Management Plan To Control Noxious and Nuisance Aquatic Plants in Big Bear Lake

SUBMITTED TO:

SANTA ANA REGIONAL WATER QUALITY CONTROL BOARD

SUBMITTED BY:

Big Bear Lake TMDL Task Force

In partial fulfillment of requirements specified in:

Task 6c in Resolution R8-2006-0023

February 25, 2010

Executive Summary

Big Bear Lake, located high in the San Bernardino mountains, is on California's list of impaired waterbodies due to excessive growth of nuisance and noxious aquatic plants such as Eurasian Watermilfoil. These invasive weeds crowd out native vegetation destroy aquatic habitat and interfere with recreational opportunities at the lake.

In order to control the amount of nutrients contributing to the excess growth of these non-native aquatic plant species, the Santa Ana Regional Water Quality Control Board adopted a Total Maximum Daily Load (TMDL) in 2006. The TMDL requires all the responsible agencies to develop and implement management strategies to eradicate the noxious and nuisance aquatic weeds and to reduce the concentration of nitrogen and phosphorus being discharged to the lake in the form of runoff from the surrounding watershed.

Specifically, the TMDL obligates the responsible agencies to prepare and submit an Aquatic Plant Management Plan by February 26, 2010. The plan must describe the techniques and technologies that will be used to eliminate Eurasian Watermilfoil from Big Bear Lake. The plan must also describe the intended approach for assuring adequate recovery of native aquatic vegetation in the lake and the methods that will be used to demonstrate acceptable progress toward meeting the targets identified in the TMDL.

Stakeholders in the Big Bear Lake watershed (e.g.: City of Big Bear Lake, County of San Bernardino, U.S. Forest Service, CalTrans, San Bernardino County Flood Control District, Big Bear Mountain Ski Resorts, Inc., and the Big Bear Municipal Water District) formed the Big Bear Lake TMDL Task Force to implement the TMDL requirements. Working cooperatively, they developed this APMP.

Big Bear Municipal Water District (BBMWD) has been working to eradicate invasive aquatic plants for many years. Initially relying on mechanical harvesting technology, BBMWD has recently shifted to using aquatic herbicides that targets only Eurasian Watermilfoil. This program has proven highly successful is now an integral part of BBMWD's long-term lake management strategy.

Rather than interfere with or duplicate the on-going weed control program, the stakeholders named in the TMDL have elected to partner with BBMWD. The Water District will continue to take primary responsibility for acquiring and applying appropriate aquatic herbicides to eradicate Eurasian Watermilfoil. The other Task Force agencies will be responsible to conduct the monitoring and submit the reports required to demonstrate that the weed control program is implementing the Aquatic Plant Management Plan as required by the TMDL.

It is envisioned that the Aquatic Plant Management Plan will be updated every three years in accordance with the Regional Board's TMDL review schedule. