has a habitat enhancement area and trail system along the southern shoreline. The LEC has decided to use the aquatic herbicide 2,4-D on the whole lake (18 acres) to provide immediate relief from the Eurasian watermilfoil, followed by the stocking of grass carp.

No water withdrawals from this lake were identified through the public meeting process. No active surface water rights were identified in this area by the Department of Ecology's Water Rights Tracking System. Therefore, the use of herbicide is not anticipated to interfere with irrigation or drinking water for the lake residents and property owners. This lack of water withdrawals for irrigation was an important factor in choosing 2,4-D as an appropriate herbicide for this lake. 2,4-D concentrations commonly are well below the limit ($\leq$ 100 ppb) five days after treatment. However, it took over 30 days for 2,4-D concentration to drop below the irrigation limit in Spring Lake, WA after treatment in the summer of 2003. See: http://www.ecy.wa.gov/programs/wq/pesticides/final_pesticide_permits/noxious/monitoring_dat

a/spring_lake_24d.html for monitoring results for Spring Lake. Big Bow Lake may have active irrigation water withdrawals. Therefore, as a conservative measure Hideaway Lake was deemed more appropriate for the use of 2,4-D.

Pit Lake: This Lake is 5 acres in size but is quite deep, as it was formed from an old gravel pit operation. The lake is used for swimming and fishing, with fishing limited to children 15 years old or younger. The littoral zone is narrow (10-20 feet from shore) for most of the lake as water depth increases rapidly from shore towards the center of the lake. The littoral zone is completely dominated by Eurasian watermilfoil, which forms a narrow but dense band around the lake. Because the total amount of Eurasian watermilfoil within the lake constitutes a relatively small portion of the total surface area of the water, the LEC has identified grass carp as the only plant control option. Grass carp will be stocked in the summer of 2004 to provide both short and long-term control of the Eurasian watermilfoil.

Hammond Lake: This is a 31-acre shallow waterbody that is completely choked with submerged aquatic plants, especially Eurasian watermilfoil. Like Big Bow and Hideaway lakes, the entire lake is suitable for submerged aquatic plants and at the time of the aquatic plant survey these plants were growing to the water's surface in most areas. Even though this lake is currently used for fishing, boating, and swimming, the LEC has indicated that it may be mined for gravel in the next decade. A gravel mining operation would directly and indirectly control much of the aquatic plants in the lake, reducing the cost-effectiveness of aquatic herbicides. Therefore, the LEC has committed to using grass carp for both short and long-term aquatic plant control, and forgo the use of relatively expensive herbicides. Grass carp will be stocked in this lake in the summer of 2004.

General Considerations and Permitting

Information on all techniques available to manage aquatic plants is presented in Appendix B of this Management Plan. 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, 2001c), and the Department of Ecology's Aquatic Plants and Lakes website: http://www.ecy.wa.gov/programs/wq/plants/management/index.html.

It is important to note that the lake-specific strategies outlined above do not preclude lake residents from any small-scale physical control methods (e.g. raking or cutting) in areas of the lakes adjacent to their properties. Additionally, the LEC may also consider other small-scale control strategies such as the use of bottom barriers in swimming areas, or boat launches to control plants. Information on these small-scale plant control methods are presented in Appendix B.

It is also possible that alternative herbicides may be approved for use in Washington in the future. If new herbicides become available, their effectiveness and feasibility for the lakes should be investigated.

Essentially all aquatic plant control activities require a permit from one or more State agencies. Detailed permitting information for controlling aquatic plants is provided in Appendix C. All manual, mechanical, and physical techniques require issuance of a WDFW Hydraulic Project Approval. Dredging may require a permit from the US Army Corps of Engineers. Permit guidance in the "Aquatic Plants and Fish" pamphlet (WDFW, 1998) was developed in recognition of the importance of controlling aquatic noxious and nuisance weeds, the need to protect the aquatic resource and to facilitate the approval process for HPA projects. Application of chemicals to State waters to control algae or aquatic plants must be covered under a NPDES permit. An NPDES permit has been issued to the Washington Department of Agriculture for control of State-listed noxious weeds and individual treatments must request coverage under this permit.

Monitoring and Evaluation

Annual Plant Survey

Ongoing surveys and monitoring is critical to preventing the rapid expansion of existing Eurasian watermilfoil 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 aquatic plant survey performed in 2003 included the identification of plant species and their relative locations and densities. The survey also included the use of GPS equipment to help document the relative densities and locations of different plant species along transect lines. The general locations of the different aquatic plant communities were incorporated into a Geographic Information System computer program (ArcView 3.3) and aquatic plant community maps were prepared (Figures 3-6). It is recommended that GPS/GIS mapping be performed as a regular component of the annual and long-term surveillance program. Aquatic plant maps and an explanatory report should be prepared and provided to the residents of the City of Rock Island Lakes as part of the Education/Awareness program.

Furthermore, the WDOE strongly recommends that lake groups (through volunteers or a consultant) monitor plant species and area of coverage, before and for several years after stocking grass carp. The WDFW often has made the stocking of grass carp contingent on having a more extensive aquatic plant monitoring plan in place. More detailed aquatic plant monitoring efforts include establishing set transects on the lakes. Using the transect lines as a reference, divers would survey and document the different aquatic plants and their relative densities. The divers would also perform annual plant biomass estimations by using a sampling device of a known size to collect plants. The dry weight of these plants would be determined and would provide a means to compare the impacts of stocking grass carp among different years and lakes. The data collected during this process might provide information useful for obtaining additional grass carp if plant biomass in the lakes has not been reduced a few years after the initial stocking effort

The use of volunteers to survey and monitor aquatic plants is an alternative option to contracting with a consultant. Volunteers who receive training from a consultant may be able to assume responsibility for aquatic plant surveys and monitoring. The main purpose of these surveys

would be to monitor the existing Eurasian watermilfoil populations and to detect any new infestations of other noxious plants. However, the surveys also provide a means for monitoring the native submerged plant communities and determining where future control efforts should be focused. Volunteers would receive extensive training from a contractor upon implementation of this Management Plan. Further training would be provided to volunteers if requested. The volunteers would be receive training in plant identification and survey techniques and each would be given the responsibility for surveying a specific lake or portion of a lake 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 plant species. .

The primary advantage of maintaining low densities of Eurasian watermilfoil in smaller areas is that it reduces the probability that a large area of any one of the lakes would need to be controlled by a more intensive and likely more expensive technique. A drawback of maintaining low densities and small infestations are the annual costs associated with a complete aquatic plant survey. The annual plant survey conducted by professional technicians would take approximately two days and cost $2,500. A more extensive survey in which plant biomass is monitored along set transects would cost and additional $3,000. Although the volunteer survey program should have no long-term cost, a training workshop would be necessary the first year. A volunteer training workshop cost of $1,500 has been included in the cost estimate of this Management Plan.

The exotic plant monitoring and detection efforts compliment the Eurasian watermilfoil control efforts in the lakes. Although volunteers would receive training on exotic aquatic plants, it is more likely than new infestations of noxious plants would be detected through professional surveys. Therefore, it is recommended that professional field technicians perform the annual surveys. The annual surveys would be relied upon to detect an upswing in the Eurasian watermilfoil population and any introduction of new noxious weeds. If Eurasian watermilfoil populations start to increase or other exotic plants are found, immediate action should be taken and another survey should be planned later in the growing season to ensure the effectiveness of whatever control technique is employed. Additional control measures may include; installation of bottom barriers, stocking additional grass carp, or the use of an aquatic herbicide.

Performing an additional survey later in the growing season was not included as a component of this Management Plan but should be considered if new infestations of other noxious plants are detected. However, the costs associated with restocking grass carp and the use of herbicide in years subsequent to initial control efforts was included and may be seen as contingency elements to the overall IAVMP for the lakes. It is likely that additional grass carp will have to be stocked over time as the fish populations are diminished by natural mortality and predation. The use of herbicides in later years is mainly contingent on how effective the grass carp are at controlling aquatic vegetation in the lakes.

<u>Herbicide Monitoring</u>
Beginning in 2003, the NPDES Noxious Weed Permit requires permit holders to monitor herbicide residues. However, in order to minimize the costs of this requirement for privately funded projects, only those projects funded through the Department of 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. A detailed discussion of these requirements and the procedures used to monitor herbicides 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). This Monitoring Plan outlines a procedure to monitor herbicide residues after treatment of Eurasian watermilfoil with diquat or other approved herbicides.

The Department of Agriculture also developed a Group Monitoring Plan for noxious freshwater emergent plant herbicide applications. This Monitoring Plan outlines a procedure to monitor herbicide residues after treatment of purple loosestrife with glyphosate.

Monitoring herbicide residues and impacts on target species is a statewide activity. Data from these efforts is compiled annually, and is used to determine:

- Water herbicide concentrations after treatment using alternative methods of application,
- Water herbicide concentrations after treatment in different locations in Washington,
- Water herbicide concentrations after treating different species of noxious weeds,
- The concentration and transport of herbicides after application,
- The relative herbicide persistence in the water column, and
- Plant species surveys (efficacy of treatment and species diversity after treatment).

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 intervals. 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.

Herbicide sampling should be accomplished by experienced water quality professionals. This may include but is not limited to: the herbicide applicator (note: ideally the person sampling should not be the applicator or use applicator's boat or equipment because of the possibility of sample contamination), a County or State water quality professional, or a private firm with monitoring expertise. It is estimated that herbicide monitoring would cost approximately $3,000 in the years in which herbicide is used at the lakes. This estimate includes time, labor, travel, and analytical costs. In some instances the manufacturers of the herbicides perform the sample analysis for free, in which case the overall cost of herbicide monitoring would be less.

Public Education Program

<u>Invasive Plant Prevention and Detection</u>
The use of aquatic herbicides and grass carp stocking is anticipated to provide both short and long-term control of Eurasian watermilfoil in the lakes. However, this weed eventually could expand to nuisance levels in the lakes without ongoing monitoring efforts. Additionally, other non-native, highly invasive plants could be introduced to the lakes. Examples of these plants include; Parrotfeather (*Myriophyllum aquaticum*), Brazilian elodea (*Egeria densa*), Hydrilla (*Hydrilla verticillata*), Fanwort (*Cabomba caroliniana*), and Water Hyacinth (*Eichhorinia*

crassipes). A primary focus of any lake management plan is implementation of a prevention and detection program to thwart infestation by new non-native plants.

To be effective this prevention and detection program should include both a source control component and a detection program. The objective of the source control is to prevent other non-native submerged plants from entering the lakes. In addition to the threat posed by the already present Eurasian watermilfoil, some of the non-native aquatic weeds mentioned above are present in the Columbia River and other lakes in the area, which are in very close proximity to the lakes in and around the City of Rock Island.

The boat launches represent areas where a high potential for introduction or re-introduction of invasive plants exists. At a minimum, signage should be posted at each boat launch warning about Eurasian watermilfoil and other exotic plants and include instructions on how to clean boats and trailers. The addition of boat and trailer wash facilities is sometimes recommended to facilitate the removal of plant fragments. However, these can be expensive to install since they require a water supply (well and pump), drainage facilities and possibly a holding tank to keep the wash water and associated pollutants (plant fragments, heavy metals, oils, etc.) from entering the lake or stream. These facilities also require continual oversight and maintenance. Furthermore, it is difficult to regulate their use and therefore their effectiveness is questionable.

Residents of the City of Rock Island should also receive informative brochures on an annual basis reminding them of aquatic plant invasion issues and the importance of keeping their own equipment free of plant material. It is also recommended that the residents and property owners institute some sort of public information campaign for opening day of 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.

<u>Lake Stewardship Education</u>
Each lakeside resident or property owner should be educated about how to reduce the amount of pollutants entering the lake from their property, as well as other actions they can take to help retain a complex, diverse, and therefore healthier lake environment. The properties located directly adjacent to the Lakes have the greatest potential for adversely impacting the Lakes since pollutants generated on these properties have direct access to the water and no other defined surface inflows exist for any one of the Lakes.

Lakeside property owners should be provided with information about problems associated with typical urban and rural 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 (BMP's).

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 such as gasoline, paint, fertilizers, pesticides, etc. away from this shore.
- Plant a shoreline buffer of shrubs and tall grasses, preferably native species. This simple action has the potential to cause multiple environmental benefits. If properly designed it will keep geese and other waterfowl from moving onto lawn areas. The vegetation will also 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 areas, or if necessary, clean up only a narrow strip alongside the dock area. If a tree along the shoreline falls in the water, leave it. Add structure in the form of treetops, twig bundles, and rocks to diversity and naturalize the nearshore area and attract more fish and wildlife.
- Allow emergent vegetation, and other plants to colonize some portion of the waterfront area.

Public education and involvement will also center on the annual plant survey. In the spring of each year the City of Rock Island Lake Enhancement Committee should plan a short workshop to describe plant survey results from the past year and the plant control strategy (if any) for that year. During the workshop, a schedule should be agreed upon for volunteer surveys. At this time everyone should be trained or re-trained on plant identification and survey techniques.

Watershed Protection/Pollution Prevention

Over the long term, the quality of the Lakes may be most impacted by development activity in the watershed. Recommendation of watershed protection measures is beyond the scope of this Management Plan. However, lake residents and property owners should be aware of the potential impacts and take a pro-active role to insure protection of their lake. Furthermore, activities with the potential to affect the watershed should be monitored to ensure that appropriate BMP's are being carried out in nearby commercial, residential, and agricultural areas. This should include; tracking where activities are occurring, reviewing permit applications to ensure 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 information is already contained in available brochures, there is little cost in developing the information. A $1,600 per year cost has been included for the development and reproduction of brochures and includes mailing and postage. It is assumed that the first plant workshop would be completed by a professional who can develop a training and survey program. After that the workshops would be put on by lake residents and property owner volunteers. The cost for this first workshop was estimated at $1,600 and included in the Management Plan.

Project Cost

Table 5 provides a summary of each element identified in this Management Plan and the associated costs. Total cost for the first ten-year period is estimated at $144,695 (tax not included), for an average of about $14,470 per year. The majority of the cost occurs during the first year when all the components are implemented simultaneously, some of these (e.g. volunteer training and public education brochures) could be offset to the following to spread out the costs. These costs are based on 2003 cost estimates. Assuming an inflation rate of three to five percent per year, the ten-year cost will range from $188,794 to $224,469.

Implementation of the Rock Island Lakes Integrated Aquatic Vegetation Management Plan is projected to occur over a ten-year period. A combination of grant funding and local revenue (through formation of a lake management district, homeowners or lake association, etc.) is proposed to fund the Management Plan's implementation.

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). The AWMF has a yearly funding cycle for general aquatic weed management projects. 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 aquatic weed management grants 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.

A public body (e.g. a local agency such as Douglas/Chelan County or the City of Rock Island) 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. The percentage of match varies according to project type: General aquatic projects will be funded at 75 percent state share and 25 percent local share. Pilot projects and early infestation projects will be funded at 87.5 percent state share and 12.5 percent local share.

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. Ultimately these projects will

Table 5. Estimated costs for implementation of the City of Rock Island Lakes Integrated Aquatic Vegetation Management Plan[1]

TASK	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10	10-YEAR TOTAL
Reward® (diquat) Herbicide											
Permit	-	-	-	-	-	-	-	-	-	-	-
Notification	$1,000	$1,000	-	-	-	-	-	-	$1,000	$1,000	$4,000
Treatment[2]	$8,575	$8,575	-	-	-	-	-	-	$8,575	$8,575	$34,300
DMA*4IVM® (2,4-D) Herbicide											
Permit	-	-	-	-	-	-	-	-	-	-	-
Notification[3]	-	-	-	-	-	-	-	-	-	-	-
Treatment[4]	$5,400	-	-	-	-	-	-	-	$5,400	-	$10,800
Grass Carp											
Tech. Support & Permit[5]	$5,000	-	-	-	$650	-	-	-	-	$545	$6,195
Fish Screen	$3,000	-	-	-	-	-	-	-	-	-	$3,000
Stocking[6]	$20,500	-	-	-	$7,200	-	-	-	-	$7,200	$34,900
Monitoring & Evaluation											
Comprehensive Surveys[7]	$2,500	$2,500	$2,500	$2,500	$2,500	$2,500	$2,500	$2,500	$2,500	$2,500	$25,000
Herbicide Monitoring[8]	$3,000	$3,000	-	-	-	-	-	-	-	$3,000	$9,000
Volunteer Surveys	$1,500	-	-	-	-	-	-	-	-	-	$1,500
Public Education											
Volunteer Training w/ brochures/newsletter[9]	$1,600	$1,600	$1,600	$1,600	$1,600	$1,600	$1,600	$1,600	$1,600	$1,600	$16,000
TOTAL COST	**$52,075**	**$16,675**	**$4,100**	**$4,100**	**$11,950**	**$4,100**	**$4,100**	**$4,100**	**$19,075**	**$24,420**	**$144,695**

Note 1: Purple loosestrife control is funded by the Chelan County PUD at app. $5,000 per year and is not included in this budget

Note 2: Diquat application to 1/2 littoral zone (24.5 acres at $350 per acre)of Big Bow Lake in years 1, 2, 9, and 10

Note 3: Cost for notification included in Reward herbicide notification

Note 4: Whole lake (18 acres at $300 per acre) 2,4-D application to Hideaway Lake in years 1 and 9

Note 5: Cost associated with working with WDFW, completing HPA and Fish Stocking Permits, SEPA checklist

Note 6: Assumes initial stocking rate of 20 fish per vegetated acre

Note 7: Cost may be as much as $5,000 per year if more extensive monitoring required by WDOE or WDFW

Note 8: Not required if project self-funded. If monitoring required, overall cost may be less depending on analytical costs.

Note 9: Cost for annual public meeting, materials, travel, etc.

fail unless lake groups form some sort of self-taxing district to carry on with monitoring and other long-term efforts.

Long-Term Funding

To-date, no submerged aquatic plant control efforts have taken place at the lakes. However, annual purple loosestrife control efforts have been underway since 1998. Those efforts have included both biocontrols and herbicide applications and have been funded by the Chelan County PUD. It is anticipated that these efforts to control purple loosestrife will continue in the future and funded by the Chelan County PUD and/or the City of Rock Island. Because purple loosestrife grows in and around the lakes and is part of the overall aquatic plant community, it may be possible to obtain additional funds from the Chelan County PUD for other lake management activities.

Few residents live on these lakes and they are primarily used by other outside groups such as fishing and remote-control boat clubs. These groups represent a possible source of long-term funding for lake management activities. They often are experienced in organization fund-raising activities such as raffles and benefits, which could become annual events in the area.

Unfortunately, relatively few funds for exotic plant control are available from the state. What little funding is available from the state is through revenue generated from (http://www.leg.wa.gov/RCW/index.cfm?fuseaction=section&section=46.16.670) boat trailer fees. A few years ago, the state legislature formed a bipartisan Lake Health Committee to look into lake issues, including funding. The conclusion of this committee was that the legislature should make laws that streamline the process for lake groups to form self-funding districts. Although increased funding was discussed, there was no move to develop new state funding sources or to increase existing funds. Unfortunately, it is still up to each lake group to take the initiative to remove exotic plants from their lake, no matter what merit their arguments may have. Listed below are some long-term funding options for lake groups.

Lake Management Districts

The most common method used to fund long-term aquatic weed control efforts is the formation of a local taxing district, often called a "Lake Management District." This allows for lake residents and property owners to develop a method of taxing themselves and other lake users to collect funds for various lake management activities. Information about this can be obtained from the Washington State Legislature RCW 36.61 (http://www.leg.wa.gov/RCW/index.cfm?fuseaction=chapterdigest&chapter=36.61). Lake groups that have formed lake management districts include: Long Lake and Lake Lawrence, Thurston County; Campbell-Erie Lakes, Skagit County; Loon Lake, Stevens County; and Lake Wilderness and Beaver Lake, King County.

Water and Sewer Districts

Water and Sewer Districts are self-taxing districts whose funds can also be used to manage lake problems. Lake groups that have formed water and sewer districts include: Liberty Lake, Spokane County; Clear Lake, Pierce County, and Sacheen Lake, Pend Oreille County.

Homeowners Associations
Some lake groups have homeowners associations that assess themselves for lake management activities. Lake Limerick, Mason County and Surfside Canal, Pacific County are examples of these.

Lake Associations
These typically do not have taxing or assessment functions, but they are the first step in getting organized as a functioning lake group and may have the structure to provide some initial revenue for the project

IMPLEMENTATION STRATEGY

The following is a detailed step-by-step approach to implementation of this plan:

Step 1) Set up a Management Plan Implementation Committee

The first step to implementing the plan is to set up an organization or committee that will oversee its implementation. The lake communities and the City of Rock Island will control how and whether the Management Plan is implemented. Many of the tasks this committee will need to carry out are described under the "plant control advisory committee" section.

Step 2) Secure a Funding Source

Plan implementation for the first year will cost an estimated $52,075, and long-term funding for a full 10-year period is estimated to cost $144,695, or an average of $14,470 per year. The source for this money should be identified and a budget created.

Step 3) Apply for a Plan Implementation Grant

Grants for up to $75,000 are available through the WDOE Aquatic Weeds Program for implementation of approved Integrated Aquatic Vegetation Management Plans. Lake residents and property owners should work with the City of Rock Island and Douglas County to apply for these grant funds. Applications are due in the fall and should be set in motion no later than mid-summer to ensure completion.

Step 4) Apply Aquatic Herbicides and Stock Grass Carp

A request for proposals (RFP) to apply aquatic herbicides and stock grass carp should be prepared for release by April of 2004, allowing two weeks for bidders to respond. The RFP should include preparation of permit applications, notification requirements, herbicide application and grass carp stocking costs. Applying aquatic herbicides and stocking grass carp could also be broken down into separate RFP's at the discretion of the Lake Enhancement Committee.

Step 5) Prepare a Public Education Plan

Meet with Douglas/Chelan County staff and collect available brochures and pamphlets regarding lake stewardship. Solicit professionals to volunteer to make presentations to the community and set up dates for presentations. Also develop an article for each newsletter describing different lake protection issues.

Step 6) Institute a Long-Term Monitoring Program

Develop a list of lake volunteers interested in conducting annual aquatic plant surveys. Develop a plan for training volunteers, performing the surveys, and handling and reviewing information. Contact professional aquatic plant experts for conducting annual surveys.

Step 7) Conduct Annual Surveys and Mapping

A RFP to conduct an aquatic plant survey with maps and a report to follow should be prepared for release by March of 2004, allowing two weeks for responses. The RFP should include conducting an aquatic plant survey, producing maps with results of the survey along with a written narrative of the findings. It is recommended that lake managers consider proposals from professionals that are not directly connected to plant control activities to remove the possibility of any perceived conflict of interest that may arise for lake residents and/or property owners. Herbicide monitoring tasks could also be included in this RFP or the RFP for the herbicide applicator at the discretion of the Lake Enhancement Committee, if necessary.

Step 8) Conduct Annual Evaluation

A complete written annual evaluation that describes what elements of the Management Plan have been implemented, relates the existing plant community to established goals, and makes recommendations for the next years activities.

As implied in Step 8, it is important that there is some mechanism in place for periodic evaluation of this Management 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 plant 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; does an herbicide treatment or the stocking of additional grass carp need to be scheduled? Has there been a dramatic increase in the amount of Eurasian watermilfoil in the Lakes? 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.

SUMMARY AND CONCLUSIONS

The City of Rock Island Lakes are heavily infested with Eurasian watermilfoil, which is greatly reducing beneficial uses such as fishing, swimming, boating, and overall aesthetics. Without some sort of action plan the Eurasian watermilfoil will continue to hinder these beneficial uses. This report details a plan for the long-term control Eurasian watermilfoil in these lakes through a combination of grass carp and aquatic herbicides. Using alternative strategies in different lakes will provide an opportunity to compare and evaluate the response or success of the lake-specific control methods employed. Implementation of this plan is estimated to cost a maximum of $144,695 over ten years or a maximum average of $14,470 per year.

The density of Eurasian watermilfoil and potential invasion of other nonnative plants in the lakes will be closely monitored through annual aquatic plant surveys. This Management Plan is a flexible document and allows for changes in control strategy in the event that Eurasian watermilfoil is not reduced to acceptable levels and/or other nonnative plants become established in the lakes. 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 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.

REFERENCES

Bonar, S., B. Bolding, and M. Divens. 1996. Management of Aquatic Plants in Washington State Using Grass Carp: Effects on Aquatic Plants, Water Quality and Public Satisfaction 1990-1995. Research Report No. IF96-05, Washington Department of Fish and Wildlife, Olympia, WA.

City of Rock Island. 1995. Rock Island Urban Area Comprehensive Plan, 1995-2015. Rock Island, WA.

Crowell, W.J. 1999. *Minnesota DNR tests the use of 2,4-D in managing Eurasian watermilfoil*. Aquatic Nuisance Species Digest. 3(4):42-46.

EPA. 1995. Reregistration Eligibility Decision (RED): Diquat Dibromide. United States Environmental Protection Agency, Washington, D.C.

Evenhus, Whitey. 2002. Personal Communication. Mayor of Rock Island. Rock Island, WA.

Fielder, Paul. 2003. Personal Communication. Chelan County Public Utility District No.1.

Foster, Joseph, H., P.C. Fielder, D.R. Eldred, and R.L. Perleberg. 1984. Post-Flood Wildlife Inventory *for the* Rock Island Hydroelectric Project. City of Rock Island, WA.

Foster, Joseph H. 2003. Personal Communication. WDFW Regional Fisheries Manager. Ephrata, WA.

Hamel, Kathy. 2003. Personal Communication. WDOE Aquatic Vegetation Management Program. Olympia, WA.

Lamb, David. 2002. Integrated Aquatic Vegetation Management Plan for Sacheen Lake. Pend Oreille County, WA.

Pacific Groundwater Group, Montgomery Water Group, and R2 Resource Consultants. WRIA 44/50 Phase 2 Technical Assessment. Seattle, WA.

Peterson, Marc R. 2003. Personal Communication. WDFW Regional Fisheries Manager. Ephrata, WA.

Parsons, Jenifer K.; K.S. Hamel, J.D. Madsen and K.D. Getsinger. 2001. *The Use of 2,4-D for Selective Control of An Early Infestation of Eurasian Watermilfoil in Loon Lake, Washington*. J. Aquat. Plant Manage. 39:117-125.

RH2. 2002. City of Rock Island Sewerage Feasibility Report. East Wenatchee, WA.

SePRO Corporation. 2002. Product labels for Sonar AS®, SRP®, PR®, and Q® Aquatic Herbicides. Carmel, IN.

Tamayo, M., C.W. O'Brien, R.P. Creed, C.E. Grue, and K. Hamel. 1999. *Distribution and classification of aquatic weevils (Coleoptera: Curculionidae) in the genus Euhrychiopsis in Washington State.* Entomology News 110:103-112.

Viola, Art. 2003. Personal Communication. WDFW Fish Biologist. Ephrata, WA.

Wamsley, Bill. 2003. Personal Communication. Lewis County Noxious Weed Board. Chehalis, WA.

Washington Department of Ecology (WDOE). 1994. A Citizen's manual for Developing Integrated Aquatic Plant Management Plans. Publication 93-93. Water Quality Financial Assistance Program. Olympia, WA.

Washington Department of Ecology (WDOE). 2001. Final Supplemental Environmental Impact Statement Assessment of Aquatic Herbicides. Publication No's 00-10-040 through 00-10-045. Olympia, WA.

Washington Department of Ecology (WDOE). 2002a. Washington's Water Quality Management Plan to Control Nonpoint Source Pollution Final – April, 2002. Publication No. 99-26. Olympia, WA.

Washington Department of Ecology (WDOE). 2002b. Final Risk Assessment for Diquat Bromide. Publication No. 00-10-046. Olympia, WA.

Washington Department of Ecology (WDOE). 2002c. Final Supplemental Environmental Impact Statement Assessment for Diquat. Publication No. 00-10- 052. Olympia, WA.

Washington Department of Ecology (WDOE). 2003. Minor Permit Modification for Permit No. WAG-994000, Aquatic Nuisance Plant and Algae Control NPDES General Permit; and Permit No. WAG-993000, Aquatic Noxious Weed Control NPDES General Permit regarding Conditions for use of Diquat. Olympia, WA.

Washington Department of Fish and Wildlife (WDFW). 1990. Grass Carp use in Washington. Fisheries Management Division Publication 90-4. Olympia, WA.

Washington Department of Fish and Wildlife (WDFW). 1998. Aquatic Plants and Fish. Publication APF-1-98. Olympia, WA.

Washington Department of Fish and Wildlife (WDFW). 2001. 2000 Warmwater Fisheries Survey of Rock Island Ponds, Douglas County, Washington – Draft. Ephrata, WA.

Washington Department of Fish and Wildlife (WDFW). 2003. Habitats and Species Report in the Vicinity of T22R21E, Section 25.

Washington State University (WSU). 1982. Pre & Post Flood Water Quality Investigation, Rock Island, WA. Pullman, WA.

Washington State University (WSU). 1974. Preliminary Report on Water Quality of Rock Island Area. Publication Report # 74/15-80. Pullman, WA.

Zeneca Professional Products. 1997. Product label for Reward® Landscape and Aquatic Herbicide. Wilmington, DE.

APPENDIX A

LAKE ENHANCEMENT COMMITTEE MEMBERS AND PUBLIC MEETING MINUTES AND NOTES

LAKE ENHANCEMENT COMMITTEE

Joe Foster 1550 Alder St. NW Ephrata, WA 98823	(509) 754-4624 fostejhf@dfw.wa.gov	Dept. Fish & Wildlife
*Linda Remington 327 N. Wenatchee Ave. Wenatchee, WA 98801	(509) 663-8121 ext. 4235 lindar@chelanpud.org	Chelan Co. PUD
*Ray Hyatt 327 N. Wenatchee Ave. Wenatchee, WA 98801	(509) 663-8121 rayh@chelanpud.org	Chelan Co. PUD
Ron Draggoo 636 Valley Mall Pkwy #204 East Wenatchee, WA 98802	(509) 886-0899 rdraggoo@co.douglas.wa.us	Do. Co. Solid Waste
Dane Keane PO Box 747 Waterville, WA 98858	(509) 884-9444 dprewitt@co.douglas.wa.us	Douglas County
Charlie Mason PO Box 97 Rock Island, WA 98850	(509) 884-2114 pixie@wenval.com	Public (by request)
Mark Kulaas 470 9th St. NE East Wenatchee, WA 98802	(509) 884-1511 mkulaas@co.douglas.wa.us	Trans. & Land Services
Joel Bender 255 N. Georgia East Wenatchee, WA 98802	(509) 884-8015 jbender@ersaparks.com	Parks Dept. (ERSA)
Whitey Evenhus PO Box 161 Rock Island, WA 98850	(509) 884-1261	City of Rock Island
Don Moos 1523 Country Club Dr. East Wenatchee, WA 98802	(509) 884-1266 (509) 884-3447 fax	Public (by request)
Ray Pearson PO Box 187 Rock Island, WA 98850	(509) 884-6131	Public (by request)

CITY OF
ROCK ISLAND

5 N. Garden Avenue • PO Box 99 • Rock Island, WA 98850
(509) 884-1261 • fax (509) 886-0569 • rockisl@gte.net

LAKE ENHANCEMENT MEETING

WHEN: Friday, June 7, 2002

TIME: 1:30 PM

LOCATION: 636 Valley Mall Parkway, Suite 204
Solid Waste Conference Room

ITEMS TO DISCUSS:

- ☐ Aquatic Weed Management Plan Grant
- ☐ Parking Areas and Boat Launches
- ☐ Mesquitoes

Please call Rock Island City Hall if you are unable to attend.

Thank you,

Kay Jones, CMC
City Clerk-Treasurer

ROCK ISLAND AQUATIC WEED GRANT STEERING COMMITTEE

Joe Foster 1550 Alder St. NW Ephrata, WA 98823	(509) 754-4624	Dept. Fish & Wildlife
Paul Fielder 327 N. Wenatchee Ave. Wenatchee, WA 98801	(509) 663-8121	Chelan Co. PUD
Jim Latimer 801 Etta St. NE East Wenatchee, WA 98802	(509) 884-4414 (509) 663-4467 wk.	Director / Apple Blossom Regatta
Ron Dragoo 636 Valley Mall Pkwy #204 East Wenatchee, WA 98802	(509) 886-0899	Do. Co. Solid Waste
Dane Keane Douglas County Commissioner PO Box 747 Waterville, WA 98858	(509) 884-9444	Douglas County
Don Moos 1523 Country Club Dr. East Wenatchee, WA 98802	(509) 884-1266	Public (by request)
Whitey Evenhus PO Box 161 Rock Island, WA 98850	(509) 884-1261	City of Rock Island
Chris McCart 470 9th St. NE East Wenatchee, WA 98802	(509) 884-1511	Trans. & Land Services
Ken Stanton Douglas County Commissioner PO Box 747 Waterville, WA 98858	(509) 884-9444	Douglas County Eastmont Recreation Service Area
Rob Kennedy PO Box 394 Rock Island, WA 98850	509-884-2942	Land Owner
Myla Kennedy PO Box 375 Rock Island, WA 98850	509-884-2019	Land Owner

As-of 10-14-02

Don Barth PO Box 85 Pateros, WA 98846	509-923-2211 cell 322-3472 altalakegolf@yahoo.com	Rock Island Golf Course
Jeff Keane 14 S Garden Ave. Rock Island, WA 98850	509-884-4356	Land Owner
Gary Downes 1580 Ohio St. Rock Island, WA 98850	509-884-4216	Land Owner
Fred Walk 5083 State Hwy 28 Rock Island, WA 98850	509-886-4487	Land Owner
Bob Rose Dept. of Fisheries, Yakama Indian Nation PO Box 151 Toppenish, WA 98948	509-865-5121	Yakama Nation
Joseph Pakootas Chairman of the Colville Confederated Tribes Business Council PO Box 150 Nespelem, WA 99155	888-881-7684	Colville Confederated Tribes
Gary Passmore Manager, Environmental Trust PO Box 150 Nespelem, WA 99155	888-881-7684	Colville Confederated Tribes
Joe Peone Fish & Wildlife PO Box 150 Nespelem, WA 99155	888-881-7684	Colville Confederated Tribes
Adeline Fredine History & Archeology PO Box 150 Nespelem, WA 99155	888-881-7684	Colville Confederated Tribes
Ray Lathum 15 West Yakima Yakima, WA 98902	509-575-2807 rlat461@ecy.wa.gov	Dept. of Ecology

As-of 10-14-02

Rock Island Steering Committee Meeting
Aquatic Weed Management Plan
Agenda

August 30, 2002

1:00pm - Rock Island City Hall

- Introductions
- Explain Purpose and Process
- Draft problem statement
- Review RFP and Scope of Work
- Schedule for Public Participation
- Review Public Announcement
- Set publication date and deadline for RFP
- Questions or Comments
- Adjournment

- get copy of similar, good plan from Kathy

PSA on 19th review

9/16/02 - letter to property owners - Post at City Hall & Post Office

9/13/02 - Draft Problem Statement & management goals to Committee

9/18/02 - Compile Proposals

9/19/02 - Steering Committee

- Review PSA, PS & MG, agenda for Public Meeting, mailing list

LAKE ENHANCEMENT MEETING

Rock Island City Hall
August 30, 2002 at 1:30 p.m.

PLEASE SIGN IN	PRINT NAME
1. Myla Kennedy	1. MYLA KENNEDY
2. Bill McGuire	2. BILL McGUIRE
3. Ron Draggoo	3. RON DRAGGOO
4. Lou Moos	4.
5. Fred Walk	5. FRED WALK
6. Jeff Keane	6. JEFF KEANE
7. Rob K	7. ROB KENNEDY
8. Joseph J Smith	8.
9.	9.
10.	10.
11.	11.
12.	12.
13.	13.
14.	14.
15.	15.
16.	16.
17.	17.
18.	18.
19.	19.
20.	20.

Rock Island Steering Committee Meeting
Aquatic Weed Management Plan
Agenda

September 18, 2002

7:30pm – Rock Island City Hall

- Introductions
- Review Draft Problem Statement
- Review Draft Management Goals
- Review Public Announcement
- Review Consultant Proposals
- Questions or Comments
- Adjournment

Rock Island Steering Committee Meeting
Aquatic Weed Management Plan
Agenda

September 30, 2002

7:30pm – Rock Island City Hall

- Introductions
- Describe the Purpose of Meeting
- Explain the Planning Process
- Identify Each Person's Ideas, Opinions and Issues
- Identify the Community Benefits from the Process
- Describe the Next Steps
- Questions or Comments
- Adjournment

Rock Island Steering Committee Meeting
Aquatic Weed Management Plan
Agenda

February 24, 2003

6:00 pm – Rock Island City Hall

- Review Schedule, Expectations and Process
  - Discuss when the contract was signed, changes to the contract (i.e. plant mapping), and why the process has been purposely "delayed"
  - Who is doing what part of this work
  - Who is point of contact for questions and etc.

- Review Aquatic Plant Management Plan Elements

- Identify Beneficial Uses by Lake & Map Uses
  - Do lake by lake listing of primary beneficial uses
  - Locate areas on each lake where that use occurs if appropriate
  - Discuss how and why the uses are being affected

- Describe Available Control Strategies

- Questions or Comments

- Schedule Next Meeting

- Adjournment

Committee Members

FORM F: RECORD OF MEETING ATTENDANCE

Agreement No: _____ Recipient: _____ Payment Request _____ Page _____ of _____

Purpose of Meeting: 1st Public Meeting - Aquatic Plant Management Plan Date of Meeting: 2/24/03

Name (please print)	Representing	No. of Hours at Meeting	Signature (required)
Rob Stutler	Chelan County PUD	2.5	Rob Stutler
MYA KENNEDY	Land Owner	2.5	Myra Kennedy
Bill McGUIRE	Land Owner	2.5	Bill McGuire
Don Macros	Fly fishing club	2	[illegible]
Whitey Evenhus	City of Rock Island	2.5	Whitey Evenhus

ELEMENT NUMBER _____ TOTAL VOLUNTEER HOURS: _____ X $12.50 = $ _____

Enter the value computed in the lower right hand box on Form C1 for the appropriate element.

ECY 060-13 (10/00)

Ecology is an Equal Opportunity and Affirmative Action Employer.

PAGE 05 ALLIANCE CONSULTING 5098869255 03 11:16

Public Attendees

CITY OF ROCK ISLAND

~~COUNCIL MEETING~~ Aquatic Plant Management Pla
~~February 27, 2003~~ 1st Public Meeting
~~7:00 pm.~~ February 24, 2003
6:00 pm

PLEASE SIGN IN	PRINT NAME
1. Gloria Matherin	1. Gloria Matherla
2. [illegible]	2. Kevin McKinley 5449 Riverside Rock Island, Wa 98660
3. Ray Pearson	3. Ray Pearson
4. Charlotte Evenhus	4. Charlotte Evenhus
5. Jolene Gosselin	5. Jolene Gosselin
6.	6. Angela Larson
7. ~~Gwen Funner~~	7. ~~G~~ Mike Funner (~~[illegible]~~)
8.	8. (Husband)
9.	9. (wife)
10. Gwen Funner	10. Gwen Funner
11.	11.
12.	12.
13.	13.
14.	14.
15.	15.
16.	16.
17.	17.
18.	18.
19.	19.
20.	20.

IMPORTANT!! **IMPORTANT!!** **IMPORTANT!!**

Dear Property Owners and Interested Citizens!

We have completed the survey of the lakes and are ready to review the results. As you may recall, the City of Rock Island has received an Aquatic Weed Management Grant from the Department of Ecology to develop a plan for how to eradicate and/or manage the milfoil and other non-native plants in some of the lakes, i.e. Big Bow, Hammond, Hideaway and Pit. The success of this project depends largely on early, active and continuous participation by property owners and residents living adjacent to the lakes, as well as participation from the general public who use and enjoy the benefits of the lakes. To guide the development of the plan, the City has established a Steering Committee made up of property owners, local governments, interested State and Federal agencies and Native American Tribes.

It is now time to begin looking at what is in/at the lakes and how to manage them. The Steering committee will be holding their third **PUBLIC MEETING on Thursday August 7, 2003 in the Rock Island Council Chambers at 6:00 pm**. The topics at this meeting will include the following items:

- Review the Survey Results
- Review the Control Strategy (as discussed at previous meetings)
- Review the Cost Estimate for Managing Lakes
- How to Implement the Strategy

We invite you to attend this important meeting and encourage you to share your thoughts on the issue of non-native aquatic weeds in the Rock Island Lakes. We would also ask that you please forward this invitation to your neighbors and friends who may not have received this notice directly.

We hope to see you there!

PUBLIC MEETING!! **PUBLIC MEETING!!** **PUBLIC MEETING!!**

August 7, 2003
6:00pm

R.I. Aquatic Weeds
Public Meeting

Name	Address
Kris Hansen, ACG	720 Valley Mall Pkwy
[illegible]	City of Rock Island
Roy Pearson	PO Box 18 Rock Island
Don Moon	
Mark Lundy	Bogart's Rock Island
Bill McGuire	" "
Angela	

COUNTYWIDE SOLID WASTE PROGRAMS
of Douglas County
140 19th Street N.W., Suite B • East Wenatchee, WA 98802
(509) 886-0899 • (509) 884-5350

October 20th, 2003

City of Rock Island
c/o: Whitey Evenhus, Mayor
5 North Garden Avenue
Rock Island, WA. 98850

The Honorable Mayor Evenhus,

I have completed my review of the City of Rock Island "Draft" *Integrated Vegetation Management Plan* and would make the following comments.

First in all of our discussions it has been consistently stated that Hideaway Lake was to be utilized not as a fishery but as a recreation resource, primarily for the use of the radio controlled boats. The "draft" plan lists Big Bow as the identified lake with the radio controlled boats while no mention has been made concerning Hideaway. It was my belief that Big Bow and Hammond were to be identified as fisheries, Pit was to be identified as a juvenile fishery and Hideaway as a recreation resource, with appropriate control measures being taken to fit the identified use. If this is true and the City's desire is to allow the radio controlled boaters the right to develop this lake for their use, it is not unreasonable that they could also be responsible for the cost of the application of the aquatic herbicide necessary to control the aquatic vegetation. With this possibly being the case, it would seem that the application of 2,4-D as the aquatic herbicide would allow the City another control method to determine its effectiveness along with the application of Diquat and grass carp.

Second is a question. Has any thought been given to what will happen to the die off of the aquatic weeds once they have been treated? Are they going to rise up to the lake surface and be pushed down lake as they currently are or will they settle to the bottom of the lakes? Has any thought been given to having the PUD bring in their harvester prior to the application of the aquatic herbicide and remove the majority of the aquatic growth from the lakes? I would think that this would make the application of the aquatic herbicide more effective, as the herbicide would then be absorbed directly onto the surviving plant stems rather then the majority of growth. Also, with the removal of the aquatic growth, the grass carp would feed on the newly sprouting growth thus keeping the aquatic plant growth to a minimum. Just a thought.

This recycled paper is recyclable

Other than these comments I found the plan to be well written and very informative. I think that Envirovision Corporation has done a good job of identifying the concerns of the Lake Enhancement Committee and put together a realistic and do-able plan. Lets hope that with a minimum amount of changes the plan will be acceptable to the Washington State Department of Ecology and the Washington Department of Fish and Wildlife. Lets hope that once the plan has been approved, the City will be able to obtain financial support from the Chelan County P.U.D and the Douglas County Board of Commissioners so that the City can begin to develop this local recreational resource. Also, lets hope that the ERSA will see the benefit of such a local recreational resource and become more actively involved in the recreational development of the area.

I hope that these comments will be helpful to the City of Rock Island and will further it's desire to improve the lakes identified within the City of Rock Island "Draft" *Integrated Vegetation Management Plan*. If you have any questions concerning the comments made or wish clarification on any of the points I have made I can be reached at (509) 886-0899.

Professionally,

Ron Draggoo

Ron Draggoo
Solid Waste Program Administrator

APPENDIX B

SUMMARY OF PLANT CONTROL TECHNIQUES

PLANT CONTROL TECHNIQUES

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, 2001c), the King County Regional Milfoil Plan:
http://dnr.metrokc.gov/wlr/waterres/smlakes/kcmilfoilplan.pdf, and the Department of Ecology's Aquatic Plants and Lakes website:
http://www.ecy.wa.gov/programs/wq/plants/management/index.html.

PHYSICAL/MECHANICAL METHODS

Mechanical Harvesting

Harvesting is a way to mechanically remove milfoil in order to provide open areas of water for recreational activities and navigation. Harvesting immediately removes surfacing milfoil mats, but since the cut plants grow back (sometimes within weeks), the same area may need to be harvested twice or more per growing season. Harvesting machines (harvesters) are specialized underwater mowing machines specifically designed to cut and collect aquatic plants. Cut plants are immediately removed from the water via a conveyer belt. The cut plants are stored on the machine until they can be off-loaded and disposed of properly. Several manufacturers sell various sizes and models of machine, and there are firms that contract for harvesting operations. More information about harvesting is available at the following web address:
http://www.ecy.wa.gov/programs/wq/plants/management/aqua026.html

Waterbodies suitable for harvesting programs:
Waterbodies suitable for harvesting programs include larger lakes (about 100 acres or more), and rivers with widespread, well-established milfoil populations, where milfoil eradication is not an option. Since on-going harvesting operations are expensive, having a large lake association, residential community, or a motivated local government to share the harvesting costs is crucial.

Special considerations:
Harvesting is not recommended in waterbodies with early infestations of milfoil since the resulting fragments are never completely contained and harvesting may increase the spread of milfoil throughout the waterbody. Because harvesting is a whole-lake activity it should be conducted under the direction of an integrated aquatic vegetation management lake plan. Factors to consider when designing a harvesting program include:

- Lake surface area, width, and depth;
- Vegetated acres;
- Bottom contours and bottom obstructions such as stumps, rocks, other debris;
- Traffic patterns,
- Prevailing winds;
- Harvester launching and off-loading sites;
- Shoreline development; and
- Sensitive areas (critical habitat).

A reliable funding source, such as a Lake Management District or a committed local government, is necessary to provide funding either to purchase and operate a harvester or to contract for harvesting on an annual basis. In at least one jurisdiction (Skagit County, Washington), the County trained volunteers to operate the County-owned harvester to remove milfoil on local lakes. However, liability may become an issue with volunteers using harvesters since harvesting machines have been known to capsize when improperly filled or overloaded.

A lake committee and/or local government staff identifies acreages and areas to be harvested within the lake. Priorities may be determined by who funds the program. For example, a local government will be more interested in harvesting public areas, whereas the lake group may be interested in harvesting the areas in front their homes. In general, high use areas such as public parks, community access points, navigation channels, public boat launches, and water ski lanes receive priority for clearing. Because harvesters are large machines and are difficult to maneuver near-shore between and around docks, in at least one harvesting program (Long Lake, Thurston County), harvesting was limited to areas outside of the docks. Individual homeowners, at their discretion, were considered responsible for removing plants growing between the end of the dock and their shoreline.

Prior to harvesting, machinery launch sites (a paved ramp with deep water is best), and plant disposal off-loading sites need to be identified. A summer harvesting schedule must be developed. If harvesting services are contracted, bid documents and a contract need to be prepared.

Description of a harvesting project:
Harvesting starts when plants have neared or approached the water surface. The harvester's cutting head is lowered into the water and the harvester moves forward, cutting and collecting plants as it advances. Harvesters vary in size and capability. Most cut plants about five feet below the water and in a swath between five and ten feet wide. Bigger, faster machines with larger cutting heads and holding capacities may be more efficient, but are also less maneuverable. Depending on time of year, weather, and depth of cut, the same area may need to be harvested again in a few weeks.

The cuttings are collected on a conveyer belt and deposited in a holding area on board. Although the harvester collects most plant materials as it operates, inevitably some fragments are missed. Not overloading the carrying capacity of the harvester helps to keep plant fragments to a minimum. Along with plants, the harvester also inadvertently collects small fish (some are able to escape from the conveyer belt) and invertebrates.

When the plant storage area is filled, the harvester must off-load the cut plants. Plants can be off-loaded to either a barge stationed offshore or to a trailer or dump truck. These plants may be used as compost or disposed of in a landfill. As the distance from the work area to the off-loading site increases, the time spent on plant disposal activities can exceed the time spent cutting. This can add greatly to the duration and expense of the project and is a critical limitation to some harvesting projects. The plant density and machine specifications will also determine how often the harvester needs to off-load the cut plants.

Delays in the harvesting schedule can result from high winds, thunderstorms, and mechanical failure. Unscheduled maintenance or machine breakdowns can also result in lost harvesting time.

Complaints about harvesting have included reports by homeowners that plant fragments wash up more frequently on their beaches after harvesting. Homeowners may also report that their neighbor's property was harvested sooner or the job done more thoroughly than at their own property. It is important to establish some clear guidelines and policies to help make decisions and to settle disputes.

General impacts of harvesting:
While some people view harvesting as an excellent non-chemical control method for milfoil, others scoff at the waste of money to "merely mow the weeds." Harvesting plants has the added benefit of removing nutrients from the waterbody that are tied up in the plant biomass. Because only the top part of the plant is removed, the rest of the plants remain for habitat and sediment stabilization.

Harvesters are large machines and occasionally hydraulic fluid or fuel are leaked or spilled. The operator should have a spill plan and containment equipment available at all times. When working in shallow water, the propulsion system or the cutter head can sometimes churn up the sediment creating turbid water. Significant numbers of fish can be removed from a waterbody during harvesting activities as fish become collected along with the cut plants (Mikol, 1985). These are often juvenile fish, because larger fish can more easily avoid the harvester. Long term milfoil harvesting programs in Washington state include; the Columbia River, Lake Washington, and Green Lake. There is also a program aimed at native plant control on Long Lake (Thurston County).

Appropriateness for the Lakes:
Mechanical harvesting is not considered appropriate for the lakes because of the need for regular, repeat cuttings, the difficulty in accessing the lakes with a harvester, and the relatively high cost.

References:
Mikol, G. F. 1985. *Effects of harvesting on aquatic vegetation and juvenile fish populations at Saratoga Lake, New York*. Journal of Aquatic Plant Management. 23: 59-63.

Your Aquatic Plant Harvesting Program: A How-To Field Manual. Produced by the Wisconsin Lakes Partnership- University of Wisconsin-Extension, Wisconsin Association of Lakes, and Wisconsin Department of Natural Resources. Publication FH-205-97

Rotovation (underwater rototilling)

A rotovator is a barge-mounted rototilling machine that lowers a tiller head about eight to ten inches into the sediment to dislodge milfoil root crowns. The mechanical agitation produced by the tiller blades dislodges the root crowns from the sediment and the buoyant root masses float to the water surface. Since the entire plant is removed, plant biomass remains reduced in the treatment area throughout the growing season and often longer. Rotovation often provides two full seasons of control (Gibbons et. al, 1987). Unlike harvesters, rotovators do not have the capability to collect the plants
More information about rotovation is available at the following web address: http://www.ecy.wa.gov/programs/wq/plants/management/aqua027.html

Waterbodies suitable for rotovation programs:
Rotovation is a way to mechanically remove milfoil to provide open areas of water for recreational activities and navigation. Waterbodies suitable for rotovation include larger lakes or rivers with widespread, well-established milfoil populations where milfoil eradication is not an option. Since on-going rotovation programs are very expensive, having a large lake population or a motivated local government to share these costs is crucial. Because rotovation is expensive and multiple permits are needed, rotovation has not become a wide-spread milfoil control activity in Washington or elsewhere in the United States.

Special considerations:
Rotovation is not recommended in waterbodies with early infestations of milfoil since fragments are created and rotovation may increase the spread of milfoil throughout the waterbody. Because rotovation creates turbidity, rotovation may not be appropriate in salmon-bearing waters, although sometimes Fish and Wildlife staff are able to provide windows of time when rotovation activities will have the least impact on fish. Because rotovation and the resultant turbidity may impact the entire waterbody, it should be conducted under the direction of an integrated aquatic vegetation management plan.

Factors to consider when designing a rotovation program include:

- Waterbody surface area, width, and depth;
- Vegetated acres;
- Bottom contours and bottom obstructions such as stumps, rocks, other debris;
- Traffic patterns,
- Prevailing winds;
- Rotovator launching and off-loading sites;
- Sediment type;
- Shoreline development; and
- Sensitive areas (critical habitat).

A waterbody committee and/or local government staff identifies acreages and areas to be rotovated. Priorities may be determined by who funds the program. A local government will be more interested in rotovating public areas, whereas local residents may be interested in rotovating areas in front their homes. However, generally high use areas such as public parks, community access points, navigation channels, public boat launches, and water ski lanes receive

priority. Sometimes rotovators can be used to create fishing lanes in dense beds of milfoil to provide better fishing access to anglers.

Prior to rotovation, machinery launch sites (a paved ramp with deep water is best) need to be identified. Since rotovators do not collect plants as they work, a method for removing plants from the water should be developed. This may involve having a harvesting machine follow behind the rotovator to collect plants or hiring people to rake plants off beaches. When Pend Oreille County rotovates milfoil in the Pend Oreille River, they begin at the milfoil bed furthest upstream. The plants are then carried downstream and get caught up on the remaining dense milfoil beds. Their rotovator also has a clam rake attachment that can be used to pick up the plants and place them on-shore. This removal technique is acceptable on the Pend Oreille because there are many uninhabited shoreline areas. This would not be suitable in well-populated bodies of water.

Description of a rotovation project:
During a rotovation project, the rotovator tilling head is lowered into the sediment and power is applied. The rotating head churns into the sediment dislodging milfoil root crowns and plants, and a plume of sediments. The rotovated plants eventually sink or wash up on shore and the sediments gradually settle from the water. Canadian plant managers have recorded milfoil stem density and root crown reductions of better than 99 percent after rotovation test trials (British Columbia Ministry of Environment memo dated 1991). Where repeated treatments have occurred at the same site over several consecutive years, treatment intervals may extend longer than two years (Gibbons, et. al, 1987).

If rotovation services are contracted, bid documents and a contract need to be prepared, but there are few, if any, contractors offering these services. In a few waterbodies such as in the Pend Oreille River, rotovation may be performed year-round. In most waterbodies, timing is dependent on fish windows. Washington Fish and Wildlife does not want rotovation activities to take place when fish are spawning or juvenile salmon are migrating through the waterbody.

For efficacy of milfoil removal, it's best to begin operations in early spring and resume again in the fall. Rotovation is less effective in the summer when the long milfoil plants wrap around the rotovating head, slowing down the operation. If rotovation is done during the summer, it is more efficient to cut or harvest the plants beforehand. Weather creates winter rotovation delays, although it is possible to rotovate throughout the winter months (as long as the waterbody doesn't freeze). Delays in the rotovation schedule can result from high winds, thunderstorms, freezing water, and mechanical failure. There is a lot of maintenance and some down time on machinery working on the water.

Complaints about rotovation include increased plant fragments washing up along shorelines, broken water intakes, and homeowners perceiving that their neighbor's property was rotovated sooner or more thoroughly than their own property. It is important to establish some clear guidelines and policies to help make decisions and to settle disputes.

General impacts of rotovation:
Rotovators stir sediments into the water column. In addition to the sediments, buried toxic materials and/or nutrients may be released. Generally turbidity is short-term and the water returns to normal within 24 hours, but the length of time that sediments remain suspended depends on sediment type. Plants and root crowns are uprooted from the sediment and unless a plant removal plan is in place, these plants will either sink or be washed on shore. Rotovation appears to stimulate the growth of native aquatic plants. Whether this is due to the removal of milfoil, the action of the rotovator stimulating seed or propagule germination, or a combination of these factors is not known. Rotovators are also large machines with hydraulic systems and fuel that occasionally leaks or is spilled. The operator should have a spill plan and containment equipment on board for emergency use.

In 1987, Ecology conducted an evaluation of rotovation in Lake Osoyoos. This lake was chosen because it has a history of mining and agricultural use and therefore might represent a "worst case" scenario in terms of the potential for release of contaminants from sediment. The objectives of the study were to document effectiveness of rotovation by measuring changes in milfoil stem densities before and after treatment, and to assess impacts of rotovation on selected water quality parameters, benthic invertebrates, and the fisheries. Although the rotovator malfunctioned during the test (the hydraulic system driving the rototiller was not functioning properly), the results were consistent with data collected by the British Columbia Ministry of the Environment of sites rotovated by a fully operating rotovator. During the Lake Osoyoos rotovator test, rotovation appeared to have little impact on fish, water quality, or benthic invertebrates. However during this test, milfoil stem densities were not reduced to the extent that should have occurred had the machinery been operating properly. Although the results indicated only short-term impacts associated with rotovation, the test was faulty and it is difficult to draw firm conclusions. This study was not repeated using a fully functioning machine

Appropriateness for the Lakes:
Rotovation is not considered appropriate for the lakes due to the lack of target specificity, the potential that this will significantly spread the problem through fragment generation, the lack of suitable access to the lakes for the machinery, and the likelihood of fish and wildlife habitat degradation.

References:
Gibbons, M.V., Gibbons, H.L., and Pine, R.E. 1987. *An evaluation of a floating mechanical rototiller for Eurasian watermilfoil control*. Department of Ecology. Publication Number 87-17.

Diver Dredging

Diver dredging is a mechanical control technology for milfoil removal that was pioneered by the British Columbia Ministry of Environment. During diver dredging operations, divers use venturi pump systems (small gold mining dredges) to suction plants and roots from the sediment. The pumps are mounted on barges or pontoon boats and the diver uses a long hose with a cutter head to remove the plants. The plants are vacuumed through the hose to the support vessel where the plants are retained in a basket and sediment and water are discharged to the waterbody. Often a silt curtain is deployed around the treatment site to control turbidity. To learn more about diver dredging, see the following web page:
http://www.ecy.wa.gov/programs/wq/plants/management/dredging.html

Waterbodies suitable for diver dredging:
Sites suitable for diver dredging include lakes or ponds lightly to moderately infested with milfoil. Because diver dredging can be very expensive, this method is most suitable for moderate to early infestations of milfoil and for follow-up milfoil removal after an herbicide treatment. Diver hand pulling is more effective in lightly scattered patches of milfoil, whereas diver dredging may be more appropriate in denser milfoil beds. Diver dredging may also be applicable in waterbodies where no herbicide use can be tolerated. Theoretically diver dredging could be used in any waterbody to eradicate milfoil; however the costs for large scale projects would become astronomical.

Special Considerations:
Development of an integrated vegetation management plan is advised prior to beginning a diver dredging project. Diver dredging projects may require a federal permit from the US Army Corps of Engineers. The necessity for this permit is site dependent.

Description of a diver dredging project in Washington:
The littoral zone of the lake is surveyed immediately prior to starting control work and milfoil locations are mapped and Global Positioning System (GPS) points established. Diver dredging can begin as soon as milfoil can be easily seen and identified - generally in the spring. If diver dredging is being used as a milfoil eradication method also see the milfoil eradication strategy using hand pulling and bottom barrier installation. Diver dredging can be used in conjunction with these other methods to achieve eradication; with dredging used to reduce the density of plants, followed up by hand pulling. Generally diver dredging projects continue for several years and are very expensive.

During diver dredging, the divers may use a tool to loosen milfoil root crowns before using a suction head to remove the plant. In hard-packed or rocky sediments, the plants often break off at the root crown, leaving the root behind to regrow. In these areas, alternative control methods, such as bottom barrier installation, should be used. In locations with denser milfoil colonies, divers should make several passes through the area to ensure that all plants have been located and removed. Removed plants can be used for compost rather than having to be discarded as solid waste.

Factors that affect the success of diver dredging include: sediment type, visibility, amount of fragments created, density of native aquatic plants, and effort expended. The amount of acres covered per day is dependent on plant density, ease of removal, and number of divers. Once milfoil plants have become sparse, diver hand pulling is just as fast as dredging and has less impacts.

Sometimes diver dredging equipment is used just to transport plants to the surface. The diver pulls the plant and uses the dredge hose to suction the plant to the support boat rather than placing the plants in a bag and carrying them to the surface. Using a dredge for plant disposal is not considered dredging and does not trigger the need for Corps of Engineers approval.

In Washington, diver dredging was used in Silver Lake in Everett to contain a relatively early infestation of milfoil. Although milfoil was not eradicated in Silver Lake, dredging, in combination with hand pulling and bottom barrier installation, did remove most of the milfoil from the lake. Diver dredging is also being used in Idaho lakes and rivers to contain recently discovered milfoil populations.

General impacts of diver dredging:
No research has been conducted in Washington to quantify the impacts of diver dredging. Although the object of diver dredging is to remove milfoil, sediment is unavoidably stirred into the water. The obvious impact of diver dredging is increased turbidity in the area of plant removal with the degree of turbidity dependent on the sediment type. Fine silty sediments produce more turbidity than sandy or rocky sediments. If turbidity interferes with the ability of the divers to see the milfoil plants, efficacy of plant removal can be affected. Diver dredging may also release buried pollutants and/or nutrients. In Silver Lake, sediment bioassays were required prior to dredging to ensure that the sediments did not contain toxic materials. Bioassays are probably more important in waterbodies with a history of mining, combined sewage outfalls, land filling, storm water outfalls, or other activities that may have contributed pollutants to the sediments.

It is very difficult to control fragment release during dredging operations. If a silt barrier is deployed around the dredging site for turbidity control, divers should make an attempt to collect milfoil fragments within the area before removing the barrier.

Follow-up to treatment:
Diver dredging, used alone, is probably not an eradication tool, but it can be the first step to reducing the biomass of milfoil to the point where other manual methods can be used to eventually eradicate the plant.

Appropriateness for the Lakes:
Due to the high level of Eurasian watermilfoil in the lakes and the fact that milfoil control has been selected (as opposed to eradication) has been selected, diver dredging is not expected to be a cost-effective option in the short and long-term.

Water Level Drawdown

Milfoil can sometimes effectively be controlled when waterbodies are dewatered by releasing water via a water level control structure (dam or weir) or by pumping. The effectiveness of milfoil control is determined by several factors including the amount of the waterbody bottom exposed, duration of exposure, presence of springs, and the weather at the time of drawdown. The success or failure of drawdowns in controlling milfoil can be highly variable from lake to lake and from year to year within the same waterbody (Vermont Agency of Natural Resources, 1989). G. Dennis Cook (1980) recommended lake level drawdown for macrophyte control in situations where prolonged (one month or more) dewatering of lake sediments is possible under rigorous conditions of cold or heat; a key factor being desiccation. The author pointed out that those conditions suitable for macrophyte control may not occur with heavy snowfall or during milder, rainy winters. More information about water level drawdown is available at the following web address:
http://www.ecy.wa.gov/programs/wq/plants/management/drawdown.html

Waterbodies suitable for water level drawdown:
In Washington, milfoil control has usually been a side benefit of drawdown regimes occurring in waterbodies and reservoirs for other purposes such as for power generation, irrigation, or flood control. The impacts of fluctuating water levels are severe on a natural waterbody so this activity rarely occurs solely for milfoil control in Washington. Waterbodies suitable for water level drawdown are those with infestations of milfoil where drawdown occurs on a prolonged and regular basis. Because western Washington is so much wetter and milder than eastern Washington, drawdown is generally more successful in controlling eastern Washington milfoil populations. However, in some western Washington reservoirs, such as Tapps Lake and Riffe Lake, prolonged annual drawdowns have helped control milfoil infestations. Since milfoil survives in deeper water, drawdowns will not eradicate milfoil from the waterbody. Generally waterbodies with fluctuating water levels such as reservoirs are highly perturbed systems.

Special considerations:
Because water level drawdown impacts the entire waterbody, it should be conducted only under the direction of an integrated aquatic vegetation management plan. Few waterbodies in Washington, except for reservoirs, have water control structures and the means to lower the water level to the extent necessary to achieve significant milfoil control. Some lakes with water level controls also have court adjudicated water levels. Because impacts to habitat are severe, drawdown should only be considered as a milfoil control in waterbodies where the habitat value is not considered important by resource agencies.

Factors to consider when evaluating water level drawdown as a possible control for milfoil include:

- Presence of an outlet structure or the means to lower the water level;
- Amount of waterbody bottom exposed at different water levels;
- Timing of water withdrawal and return;
- Climate;
- Potential impacts to surrounding wetlands/emergent plants;
- Sediment type;

- Shoreline development;
- Species dependent on near-shore habitat;
- Endangered species and/or rare plants; and
- Sensitive areas (critical habitat).

General impacts of water level drawdown:
As the water recedes, docks and other shoreline structures, such as retaining walls and irrigation or potable water intakes, are exposed and shallow wells may run dry. It may become impossible to launch boats, and boating and other recreational activities may be curtailed or restricted during drawn down periods. On the plus side, lowered water levels may allow repairs to be more easily made to near-shore structures. Sometime drawdown can consolidate flocculent sediments and results in firmed sediments when the water returns.

Water level drawdown exposes the sediment and affects the habitat for emergent and submersed plants, fish, benthic invertebrates, waterfowl, and aquatic mammals. Vermont concluded that drawdown did major damage to deepwater wetland communities at Lake Bomoseen. It caused decreases to two rare plant species and provided only short-term control of milfoil. Greening and Gerritsen (1987) noted that frequent drawdowns result in a reduction in species diversity and favor tolerant plants, which eventually come to dominate the lake.

The impacts to animals by the Lake Bomoseen winter drawdown (September 1988 to March, 1989) were also significant. The drawdown "decreased habitat suitability for species that require stable water levels such as beaver and muskrat by preventing them from using their winter food supplies and exposing them to adverse weather and predation. Habitat suitability was decreased for species that overwinter in the bottom sediments such as frogs, turtles, and macroinvertebrates because freezing the sediment kills these animals." The Vermont report also concluded that the drawdown of Lake Bomoseen had an adverse impact on all the littoral zone macroinvertebrate communities (snails, mussels, aquatic insects). The impacts to fish by the Lake Bomoseen drawdown were difficult to measure because only one year of data was collected.

Other impacts that may occur after drawdown include:
- Low lake levels after winter drawdowns if insufficient spring rains fail to refill the waterbody;
- Dried up streams as water flows from the lake cease;
- Damage to the lake bottom; and
- Nutrient releases and algal blooms that occur after the water level rises.

There is some anecdotal evidence in Washington to suggest that milfoil seeds may germinate after summer lake bottom desiccation. In two small natural lakes in Thurston County where milfoil had been eradicated, milfoil appeared in abundance after drought conditions contributed to partial or whole lake drawdown. The fall/winter following the drought, the lakes, refilled and an abundant population of milfoil was observed in the spring/summer, particularly in the areas where the lakes had been dewatered.

Appropriateness for the Lakes:
Drawdown is not considered appropriate for the lakes due to the lack of target specificity, the significant impacts that this would have to the lake biota (and potentially water quality), the technical difficulty due to high hydraulic connectivity with the nearby Columbia River, and the cost associated with this technique.

References:
Cook, G. D. 1984. *Lake level drawdown as a macrophyte control technique.* Water Resources Bulletin, Vol. 16, No. 2.

Greening, H.S. and Gerritsen, J. 1987. Changes in macrophyte community structure following drought in the Okefenokee Swamp, Georgia. USA. Aquatic Botany, 28:113-128.

A report prepared for the Vermont Legislature by the Vermont Agency of Natural Resources, Waterbury, Vermont. 1989. *The Lake Bomoseen drawdown: An Evaluation of its Effects on Aquatic plants, wildlife, fish, invertebrates, and recreational uses*.

Hand Pulling and Bottom Barrier Installation

Hand Pulling:
During hand pulling, milfoil plants are manually removed from the lake bottom, with care taken to remove the entire root crown and to not create fragments. In deeper water, divers are usually needed to reach the plants. See this web page for more information about hand pulling techniques: http://www.ecy.wa.gov/programs/wq/plants/management/aqua022.html.

Bottom Barrier Installation:
Bottom barriers are semi-permanent materials that are laid over the top of milfoil beds and are analogous to using landscape fabric to suppress the growth of weeds in yards. To learn more about bottom barriers and their environmental impacts, see the following web page: http://www.ecy.wa.gov/programs/wq/plants/management/aqua023.html. To learn more about installing bottom barriers, see this site:
http://www.ecy.wa.gov/programs/wq/plants/management/aqua021.html

Waterbodies suitable for handpulling and installation of bottom barriers:
Due to expense and the time intensive nature of manual methods, sites suitable for hand pulling and bottom screening are limited to lakes or ponds only lightly infested with Eurasian watermilfoil. This method is suitable for very early infestations of milfoil and for follow-up removal after a whole lake fluridone treatment, a 2,4-D treatment, or diver dredging. To be cost-effective, generally the total amount of milfoil in the waterbody should be three-acres or less in area, if all the milfoil plants were grouped together in one location. If the infestation has advanced beyond this point, it is more effective to consider other eradication techniques such as aquatic herbicides. This method may also be applicable in waterbodies where no herbicide use can be tolerated such as in a lake used as a municipal drinking water supply. Theoretically, these methods could be used in any waterbody to eradicate milfoil; however the costs for large scale projects would become astronomical.

Special Considerations:
Factors that affect the success of hand pulling include: water clarity, sediment type, suppression of milfoil fragments, density of native aquatic plants, and effort expended. It is especially important to have good visibility for the divers to locate milfoil plants. Sometimes diving is only effective in the spring or fall, or during periods between algal blooms. If water clarity is very poor, manual eradication methods may not be suitable for the waterbody.

Description of a milfoil eradication project in Washington using handpulling and bottom barriers:
Lakes where manual methods are being used for milfoil eradication typically have milfoil lightly scattered singly or in small patches within the littoral zone. To determine the extent of the infestation, the littoral zone of the lake is surveyed immediately prior to starting control work and milfoil locations are mapped and Global Positioning System (GPS) points established. The survey can be conducted prior to the removal effort or take place during the removal effort.

Handpulling can begin as soon as milfoil can be easily seen and identified - generally in the spring or as soon as it is discovered in the lake. Despite milfoil's tendency to fragment more

readily during the fall, removal should be undertaken as soon as possible after the discovery of milfoil in the lake, no matter how late in the season. Both surface and underwater surveys should be conducted several times during the growing season. During the surface survey, a surveyor moves slowly through the littoral zone in a boat, looking into the water (often using a viewing tube), and marking the locations of milfoil plants with buoys. The surface survey is immediately followed by an underwater diver survey. Because known milfoil locations have been marked during the surface surveys, the divers can concentrate their efforts at these locations. Since diver time is expensive, it can be cost-effective to conduct surface surveys before underwater surveys.

During handpulling, the divers dig around and beneath the plant roots with their hands or with a tool and gently lift the entire plant out of the sediment. The ease of removal is dependent on sediment type. Milfoil plants can be readily removed from loose or flocculent sediments. In hard sediments or rocky substrate, hand tools must be used to loosen the root crown before the plant can be dislodged. Sometimes fine roots are left behind; these will not regrow, but it is important to remove the root crown (the fleshy, fibrous roots at the base of the stem). Once plants are removed, the diver places them into bags for transportation to the surface. Sometimes divers may use a suction device to deliver the plant to the surface. The plant is sucked up into the boat (generally using a gold dredge), the plants are retained in a sieve, and the water is discharged back into the lake. In locations with denser milfoil colonies, divers should make several passes through the area to ensure that all plants have been located and removed. As the divers work, the people in the support boat mark the locations of milfoil plants. An accurate location is important since the areas need to be resurveyed a few weeks later. There have been instances when small fragments or plants have been overlooked and have become large plants upon resurvey. Removed plants can be used for compost rather than having to be discarded as solid waste.

If colonies are too large for efficient handpulling or if repeated visits to the same site indicate that too many fragments or plants are being missed, bottom barriers should be installed. Burlap bottom barrier (or other biodegradable material) should be placed over the plants and anchored to the lake bottom using natural materials such as rocks or sandbags. The burlap should cover and extend well beyond the growth zone of the plants. Burlap or other natural materials are preferred because they will naturally decompose over a 2-3 year period.

Some lake groups hire contract divers and surveyors to conduct manual plant removal activities. Other lakes have relied on volunteer efforts. If volunteers are used, they must be trained in plant identification and proper removal methods.

General Impacts of handpulling:
Special care must be taken to prevent the release of milfoil fragments. At certain times of the year (generally after flowering), milfoil plants can fracture into hundreds of fragments, each having the potential to form a new plant. To help contain the fragments, individual plants may be covered with a mesh bag before they are pulled. The driver of the diver support boat must also be careful not to create additional fragments by keeping the boat and propeller out of the milfoil plants. People in the support boat should use net skimmers to retrieve any fragments accidentally released by the divers.

Handpulling may increase turbidity in the area of removal. This can affect the efficacy of removal if the turbidity interferes with the ability of the divers to see the milfoil plants.

Follow-up to treatment:
Follow-up is essential to ensure the success of eradication. Even a few milfoil fragments left in the lake can start a new infestation or boaters may reintroduce milfoil into the lake.
Diver and surface inspections should continue at least twice a year during the growing season. Survey work should be as frequent as can be afforded since small milfoil plants or fragments may be easily overlooked.

Long term follow-up is the key!
Once milfoil is discovered in a lake, it generally requires continual maintenance to keep it at low levels. Even if milfoil appears to have been eradicated, it often is reintroduced by boaters. As long as the lake group continues surveying, new introductions can be identified quickly and targeted for removal before milfoil can reestablish in the lake. Although labor intensive, these manual techniques have been used to successfully eradicate milfoil in a drinking water reservoir in Washington.

Appropriateness for the Lakes:
Handpulling Eurasian watermilfoil is not appropriate for the lakes in the short-term due to the high density of the milfoil in each lake and associated handpulling costs. However, this may be an option as a means of establishing long-term control of Eurasian watermilfoil in the lakes if overall milfoil abundance is reduced to lower levels. Bottom barriers are not considered appropriate of use at the lakes at this time due to the extent of the Eurasian watermilfoil infestation, the stated management goals, and cost considerations.

Other Homeowner Control Options

In addition to handpulling and installation of bottom barriers there are varied other techniques that can be applied to a smaller control area. These are often applied by homeowners. They include:

- Cutting (using special cutting tools);
- Raking;
- Weed Rollers® (a device that consists of motor-driven metal cylinders that roll in an arc along the lake bottom);
- Diver dredging (a diver-operated suction dredge that vacuums milfoil from the lake bottom); and
- Spot treatment with herbicides (chemicals appropriate for killing or suppressing milfoil growth in small areas).

Waterbodies suitable for homeowner local control options:
Waterbodies suitable for individual home owner control options include lakes or ponds heavily infested with milfoil, where there has not been a comprehensive or lake-wide milfoil management plan developed and implemented. Or, where a plan has been developed and it calls for homeowner control. In these situations it is up to each homeowner, at their expense, discretion, and with proper permitting, to remove milfoil from their lake front property. Some of these methods may not be suitable in waterbodies experiencing an early infestation of milfoil because fragments may be created and cause increased spread.

Many of these methods offer only temporary relief because milfoil fragments will drift in from adjacent unmanaged areas and invade the cleared area. Some actions, for example cutting, raking, and handpulling, need to be repeated at intervals during the summer to maintain milfoil-free areas. Methods, such as installing bottom barriers (if kept maintained) or installing a weed roller (if operated on a regular basis), may offer longer term control. Spot treatment with aquatic herbicides may result in adjacent waters being inadvertently treated through drift. It is important to talk with neighbors to ensure that they are comfortable with the idea of chemical treatment before proceeding with any herbicide applications.

Description of methods:
All of these methods and their impacts have been described in detail on the Department of Ecology website. The web address for each method is listed below:

Manual Methods: http://www.ecy.wa.gov/programs/wq/plants/management/aqua022.html

- Hand pulling
- Cutting
- Raking

Weed Roller®: http://www.ecy.wa.gov/programs/wq/plants/management/aqua029.html

Diver Dredging: http://www.ecy.wa.gov/programs/wq/plants/management/dredging.html

Spot treatment with herbicides:
http://www.ecy.wa.gov/programs/wq/plants/management/aqua028.html

BIOLOGICAL CONTROL STRATEGIES

Triploid Grass Carp

Triploid grass carp are plant-eating fish from the Amur River Basin and lowland rivers in China and Russia. They are used as biological control for overabundant aquatic plants in some Washington waterbodies. Only sterile fish (triploids) are allowed to be stocked into Washington waters. You can obtain more information about grass carp at this web site: http://www.ecy.wa.gov/programs/wq/plants/management/aqua024.html.

Waterbodies suitable for grass carp stocking:
Grass carp are generally not recommended for milfoil control because milfoil is not a highly preferred food. Some research has indicated that grass carp have food preferences and will consume more palatable plant species, such as pondweeds and waterweed, before they will eat milfoil. As a result, the concern is that they can enhance milfoil growth by removing competition from native plants and opening up more area for milfoil to colonize. Grass carp can be used for milfoil eradiation/control only in waterbodies where the eradication of ALL submersed aquatic plants can be tolerated. Sites where grass carp may be suitable for milfoil control are rare. They include very urban lakes like Green Lake in Seattle, privately-owned artificial lakes, or small lakes with a virtual monoculture of milfoil.

Special considerations:
WDFW requires that all inlets and outlets to the lake be screened to keep grass carp from leaving the system. Therefore, grass carp are generally not allowed in waterbodies with salmon or steelhead since these fish need to pass freely between the lake and salt water. WDFW requires a lake-wide plan before allowing grass carp to be stocked into public lakes.

Description of a grass carp stocking project:
The Department of Fish and Wildlife determines the applicability of stocking grass carp into a waterbody and provides a grass carp stocking rate. To achieve milfoil eradication, a high stocking rate of fish per vegetated acre must be used. Since milfoil is not a preferred food, grass carp will eat the more palatable plants first. If too low a stocking rate is used, grass carp may actually enhance milfoil growth by removing competition from native plants and opening up more area for milfoil to colonize. In the few Washington lakes where grass carp have eradicated milfoil, all the other submersed plants in the lake have also been eliminated (e.g. Silver Lake, Cowlitz County; Surfside Lakes, Pacific County). In Washington, grass carp do not appear to eat floating leaved plants like water lilies or emergent vegetation such as cattails and bulrush.

Once grass carp stocking has been approved, Fish and Wildlife will issue a permit and provide a list of fish farmers to the project sponsor. Most grass carp farms are located in the southern US because fish grow faster in warm southern waters. Also fertile fish are not allowed in Washington so they can't be raised here. The fish farmers generally sell ten to twelve inch fish. This size of fish is considered to be large enough to avoid bass predation. It is sometimes possible to purchase larger fish, but the costs per fish increase. Depending on the number of fish, grass carp are either transported to the site in special trucks or air freighted. One concern is that the fish farmers certify that the water that the grass carp are transported in is free from exotic

organisms such as zebra mussels or the spiny water flea. The fish must also be certified as being triploid (sterile) and disease-free. The grass carp are released into the lake immediately upon their arrival. Most fish survive the trip from the fish farm, but some mortality from shipment stress is expected.

Many people prefer to stock their lakes in the spring to avoid winter stress. Once the fish are stocked, they are at risk from predation from birds of prey and otters. With abundant food and warm waters, the fish generally grow rapidly during their first summer and soon become too large for most birds to capture. Once the fish are stocked, observers may occasionally see them basking near the surface or moving in schools through the water. Their back fins often emerge from the water causing them to look like little sharks. If the correct numbers of fish have been stocked and mortality has been low, the amount of plants should slowly decline in the lake over two-three years with the palatable species disappearing before the milfoil plants. Once all submersed plants are eaten, grass carp have been known to consume detritus and organic material from the sediments (Gibbons, 1997).

As the stocked fish age, their feeding rate declines. Each year some mortality occurs and these sterile fish will eventually die out. As their population declines, native plants that have seeds or long-lived reproductive structures in the sediment may return. It is hoped that when this happens, milfoil will not reoccur in the waterbody.

General impacts of grass carp stocking:
There can be significant impacts to the waterbody following grass carp stocking. Since native plants provide habitat, sediment stabilization, and many other important functions, removal of all submersed plants can have a severe impact on the waterbody. Most of the impacts due to grass carp stocking are attributed to the removal of the plants rather than direct impacts of the fish.

The Department of Fish and Wildlife investigated the effects of grass carp on the water quality of 98 Washington lakes and ponds (Bonar, et. al, 1996). The average turbidity of sites where all submersed aquatic plants were eradicated was higher (11 nephelometric turbidity units [NTU's]) than sites where aquatic plants were controlled to intermediate levels (4 NTU's) or at sites where the vegetation was not affected by grass carp grazing (5 NTU's. In Silver Lake, NTU's of 50 were observed after all submersed plants were removed (Gibbons, 1997). Although there have been some reports that grass carp stocking can increase algal blooms, this does not appear to be the case in Washington. The increase in turbidity was all abiotic (probably suspended sediments). In other words, once the submersed species are removed or partially removed the lake becomes more turbid or muddy. Never the less, the satisfaction rate of the pond owners or lake residents with the results from stocking grass carp was high.

Frodge et. al (1995) observed positive water quality changes in Bull Lake, Washington and Keevies Lake, Washington after they were stocked with grass carp. Grass carp stocking and the resultant plant removal reduced some of the deleterious problems caused by excessive plant growth, such as low dissolved oxygen and high pH. The lake bottom in Silver Lake went from being anoxic and devoid of bottom dwelling invertebrates to oxidized and supportive of benthic organisms after grass carp had removed all submersed vegetation (Gibbons, 1997).

Pauley et. al (1995) studied fish communities for a six year period in three lakes before and after grass carp stocking. They concluded that while changes in fish populations did occur in the lakes, no consistent trend occurred after the introduction of grass carp. It should be noted that in two of the lakes, aquatic plants were not totally eliminated.

Waterfowl that feed on submersed plants are affected when these plants disappear. A report from Silver Lake (Gibbons, 1997) showed that although there were no clear indications that the number of waterfowl in the lake had declined after grass carp introduction in May 1992, there was a sharp decrease in American coots in 1994, 1995, and 1996. These data suggest that the loss of submersed plants from the lake resulted in fewer birds that depended on these plants for food from Silver Lake.

Follow-up:
Lake groups are strongly advised to monitor plant species and area of coverage, before and for several years after stocking grass carp. If the plants have not reduced in area or biomass after three years, more grass carp should be added. Since Fish and Wildlife issues the permit for extra fish, having monitoring data will provide them with the information to evaluate the request for extra fish.

Appropriateness for the Lakes:
The City of Rock Island lakes are relatively small (<50 acres) and all contain a virtual monoculture of Eurasian watermilfoil. Therefore, grass carp are considered appropriate for use in the lakes due to their ability to provide long-term aquatic plant suppression, and potentially allowing for the revegetation of the lakes by native vegetation. Grass carp are also appropriate for use in the lakes due to their lower cost relative to other control measures. This is one of the preferred aquatic plant control techniques identified in the recommended control scenario as described in the Integrated Treatment Action Plan.

References:
Bonar, S.A., Bolding, B., and Divens, M. 1996. *Management of aquatic plants in Washington State using grass carp: effects on aquatic plants, water quality, and public satisfaction* 1990-1995. Washington Department of Fish and Wildlife Research Report No. 1F96-05.

Frodge, J. D., Thomas, G.L., and Pauley, G. B. 1995. Chapter 6 - *Water quality effects of stocking sterile triploid grass carp in Keevies Lake and Bull Lake*. In: The Biology Management and Stocking Rates of Triploid Grass Carp *Ctenophyaryngodon idella*, and Their Effects on the Plant Community, Fish Assemblage, and Water Quality of Several Pacific Northwest Lakes. Final Report to the Washington Department of Ecology.

Gibbons, H.L. 1997. Silver Lake Phase II Study, 1996 Annual Report prepared for Cowlitz County by KCM, Inc.

Pauley, G.B., Marino, D.A., Thiesfeld, S.L., Vecht, S.A., Thomas, G.L., Beauchamp, D.A., and Bonar, S.A. 1995. Chapter 9 - *Impacts of triploid grass carp grazing on the game fish assemblages of Pacific Northwest Lakes*. In: The Biology Management and Stocking Rates of Triploid Grass Carp *Ctenophyaryngodon idella*, and Their Effects on the Plant Community, Fish Assemblage, and Water Quality of Several Pacific Northwest Lakes. Final Report to the Washington Department of Ecology.

Purple Loosestrife Biocontrol

In 1992 three 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. You can obtain more information about these beetles at: http://www.ecy.wa.gov/programs/wq/plants/weeds/aqua009.html

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.

These beetles are relatively inexpensive and potentially can provide long-term plant control. However, it may take several years to see an acceptable level of control. This control method is relatively inexpensive as most of the time and effort is provided by volunteers.

Appropriateness for the Lakes:
The City of Rock Island lakes have been infested with purple loosestrife for many years. Although earlier attempts to control these plants with purple loosestrife biocontrols were ineffective, the Chelan PUD and the City of Rock Island will be working together to release these biocontrol agents again in 2004. It is hoped that using a combination of biocontrol agents and herbicide applications will provide adequate control for purple loosestrife in the future.

CHEMICAL CONTROL STRATEGIES

Whole Lake Fluridone Treatment

Fluridone is a systemic herbicide that kills the entire plant and is generally non-selective since most submersed plants will be killed or affected by a whole lake treatment. Fluridone inhibits the formation of carotene (pigment) in growing plants. In the absence of carotene, chlorophyll is degraded by sunlight. Because this is a slow process and the plants can "grow out" of this if fluridone is removed, the contact time between the plant and chemical needs to be maintained for many weeks. Sonar® and Avast!® are the trade names for aquatic herbicides that contain fluridone as the active ingredient. The liquid formulation of fluridone has been used for whole-lake milfoil eradication projects. A granular formulation is also available, but has not been used for whole lake treatments. The premise for using fluridone as an eradication tool is that milfoil rarely produces viable seeds, so killing the vegetative growth will prevent spreading through fragmentation. Milfoil is particularly susceptible to fluridone and it is theoretically possible to achieve 100 percent kill. If all the milfoil plants are killed by fluridone treatment the only way that milfoil can reinfest the lake is to be reintroduced or germinate from seeds. Germination by seeds is considered rare.

Waterbodies suitable for whole-lake fluridone treatment:
Lakes and ponds suitable for whole-lake fluridone treatment are heavily infested with Eurasian watermilfoil throughout the littoral zone. Fluridone is not suitable for spot treatments (sites less than five-acres within a larger waterbody) since it is difficult to maintain enough contact time between the plant and the herbicide to kill the plant. If milfoil is limited to patches within the littoral zone, 2,4-D may be a more effective treatment method (see the 2,4-D milfoil eradication strategy). Due to the high treatment costs, fluridone treatments have been limited to smaller sites in Washington. The largest lake in Washington where this method has been used for milfoil eradication has been Long Lake (about 330 acres). In larger lakes, treatment of selected coves or embayments is possible, although milfoil will eventually reinvade from untreated areas.

Special considerations:
While there are no swimming, fishing, or drinking water restrictions when fluridone is in the water, the label warns against using the water for irrigation for seven to thirty days after treatment. Even at the low fluridone concentrations used to treat milfoil, some terrestrial plants may be sensitive to fluridone if they are watered with treated lake water.

Washington has had excellent success using this fluridone for milfoil eradication/control, but there is no guarantee that every lake group who tries this method will achieve the same results. Each site is different and many environmental factors may affect the treatment. Developing a site-specific plan for each lake is crucial to identifying environmental factors or concerns that may impact the treatment outcome.

Description of a milfoil eradication project using fluridone:
When the project goal is eradication, a whole lake fluridone concentration of 12-15 ppb (parts per billion or mg/liter) should be maintained in the lake for approximately ten weeks during the spring and/or summer. While it is possible to achieve successful milfoil control at lower

concentrations (as low as 3-6 ppb), these higher levels are recommended to ensure that all milfoil plants are killed.

Before application, the lake volume must be determined to ensure fluridone is applied in a sufficient amount to result in the target whole lake concentration. If the lake is shallow and not thermally stratified, concentrations throughout the water column must remain in the 12-15 ppb range. If the lake is deep and thermally stratified (warm above and cold below), these concentrations can be maintained in the epilimnion (warmer surface layer of water) rather than throughout the water column.

Treatment costs will vary based on lake surface area, water volume treated, and the number of treatments needed to maintain the target concentration for ten weeks. The SePRO Company (distributor for Sonar®) has developed a new patented test called planTEST™ that their preferred applicators may use. Treated plants are collected a few weeks prior to treatment and planTEST™ determines the concentration of Sonar® needed to kill the target weed. If milfoil in the lake is particularly susceptible to fluridone, it may be possible to reduce the concentration of fluridone needed to effectively treat the infestation.

Treatments can start as soon as milfoil begins rapidly growing. This can be as early as April or May and as late as early July and is site-specific. Much depends on the timing windows for salmon usage (provided by Washington Department of Fish and Wildlife for each waterbody) since juvenile salmonids should not be exposed to chemicals. Another critical factor particularly in western Washington is water flow. A heavy rainfall may wash the herbicide out of the system. For deeper lakes, treatment should be delayed until the thermocline develops and stabilizes in summer. For these reasons, fluridone treatments in Washington often begin in June or July rather than earlier.

Fluridone is applied in a liquid formulation by sub-surface injection from trailing hoses by a state-licensed applicator. About a day or two after treatment, water samples should be collected to determine fluridone concentrations. The number of samples required depends upon the size and shape of the lake. In a long narrow lake, three samples may be enough to determine lake concentration. In a small round lake, one sample taken in the middle may be sufficient. In a lake with many coves or channels, a number of samples may be needed to determine a whole lake concentration. Testing the water ensures that the target concentration of fluridone has been met. The SePRO Company and Griffin LLC (distributor for Avast!) both have fluridone analysis test kits. Test results can be available within 48 hours and each sample costs about $100. Other laboratories can also perform fluridone analysis, but turn around times for results may be longer.
Fluridone concentrations are maintained in the lake over time by the application of additional herbicide at about bi-weekly intervals or as needed. To determine how much herbicide to add, water samples are collected about 10 to 14 days after the initial treatment and analyzed for fluridone. Generally during this two-week period, fluridone concentrations decrease by about half, due to plant uptake and exposure to sunlight. Fluridone is also more persistent in cooler waters. After fluridone concentrations are determined, the applicator applies enough herbicide to the lake to bring the whole lake concentration back up to the 12-15 ppb range. This scenario continues until fluridone concentrations have been held at 12-15 ppb in the lake for ten weeks.

This fluridone concentration and exposure time should be sufficient to kill milfoil plants. During a typical treatment, the applicator may apply fluridone to the lake four times.

The SePRO Company has also developed a new patented test called effecTEST™ that their preferred applicators may use. Treated plants are collected at about five to six weeks after the initial treatment and effecTEST™ determines whether these plants have received enough herbicide to kill them or if a higher (or lower) concentration is needed.

General impacts of fluridone treatment:
There are significant impacts to the waterbody during and following treatment. Fluridone is a generally non-selective herbicide, which means most submersed plants and some floating leaved plants will be killed by fluridone during the treatment. Emergent species like cattails will be impacted but will recover. A week to three weeks after the initial treatment, observers will see the growing tips of aquatic plants bleach pink to white. Water lilies will appear bleached and cattails and other emergent species may look variegated. Since this is a slow process, low oxygen conditions do not develop. The plants eventually drop out of the water column by about six weeks post-treatment.

While there is no direct toxicity of fluridone to animals, the loss of habitat does cause indirect impacts. The smaller fish lose their hiding places and because the larger fish can find them easily, they have greater chances of being eaten. Waterfowl that eat vegetation tend to move onto other vegetated waterbodies while waterfowl that eat fish enjoy better fishing opportunities on the treated lake. Sometimes increased algal blooms are observed in the year of treatment and for a year following treatment. However, eventually the lake reaches a new equilibrium and native aquatic plants recover. Naturally occurring plants have viable seeds, tubers, and overwintering buds that allow them to revegetate the lake the year following treatment, while milfoil does not. In Washington the colonization of the lake bottom by plant-like algae called brittlewort (*Nitella* spp.) and stonewort (*Chara* spp.) is often observed following a fluridone treatment. This is because algal species are resistant to fluridone and removing milfoil opens up space for them to colonize.

Up to 100 percent of the Eurasian watermilfoil in the lake should be killed. However in inlets or areas where the herbicide may be diluted by flowing water (including in-lake springs), milfoil may be undertreated and must be physically removed if eradication is to be successful. These areas should have been identified during plan development and alternative methods planned for milfoil removal. Undertreatment or no treatment of milfoil in inlet areas may result in the lake being reinfested unless immediate management methods are undertaken.

Follow-up:
<u>For lakes that are heavily infested with milfoil, the goal of eradication should only be sought when lake residents are willing to finance and conduct the follow-up monitoring and treatments that are essential to ensure long term success</u>. The littoral zone of the lake should be thoroughly inspected by divers in the fall of the treatment year and the next spring as well to identify any milfoil plants that may have been undertreated. Areas where this might happen include areas of lake bottom with springs or near inlet streams. Any remaining milfoil plants should be hand pulled or covered with bottom barriers (See: Eradication - Hand Pulling and Bottom Barrier

Installation). Diver and surface inspections should continue at least twice a year during the growing season on an ongoing basis. Survey work should be as frequent as can be afforded, since small milfoil plants may be easily overlooked. Often divers report finding two to three foot tall milfoil plants in areas that they had extensively searched only three weeks earlier. As native plants recover, it will become more difficult to locate any milfoil plants.

Very important note!
In most Washington lakes treated with fluridone, milfoil is found growing in the lake from two to five years later. It is suspected that milfoil is reintroduced via boating activity, since it is often discovered near a public boat launch. As long as the lake group has continued the survey work, these new introductions can be identified quickly and targeted for removal before milfoil reestablishes. In treated lakes where lake groups have continued the diver and surface inspections, milfoil remains at extremely low levels and recreation, fishing, and habitat remain healthy. In the few lakes where inspections did not continue, milfoil reinvaded and the lakes returned to pre-treatment infestation levels. It is interesting to note that the one lake where milfoil never returned after treatment is a canoe and kayak lake only and located on an island (Goss Lake).

Follow-up is the key!
While it is very difficult to totally eradicate milfoil from a lake forever, extensive and long-term follow-up activities make it possible to maintain extremely low levels of milfoil that will not impede recreational activities or impact native plant communities. As an example, Long Lake in Thurston County was treated with fluridone in 1991. In 1995, milfoil was discovered growing near the public boat launch. Since then the lake residents and Thurston County have been successfully maintaining extremely low levels of milfoil in the lake by surface and diver survey and hand pulling. In 2001 about 90 pounds total wet weight of milfoil was removed from the 330-acre lake (Ryan Langen, personal communication). Much less milfoil was found in 2002. These activities are not inexpensive, but are considered a necessary cost to maintain this lake in good condition for recreation and habitat. Should these management measures cease, milfoil would probably reinfest the lake within three to five years.

Appropriateness for the Lakes:
Fluridone products are not considered appropriate for use in the lakes at this time due to the relatively high cost of this method and the likelihood of reinfestation of Eurasian watermilfoil from other lakes in the area.

2,4-D Treatment

2,4-D is a relatively fast-acting herbicide that kills the entire plant (systemic herbicide). Its mode of action is primarily as a stimulant of plant stem elongation. This herbicide is considered to be "selective" for milfoil because it generally targets the broad-leaved plants (dicots) like milfoil. Most other aquatic plants are monocots (grass-like) and are unaffected by 2,4-D. Navigate® and Aqua-Kleen® are granular 2,4-D products registered for aquatic use and DMA*4IVM® is a liquid formulation. The risk assessment and the impact statement can be viewed at the following web address: http://www.ecy.wa.gov/programs/wq/pesticides/seis/risk_assess.html.

Waterbodies suitable for 2,4-D treatment:
Sites suitable for treatment include lakes or ponds partially infested with Eurasian watermilfoil such as waterbodies where milfoil has recently invaded, but where the extent of the infestation is beyond what can be removed by hand pulling or bottom screening. In these situations an herbicide, like 2,4-D, that is effective for spot treatment can be used to reduce the amount of milfoil so that hand pulling can remove any milfoil plants that are not killed. 2,4-D is suitable for spot treatment because it is a fast-acting herbicide that only needs a 48-hour contact time with the plant. 2,4-D can be used for milfoil control in heavily infested lakes, but it does not provide the nearly 100 percent kill of the herbicide fluridone. Because many plants remain alive and scattered throughout the littoral zone after 2,4-D treatment, hand pulling extensive areas after treatment may not be effective in heavily infested lakes. Lake residents must be willing to fund the follow-up activities necessary to ensure continued milfoil eradication (or maintenance at extremely low amounts).

Special considerations:
Water users need to be identified prior to 2,4-D application. Water within the treatment areas cannot be used for drinking until 2,4-D concentrations have declined to 70 ppb and water used for irrigation cannot be used until 2,4-D concentrations are 100 ppb or less. If water users do not have other water sources, the project proponents must arrange for alternative water supply during the time that 2,4-D is in the water. In Washington, testing has shown that water both inside and outside of the treated area is generally below the drinking water standard three to five days after treatment.

Description of a milfoil eradication project in Washington using 2,4-D:
Lakes where 2,4-D is being used for milfoil eradication in Washington typically have milfoil scattered in patches within the littoral zone. The lake is surveyed immediately prior to herbicide application and milfoil locations are mapped and Global Positioning System (GPS) points established.

Herbicide application can begin as soon as milfoil starts rapidly growing. Effective treatments can be made as early as April or May and as late as early September. Timing is also dependent on salmon usage since juvenile salmonids should not be exposed to chemicals. Treatment in the spring/summer should be followed by a late summer survey and possible retreatment if large patches remain or if more milfoil is discovered in untreated areas of the lake.

A month after the initial 2,4-D treatment, the littoral zone of the lake should be thoroughly inspected by divers to identify and map remaining milfoil plants. Sparse populations of remaining milfoil plants should be hand pulled or covered with bottom barrier. Larger, denser patches may need to be treated again with 2,4-D, although in that case some assessment should be made as to why the initial treatment was ineffective. Diver and surface inspections should continue at least twice a year during the growing season. Survey work should be as frequent as can be afforded since small milfoil plants may be easily overlooked within the native plant beds. Often divers report finding two to three foot tall milfoil plants in areas that they had extensively searched only three weeks earlier.

The herbicide is available in a granular and liquid form and application must be made by a state-licensed applicator. The granular formulation of 2,4-D is typically applied using a bow-mounted centrifugal or blower-type spreader and uniformly spread over the water above the milfoil beds and slightly beyond. The clay particles sink to the bottom or are caught up in the plants. The herbicide slowly releases from the clay over the next day. Granular formulations are generally recommended for spot treatment since liquid applications may have more tendency to drift away from the milfoil beds. When the liquid formulation is used, it is applied using subsurface trailing hoses. In both cases, if the project is funded by an Ecology grant or if there are irrigation or drinking water concerns, monitoring will be required. A 2,4-D analysis test kit should be available soon or environmental laboratories can also perform 2,4-D analysis. Rapid turn around of results costs more.

General impacts of 2,4-D treatment:
2,4-D is a selective herbicide and milfoil is particularly susceptible at a labeled rate of about 100 pounds per acre (granular product). At this rate impacts to other aquatic plant species are minimal. Even if applied at higher rates there are only a few other aquatic plant species that are affected by 2,4-D. A study conducted in Loon Lake Washington showed that Eurasian watermilfoil was the only aquatic plant whose growth was statistically reduced by the 2,4-D application (Parsons, et. al, 2001). In the Loon Lake study up to 98 percent of the Eurasian watermilfoil biomass in the treatment plots was removed after the July treatment. Environmental and human health impacts of 2,4-D are addressed in Ecology's risk assessment of 2,4-D at the following web address: http://www.ecy.wa.gov/biblio/0010043.html.

A few days after the 2,4-D treatment, observers will see the growing tips of milfoil plants twist and look abnormal. These plants will sink to the sediments usually within one to two weeks of treatment. Unless treatment takes place in dense beds of milfoil, it is unlikely for low oxygen conditions to develop. Results of spot treatment may be variable depending on water movement, size of treatment plot, density of milfoil, weather conditions, underwater springs, etc.

Follow-up:
Follow-up is essential to ensure the success of eradication. Used alone, 2,4-D is not an eradication tool. Some plants survive the treatment and regrow, so these plants must be removed by other means. Surveys done in Minnesota indicated that, 2,4-D use did not result in eradication of milfoil over the long-term (Crowell, 1999). Treated lakes for which there was no follow up survey work or treatment eventually ended up with milfoil throughout the littoral zone.

Follow-up is the key!
Once milfoil is discovered in a lake, it generally requires continual maintenance to keep it at low levels. Even if milfoil appears to have been eradicated it often is reintroduced by boaters. As long as the lake group continues surveying on a yearly basis, new introductions can be identified quickly and targeted for removal before milfoil can re-establish in the lake. In treated lakes where the lake group has continued diver and surface inspections, milfoil remains at extremely low levels, without impacts to habitat or recreational activities.

Appropriateness for the Lakes:
This herbicide is appropriate for use in the lakes and is one of the preferred aquatic plant control techniques within the recommended control scenario as described in the Integrated Treatment Action Plan. A DMA*4IVM® (2,4-D)® label and toxicity information is included in this appendix.

References:
Crowell, W.J. 1999. *Minnesota DNR tests the use of 2,4-D in managing Eurasian watermilfoil*. Aquatic Nuisance Species Digest. 3(4):42-46.

Parsons, Jenifer K.; K.S. Hamel, J.D. Madsen and K.D. Getsinger. 2001. *The Use of 2,4-D for Selective Control of An Early Infestation of Eurasian Watermilfoil in Loon Lake, Washington*. J. Aquat. Plant Manage. 39:117-125.

Endothall Treatment

Endothall (active ingredient) is a fast-acting contact herbicide (an herbicide that burns back the above-sediment vegetation, but doesn't kill the roots) that is believed to disrupt the plant biochemical processes at the cellular level. The dipotassium salt of endothall is used for aquatic plant control and is formulated as Aquathol® K (liquid) and Aquathol® Super K Granular. The Washington State Department of Ecology recently completed a risk assessment and an environmental impact statement for endothall. The risk assessment and the impact statement can be viewed at the following web address:
http://www.ecy.wa.gov/programs/wq/pesticides/seis/risk_assess.html.

Endothall has been used for years in Washington lakes to spot treat milfoil along shorelines because it is rapidly-acting, and when used at higher concentrations (2-3 parts per million (ppm) needs only a short contact time to remove milfoil vegetation. Recently, lower concentrations (1-1.5 ppm) of endothall have been used to treat milfoil in whole lake or littoral zone treatments. Milfoil can be controlled (vegetative growth removed) at 1 mg/l active ingredient endothall with an exposure time of 48 to 72 hours. At this concentration, endothall impacts some native plant species to a lesser degree (Skogerboe and Getsinger, 2001).

The benefit of using low levels of endothall is to remove exotic weeds like milfoil, while allowing native species to recover. While this is not an eradication technique, it may be useful for maintaining more acceptable levels of milfoil in a lake by periodically treating the littoral zone with low concentrations of endothall. It is possible that treatments can occur as infrequently as every three years. Ecology, along with the Department of Fish and Wildlife, and the endothall manufacturer, Cerexagri, is conducting a study on a small western Washington lake (Kress Lake) to determine the efficacy of using low levels of endothall to control milfoil.

Waterbodies suitable for endothall treatment:
Whole littoral zone treatment with endothall cannot be considered as an eradication method. Endothall will suppress the growth of milfoil and may allow native plants to recover and therefore increase species diversity within a lake. Lakes and ponds considered suitable for littoral zone treatment are heavily infested with Eurasian watermilfoil. This method may be used where it is considered too expensive, or the waterbody is too large to use milfoil eradication strategies.

Special considerations:
The endothall label has a three-day fish consumption restriction in the area of treatment and an irrigation and stock watering restriction for 14-days after treatment. Ecology advises waiting 24 hours after any herbicide treatment before swimming, although there is no official label restriction for swimming. Care must be taken with the application so that low oxygen conditions do not develop as plants decompose.

Any whole lake or widespread herbicide treatment, such as littoral zone endothall treatment should be conducted under an integrated aquatic vegetation management plan.

Description of the Kress Lake project, using endothall:
A detailed report about the treatment and sampling methodology and the results of the Kress Lake project can be seen in Ecology's Aquatic Plants Technical Assistance Program: 2001 Activity Report at the following web location: http://www.ecy.wa.gov/biblio/0203025.html. The information/data below were taken from that report. The project is still ongoing and additional data will be collected in August 2002 and June 2003.

Kress Lake, a 30-acre manmade lake in Cowlitz County, is a popular fishing lake with a nuisance population of milfoil. Kress Lake is owned and managed by Washington Department of Fish and Wildlife as a warm water fishery (bass, channel catfish, and sunfish) and has no inlet or outlet. Trout and surplus steelhead are also stocked into this landlocked lake. Prior to treatment, aquatic plants were found growing throughout the lake with milfoil as the dominant species. Both fishing and the fishery of the lake were being negatively impacted by the milfoil plants (Stacey Kelsey of Fish and Wildlife, personal communication). She reported that excessive vegetation was contributing to a stunted fish population, and milfoil mats, especially along the shoreline, were interfering with fishing. The endothall study was undertaken to see if a low concentration of endothall could selectively remove milfoil, increase species diversity, and improve fishing and the fishery.

On June 21, 2000, a state-licensed applicator applied Aquathol® K at rate of 1.5 ppm to ten acres around the edge of the lake. A second treatment took place a month later with an additional 10 acres treated from the shorelines toward the center of the lake using the same application rates.

Assessment of the treatment project is ongoing. Three months after treatment the endothall treatment reduced the frequency with which the vascular plants (flowering plants like milfoil) were found, while not affecting the macroalgae muskgrass (*Chara* sp.). During this period, vascular plants were reduced to the point of eliminating plant cover completely in locations throughout the lake. By one year after treatment and throughout that summer (June 2001 and September 2001) the frequency of muskgrass appeared to level-off while some of the vascular plants increased (e.g. waterweed, (*Elodea candensis*), milfoil (*M. spicatum*), and bladderwort (*Utricularia* sp.). This recovery appeared to fill in areas left bare of plants the previous summer. The pondweeds (*Potamogeton* sp.) did not appear to be rebounding.

Two species showed a significant change in their biomass before and after treatment. The biomass of waterweed (native plant species) increased significantly one year after treatment. About one third less milfoil biomass was collected after treatment (76 g/m^2 - before treatment versus 23 g/m^2 - one year after treatment).

The species list from each sample date shows that the species diversity was greatest in June 2001; one year after treatment. A total of 12 different plant types were present at that time. This is almost double the number found before the herbicide treatment. The number of plant types observed decreased to 9 by the September 2001 sampling event. This may have been due to sampling variability, increased dominance by a few species making locating less common species more difficult, or the seasonal die off of selected species.

Endothall (Aquathol K®) significantly reduced both the biomass and frequency of observation of milfoil, over the study period. However, by 1.3 years after treatment milfoil was showing a significant increase in frequency, so the duration of the control may be ending. The results also show an increase in overall submersed aquatic plant species diversity one year after treatment.

Although the June 2002 data have not been statistically analyzed, surprisingly milfoil did not appear to have increased in frequency or biomass when compared to the previous year (Kathy Hamel, personal observation).

General impacts of endothall treatment:
Generally endothall is used to spot treat areas and therefore impacts are not widespread. Using low levels over the lake littoral zone does cause adverse impacts in the short term, since many vascular plants are affected by the treatment. Within a few weeks of treatment, most plants in the treated area are brown and dropping from the water column. In Kress Lake, an algal bloom was observed a few weeks after the herbicide treatment. This may have been caused by the nutrients released from the decaying plants. (Note: an algal bloom was also observed in August 2002, although no herbicide treatment had taken place for two years. Many lakes are naturally nutrient-enriched.) Sampling ten weeks after treatment showed mostly dead and decaying plants lying along the bottom and bright green healthy muskgrass populations. A year after treatment, the native plant community was recovering, but milfoil, though present, did not dominate the plant population.

Fish and Wildlife staff have been pleased with the results, indicating that anglers are now able to fish without tangling their gear in milfoil.

Follow-up:
This is potentially a new method available for the control of milfoil in heavily infested lakes. The results from Kress Lake have been excellent. The lake was treated in 2000 and no further treatment was needed in 2001 or 2002. At this stage of assessment, we do not know how often the lake will need to be treated to continue the suppression of milfoil.

Appropriateness for the Lakes:
Endothall is considered appropriate for use in the lakes but is more costly than other aquatic herbicides available for Eurasian watermilfoil control. The use of this herbicide might be considered for future control efforts if the methods identified in the Integrated Treatment Action Plan are not deemed efficacious.

References:
Parsons, J., B. Dickes, and A. Fullerton, 2001. Aquatic Plants Technical Assistance Program: 2001 Activity Report. Washington Department of Ecology

Skogerboe, J.G. and K.D. Getsinger. 2001. *Endothall species selectivity evaluation: southern latitude aquatic plant community*. J. Aquat. Plant Manage. 39:129-135.

Diquat Treatment

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. The Washington State Department of Ecology recently completed a risk assessment and an environmental impact statement for endothall. The risk assessment and the impact statement can be viewed at the following web address:
http://www.ecy.wa.gov/programs/wq/pesticides/seis/risk_assess.html.

Waterbodies suitable for diquat treatment:
Treatments using diquat cannot be considered as a Eurasian watermilfoil eradication method. Diquat will suppress the growth of milfoil and most other native plants that receive treatment. Lakes and ponds considered suitable for diquat treatments are heavily infested with Eurasian watermilfoil. This method may be used where it is considered too expensive, or the waterbody is too large to use milfoil eradication strategies.

Although this product is categorized as a contact herbicide, diquat has been used in Hayden Lake, ID with some apparent systemic effect (Lamb, 2002). In this instance, Reward was applied by a diver or a "drop hose" to the lower third of plants in dense Eurasian watermilfoil beds. The diver used a wand and nozzle connected to a pressure tank onboard a nearby support boat to treat one acre, while the boat treatment involved holding the wand and nozzle down into the water while traveling across a two-acre bed. A follow-up diver inspection of these treatment areas one year later found only occasional Eurasian watermilfoil sprigs (new plants) in the diver-treated area and approximately one-half acre of live plants in the boat treatment area.

Diquat has slight toxicity to most animals and freshwater fish. It is slightly to 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, 2002b, c).

Special considerations:
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. Care must be taken with the application so that low oxygen conditions do not develop as plants decompose.

Any whole lake or widespread diquat herbicide treatment should be conducted under an integrated aquatic vegetation management plan.

General impacts of diquat treatment:
Generally diquat is used to spot treat areas and therefore impacts are not widespread. As with endothall, most plants in the treated area are brown and dropping from the water column in a few weeks. It should be noted that decaying plants release nutrients, and lakes or ponds treated over a large area may be susceptible to excessive algae growth.

Follow-up:
This aquatic plant control method was approved for use in Washington in 2003 and is potentially a new method available for the control of milfoil in heavily infested lakes. Several lakes in western Washington including Plummer and Battleground lakes were treated with diquat in 2003, mainly to control Brazilian elodea. Monitoring results from those lakes should provide information on plant control effectiveness and residual herbicide amounts in the water.

Appropriateness for the Lakes:
Reward (Diquat) is considered very appropriate for use at the lakes due to its effectiveness on Eurasian watermilfoil, rapid results, fewer restrictions than Endothall, and cost effectiveness compared with other aquatic herbicides. This is one of the preferred aquatic plant control techniques within the recommended control scenario as described in the Integrated Treatment Action Plan. A Reward® label and toxicity information is included in this appendix.

References:
Lamb, David. 2002. Integrated Aquatic Vegetation Management Plan for Sacheen Lake. Pend Oreille County, WA.

Washington Department of Ecology (WDOE). 2002b. Final Risk Assessment for Diquat Bromide. Publication No. 00-10-046. Olympia, WA.

Washington Department of Ecology (WDOE). 2002c. Final Supplemental Environmental Impact Statement Assessment for Diquat. Publication No. 00-10- 052. Olympia, WA.

Washington Department of Ecology (WDOE). 2003. Minor Permit Modification for Permit No. WAG-994000, Aquatic Nuisance Plant and Algae Control NPDES General Permit; and Permit No. WAG-993000, Aquatic Noxious Wee Control NPDES General Permit regarding Conditions for use of Diquat. Olympia, WA.

Developing Plant Control 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 Action 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 may 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. Tryclopyr 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.

The advantages of using Triclopyr include: selective for broad-leaf plants (e.g. milfoil), only requires a short contact time, is systemic and has potential for long-term control. Some disadvantages of Triclopyr are that it is costly compared to other herbicides and it is not currently approved for use in Washington.

Appropriateness for the Lakes:
Renovate® (triclopyr) would be appropriate for use in the lakes if approved for use in Washington. The current cost of this herbicide is substantially higher than other appropriate herbicides and control techniques. Triclopyr should be re-evaluated for use at the lakes if it is approved for use in Washington.

References:
SePRO Corporation. 2003a. Product label for Renovate® Aquatic Herbicide. Carmel, IN.

SePRO Corporation. 2003b. Product information for Renovate Aquatic Herbicide. Internet website: http://www.sepro.com/pdf_lit/aquatics/Renovate_FAB.pdf.

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.

Appropriateness for the Lakes:
This control method is not currently used in Washington State due to the uncertainty surrounding its efficacy. These lakes also have an overabundance of small fish, which likely would prey on the weevils and reduce their ability to control milfoil.

References:
Creed, R. P., and S. P. Sheldon. 1995. *Weevils and watermilfoil: did a North American herbivore cause the decline of an exotic plant?* Ecological Applications. 5:1113-1121.

APPENDIX C

PERMITTING AND AQUATIC HERBICIDE 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. It is important to note that this document is focused on the invasive aquatic weed Eurasian Milfoil and the necessary permits for various control options. This plant is included on the Washington State Noxious Weed List that is adopted by the state and local noxious weed boards.

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 Eurasian milfoil 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 life are observed in distress or a fish kill occurs, operations shall cease and both the Department 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. A simplified matrix of these permitting requirements is also provided at the end of this appendix, as well as information on specific aquatic herbicide controls for Eurasian milfoil.

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 aquatic plants including Eurasian milfoil. 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 milfoil 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 that are applicable to the management of Eurasian milfoil. 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 Eurasian Milfoil 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.html

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.	Eurasian milfoil control is 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.	Eurasian milfoil control is 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.	Eurasian milfoil control is 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.	Eurasian milfoil control is 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.	Eurasian milfoil control is 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.	Eurasian milfoil control is 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	Eurasian milfoil control is 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

AQUATIC HERBICIDE LABELS

Specimen Label

Dow AgroSciences™

DMA* 4 IVM

Herbicide

*Trademark of Dow AgroSciences LLC

Contains Dimethylamine Salt of 2,4-D†

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

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

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

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

EPA Reg. No. 62719-3

Keep Out of Reach of Children

DANGER PELIGRO

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

Precautionary Statements

Hazards to Humans and Domestic Animals

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

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

Personal Protective Equipment (PPE)

Applicators and other handlers must wear:

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

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

Engineering Controls Statements

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

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

User Safety Recommendations

Users should:

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

First Aid

If in eyes: Hold eye open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye. Call a poison control center or doctor for treatment advice.
If on skin or clothing: Take off contaminated clothing. Rinse skin immediately with plenty of water for 15-20 minutes. Call a poison control center or doctor for treatment advice.
If swallowed: Call a poison control center or doctor immediately for treatment advice. Have person sip a glass of water if able to swallow. Do not induce vomiting unless told to do so by the poison control center or doctor. Do not give anything by mouth to an unconscious person.
If inhaled: Move person to fresh air. If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably by mouth-to-mouth, if possible. Call a poison control center or doctor for further treatment advice.

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

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

Environmental Hazards

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

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

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

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

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

Directions for Use

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

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

Agricultural Use Requirements

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

Do not enter or allow worker entry into treated areas during the restricted entry interval (REI) of 48 hours.

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

- Coveralls
- Waterproof gloves
- Shoes plus socks
- Protective eyewear

Non-Agricultural Use Requirements

The requirements in this box apply to uses of this product that are NOT within the scope of the Worker Protection Standard for Agricultural Pesticides (40 CFR Part 170). The WPS applies when this product is used to produce agricultural plants on farms, forests, nurseries, or greenhouses.
Entry Restrictions for Non-WPS Uses: When this product is applied to non-cropland areas, non-crop turf, by tree injection method only in forest sites, and when applied in aquatic areas, do not allow people (other than applicator) or pets on treatment area during application. Do not enter into treated areas until sprays have dried.

Storage and Disposal

Do not contaminate water, food, or feed by storage or disposal.
Storage: Keep container tightly closed when not in use. If exposed to subfreezing temperatures, the product should be warmed to at least 40ºF and mixed thoroughly before using.
Pesticide Disposal: Pesticide wastes are toxic. Improper disposal of excess pesticide, spray mixture, or rinsate is a violation of Federal law and may contaminate groundwater. If these wastes cannot be disposed of by use according to label instructions, contact your State Pesticide or Environmental Control Agency, or the Hazardous Waste Representative at the nearest EPA Regional Office for guidance.
Container Disposal (Metal): Triple rinse (or equivalent). Then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or by other procedures approved by state and local authorities.
Container Disposal (Plastic containers 5-gals or less): Triple rinse (or equivalent). Then dispose of in a sanitary landfill, or by incineration, or, if allowed by local authorities, by burning. If burned stay out of smoke.
General: Consult federal, state, or local disposal authorities for approved alternative procedures.

General Information

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

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

General Use Precautions and Restrictions

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

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

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

Avoiding Injury to Non-target Plants

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

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

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

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

Spray Drift Management (Aerial Application)

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

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

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

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

Aerial Spray Drift Advisory Information

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

Controlling Droplet Size:

- **Volume-**Use high flow rate nozzles to apply the highest practical spray volume. Nozzles with higher rated flows 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 3/4 of the wingspan or rotor length may further reduce drift without reducing swath width.
- **Application-**Applications should not be made at a height greater than 10 feet above the top of the largest plants unless a greater height is required for aircraft safety. Making applications at the lowest height that is safe reduces exposure of droplets to evaporation and wind.

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

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

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

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

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

Mixing

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

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

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

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

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

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

Application

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

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

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

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

Rate Conversion Table for Spot Treatment:

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

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

Weeds Controlled

Annual or Biennial Weeds

Beggarticks †
Bittercress, smallflowered
bitterweed
broomweed, common †
burdock, common
buttercup, smallflowered †
carpetweed
cinquefoil, common
cinquefoil, rough
cocklebur, common
coffeeweed
copperleaf, Virginia
croton, Texas
croton, woolly
flixweed
galinsoga
geranium, Carolina
hemp, wild
horseweed (marestail)
jewelweed
jimsonweed
knotweed †
kochia
lambsquarters, common
lettuce, prickly †
lettuce, wild
lupines
mallow, little †
mallow, Venice †
marshelder
morningglory, annual
morningglory, ivy
morningglory, woolly
mousetail
mustards (except blue mustard)
parsnip, wild
Pennycress, field
Pepperweed †
pigweeds (Amaranthus spp.) †
poorjoe
primrose, common
purslane, common
pusley, Florida
radish, wild
ragweed, common
ragweed, giant
rape, wild
rocket, yellow
salsify, common †
salsify, western †
shepherdspurse
sicklepod
smartweed (annual species) †
sneezeweed, bitter
sowthistle, annual
sowthistle, spiny
spanishneedles
sunflower
sweetclover
tansymustard
thistle, bull
thistle, musk †
thistle, Russian (tumbleweed) †
velvetleaf
vetches

Perennial Weeds

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

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

Specific Use Directions

Forestry, and Non-cropland, Uses

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

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

Forestry Uses

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

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

Precautions and Restrictions:

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

Non-cropland Areas

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

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

Precautions and Restrictions:

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

Non-crop Turf Areas

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

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

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

Precautions, Restrictions:

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

Aquatic Uses

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

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

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

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

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

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

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

Application Rate: 2 to 4 qt/acre.

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

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

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

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

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

†DMA 4 IVM contains 3.8 lb of acid equivalent per gallon of product.

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

Precautions and Restrictions for Aquatic Use:

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

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.

*Trademark of Dow AgroSciences LLC

Dow AgroSciences LLC • Indianapolis, IN 46268 U.S.A.

EPA-accepted 10/13/2000

Label Code: D02-141-001

Initial Printing

MATERIAL SAFETY DATA SHEET

Emergency Phone: 800-992-5994
Dow AgroSciences LLC
Indianapolis, IN 46268

DMA* 4 IVM HERBICIDE

Effective Date: 2/8/01
Product Code: 84631
MSDS: 000246

1. PRODUCT AND COMPANY IDENTIFICATION:

PRODUCT: DMA* 4 IVM Herbicide

COMPANY IDENTIFICATION:
Dow AgroSciences
9330 Zionsville Road
Indianapolis, IN 46268-1189

2. COMPOSITION/INFORMATION ON INGREDIENTS:

2,4-D Dimethylamine Salt: 2,4-Dichlorophenoxyacetic Acid, Dimethylamine Salt	CAS# 002008-39-1	46.3%
Other Ingredients, Total, Including Dimethylamine	CAS# 000124-40-3	53.7%

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

3. HAZARDOUS IDENTIFICATIONS:

EMERGENCY OVERVIEW
Hazardous chemical. Brown liquid with an amine odor. May cause severe eye irritation with corneal injury. The LD_{50} for skin absorption in rabbits is >1000 mg/kg. The oral LD_{50} for rats is ~1000 mg/kg.
EMERGENCY PHONE NUMBER: 800-992-5994

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

EYE: May cause severe irritation with corneal injury, which may result in permanent impairment of vision, even blindness.

SKIN: Essentially non-irritating to skin. A single prolonged exposure may result in the material being absorbed in harmful amounts. The LD_{50} for skin absorption in rabbits is >1000 mg/kg.

INGESTION: Single dose oral toxicity is low. The oral LD_{50} for rats is ~1000 mg/kg. Small amounts swallowed incidental to normal handling operations are not likely to cause injury; however, swallowing larger amounts may cause injury.

INHALATION: Single exposure to vapors is not likely to be hazardous.

SYSTEMIC (OTHER TARGET ORGAN) EFFECTS: Excessive exposure may cause liver, kidney, and gastrointestinal and muscular effects. Signs and symptoms of excessive exposure may be nausea, vomiting, abdominal cramps, or diarrhea.

CANCER INFORMATION: 2,4-Dichlorophenoxyacetic acid did not cause cancer in laboratory animal studies.

TERATOLOGY (BIRTH DEFECTS): Birth defects are unlikely. Exposures having no effect on the mother should have no effect on the fetus. Did not cause birth defects in animals; other effects were seen in the fetus only at doses which caused toxic effects to the mother.

REPRODUCTIVE EFFECTS: Excessive dietary levels of 2,4-D acid have caused decreased weight and survival in offspring in a rat reproduction study.

4. FIRST AID:

EYES: Immediate and continuous irrigation with flowing water for at least 30 minutes is imperative. Prompt medical consultation is essential.

SKIN: Immediately flush skin with plenty of water while removing contaminated clothing and shoes. Get medical attention if symptoms occur. Wash clothing before reuse. Destroy and dispose of contaminated leather items (i.e. shoes, belts, or watchbands).

INGESTION: If swallowed, seek medical attention. Do not induce vomiting unless directed to do so by medical personnel.

INHALATION: Remove to fresh air if effects occur. Consult a physician.

NOTE TO PHYSICIAN: No specific antidote. Supportive care. Treatment based on judgment of the physician in response to reactions of the patient.

*Trademark of Dow AgroSciences

MATERIAL SAFETY DATA SHEET

Emergency Phone: 800-992-5994
Dow AgroSciences LLC
Indianapolis, IN 46268

Dow AgroSciences

DMA* 4 IVM HERBICIDE

Effective Date: 2/8/01
Product Code: 84631
MSDS: 000246

5. FIRE FIGHTING MEASURES:

FLASH POINT: 190°F (88°C)
METHOD USED: TCC
FLAMMABLE LIMITS
LFL: Not determined
UFL: Not determined

EXTINGUISHING MEDIA: Water fog

FIRE & EXPLOSION HAZARDS: Noxious fumes may be produced under fire conditions. Contain water from fire fighting to prevent entry to surface or ground water.

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

6. ACCIDENTAL RELEASE MEASURES:

ACTION TO TAKE FOR SPILLS/LEAKS: Absorb small spills in an absorbent material such as sawdust, sand or clay. Dike area of large spills and call Dow AgroSciences at 800-992-5994. Wear protective clothing and self-contained breathing apparatus if vapors are present. Do not use water to clean up.

7. HANDLING AND STORAGE:

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE: Keep out of reach of children. Harmful if swallowed or absorbed through skin. Causes severe eye irritation. Avoid contact with eyes, skin and clothing. Users should wash hands before eating, drinking, chewing gum, using tobacco, or using the toilet. Keep container tightly closed when not in use. Do not store below temperature of 25°F (-4°C). If frozen (crystallized), warm to 65-75°F (19-24°C) and re-dissolve before using by rolling or shaking the container. Store in a safe manner in original container only, in a cool, dry place. Reduce stacking height where local conditions can affect packaging strength. See product label for handling/storage precautions relative to the end use of this product.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION:

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

EXPOSURE GUIDELINE:
2,4-D Dimethyulamine Salt: None established; ACGIH TLV and OSHA PEL are 10 mg/M^3 for the acid.

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. When respiratory protection is required for certain operations, use a NIOSH approved air-purifying respirator for organic vapors.

SKIN PROTECTION: Use protective clothing impervious to this material. Selection of specific items such as gloves, boots, apron, faceshield, or full-body suit will depend on operation. Remove contaminated clothing immediately, wash skin areas with soap and water, and launder clothing before reuse. Items, which cannot be decontaminated, such as shoes, belts and watchbands, should be removed, destroyed and disposed of.

EYE/FACE PROTECTION: Use chemical goggles. Eye wash fountain should be located in immediate work area.

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

*Trademark of Dow AgroSciences

MATERIAL SAFETY DATA SHEET

Emergency Phone: 800-992-5994
Dow AgroSciences LLC
Indianapolis, IN 46268

Dow AgroSciences

DMA* 4 IVM HERBICIDE

Effective Date: 2/8/01
Product Code: 84631
MSDS: 000246

9. PHYSICAL AND CHEMICAL PROPERTIES:

BOILING POINT: >212°F (100°C)
VAPOR PRESSURE: 8.0 x 10-10 mmHg @ 25°C
VAPOR DENSITY: <1 water vapor
SOLUBILITY IN WATER: Infinite
SPECIFIC GRAVITY: 1.17 approx. @ 68/68°F (20°C)
APPEARANCE: Brown liquid
ODOR: Amine

10. STABILITY AND REACTIVITY:

STABILITY: (CONDITIONS TO AVOID) Stable under normal storage conditions. Avoid excessive heat.

INCOMPATIBILITY: (SPECIFIC MATERIALS TO AVOID) Acids and oxidizing materials.

HAZARDOUS DECOMPOSITION PRODUCTS: Hydrogen chloride and nitrogen oxide under fire conditions.

HAZARDOUS POLYMERIZATION: Not known to occur.

11. TOXICOLOGICAL INFORMATION:

MUTAGENICITY (EFFECTS ON GENETIC MATERIAL):
In-vitro mutagenicity studies were negative. For 2,4-D acid: animal mutagenicity studies were predominantly negative.

12. ECOLOGICAL INFORMATION:

ENVIRONMENTAL FATE:
MOVEMENT & PARTITIONING:
No bioconcentration is expected because of the relatively high water solubility.

DEGRADATION AND PERSISTENCE:
Biodegradation under aerobic static laboratory conditions is high (BOD20 or BOD28/ThOD >40%).
5-Day biochemical oxygen demand (BOD5) is 0.47 p/p.
10-Day biochemical oxygen demand (BOD10) is 0.50 p/p.
20-Day biochemical oxygen demand (BOD20) is 0.57 p/p.

ECOTOXICOLOGY:
Material is practically non-toxic to aquatic organisms on an acute basis (LC_{50} is >100 mg/L in most sensitive species).
Acute LC_{50} in fathead minnow *(Pimephales promelas)* is 707 mg/L.
Acute LC_{50} in pink shrimp *(Penaeus duorarum)* is >1000 mg/L.
Acute LC_{50} in rainbow trout *(Oncorhynchus mykiss)* is 377 mg/L.
Acute LC_{50} in bluegill *(Lepomis macrochirus)* is 387 mg/L.
Dietary LC_{50} in bobwhite *(Colinus virginianus)* is >4640 mg/L.
Dietary LC_{50} in mallard *(Anas platyrhynchos)* is >4640 mg/L.

13. DISPOSAL CONSIDERATIONS:

DISPOSAL METHOD: Wastes are toxic. Improper disposal of excess waste, spray mixture, or rinsate is a violation of federal law and may contaminate groundwater. If these wastes cannot be disposed of by use according to label instructions, contact your state pesticide or environmental control agency or the hazardous waste representative at the nearest EPA regional office for guidance.

14. TRANSPORT INFORMATION:

For DOT regulatory information, if required, consult transportation regulations, product-shipping papers, or contact your Dow AgroSciences 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.

*Trademark of Dow AgroSciences

U.S. REGULATIONS

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

CHEMICAL NAME	CAS NUMBER	CONCENTRATION
Dimethylamine	000124-40-3	1%

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

An immediate health hazard
A delayed health hazard
A fire hazard

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

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

CHEMICAL NAME	CAS NUMBER	LIST
Proprietary Ingredient	Proprietary	NJ3 PA1 PA3
Dimethylamine	000124-40-3	NJ1 NJ2 NJ3 PA1 PA3

NJ1=New Jersey Special Health Hazard Substance (present at > or = to 0.1%).
NJ2=New Jersey Environmental Hazardous Substance (present at > or = to 1.0%).
NJ3=New Jersey Workplace Hazardous Substance (present at > or = to 1.0%).
PA1=Pennsylvania Hazardous Substance (present at > or = to 1.0%).
PA3=Pennsylvania Environmental Hazardous Substance (present at > or = to 1.0%).

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

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) RATINGS:

Category	Rating
Health	3
Flammability	2
Reactivity	1

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

CHEMICAL NAME	CAS NUMBER	RQ	% IN PRODUCT
Dimethylamine	000124-40-3	1000	1%
Proprietary Ingredient	Proprietary	5000	3%

16. OTHER INFORMATION:

MSDS STATUS: New
Reference: DR-0115-0523
Replaces MSDS Dated: 4/14/99
Document Code: D03-141-001

The Information Herein Is Given In Good Faith, But No Warranty, Express or Implied, Is Made. Consult Dow AgroSciences for Further Information.

*Trademark of Dow AgroSciences

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, non-target 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.

Reward® and the Syngenta logo are trademarks of a Syngenta Group Company.

©2001 Syngenta

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

Reward® and the Syngenta logo are trademarks of a Syngenta Group Company.

©2001 Syngenta

Syngenta Crop Protection, Inc.
Greensboro, North Carolina 27409
www.syngenta-us.com

SCP 1091A-L2 0901
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

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

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†: N-(phosphonomethyl)glycine, isopropylamine salt	53.8%
Inert Ingredients	46.2%
Total Ingredients	100.0%

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

† 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 †
Dallisgrass	Trumpetcreeper ††
Fescue (tall)	Vaseygrass

† Johnsongrass is controlled at the higher rate.
†† 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 †	*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 ††	*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 † (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 † (5)	*Eriogonum fasciculatum*
Cascara † (20)	*Rhamnus purshiana*
Catsclaw †(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 † (20)	*Parthenocissus quinquefolia*
Dewberry (1)	*Rubus trivialis*
Dogwood (9)	*Cornus spp.*
Elderberry (3)	*Sambucus spp.*
Elm † (20)	*Ulmus spp.*
Eucalyptus, bluegum (10)	*Eucalyptus globulus*
Hasardia † (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 † (20)	*Robinia pseudoacacia*
Manzanita (20)	*Arctostaphylos spp.*

Maple, red † (13)	*Acer rubrum*
Maple, sugar (14)	*Acer saccharum*
Maple, vine † (20)	*Acer circinatum*
Monkey flower † (5)	*Mimulus guttatus*
Oak, black † (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 † (20)	*Quercus alba*
Persimmon † (20)	*Diospyros spp.*
Poison-ivy (15)	*Rhus radicans*
Poison-oak (15)	*Rhus toxicodendron*
Poplar, yellow † (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 † (9)	*Tamarix spp.*
Saltbush, sea myrtle (18)	*Baccharis halimifolia*
Sassafras (20)	*Sassafras aibidum*
Sourwood † (20)	*Oxydendrum arboreum*
Sumac, poison † (20)	*Rhus vernix*
Sumac, smooth † (20)	*Rhus glabra*
Sumac, winged † (20)	*Rhus copallina*
Sweetgum (7)	*Liquidambar styraciflua*
Swordfern † (20)	*Polystichum munitum*
Tallowtree, Chinese (17)	*Sapium sebiferum*
Thimbleberry (3)	*Rubus parviflorus*
Tobacco, tree † (5)	*Nicotiana glauca*
Trumpetcreeper (2)	*Campsis radicans*
Waxmyrtle, southern † (11)	*Myrica cerifera*
Willow (19)	*Salix spp.*

† 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.

*Trademark of Dow AgroSciences LLC

Dow AgroSciences LLC • Indianapolis, IN 46268 U.S.A.

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.
All trademarks herein are trademarks of Monsanto Company or its subsidiaries.

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)

This Material Safety Data Sheet (MSDS) serves different purposes than and DOES NOT REPLACE OR MODIFY THE EPA-APPROVED PRODUCT LABELING (attached to and accompanying the product container). This MSDS provides important health, safety, and environmental information for employers, employees, emergency responders and others handling large quantities of the product in activities generally other than product use, while the labeling provides that information specifically for product use in the ordinary course. Use, storage and disposal of pesticide products are regulated by the EPA under the authority of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) through the product labeling, and all necessary and appropriate precautionary, use, storage, and disposal information is set forth on that labeling. It is a violation of federal law to use a pesticide product in any manner not prescribed on the EPA-approved label.

Although the information and recommendations set forth herein (hereinafter "Information") are presented in good faith and believed to be correct as of the date hereof, MONSANTO Company makes no representations as to the completeness or accuracy thereof. Information is supplied upon the condition that the persons receiving same will make their own determination as to its suitability for the purposes prior to use. In no event will MONSANTO Company be responsible for damages of any nature whatsoever resulting from the use of or reliance upon information. NO REPRESENTATIONS OR WARRANTIES, EITHER EXPRESS OR IMPLIED, OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR OF ANY OTHER NATURE ARE MADE HEREUNDER WITH RESPECT TO INFORMATION OR TO THE PRODUCT TO WHICH INFORMATION REFERS.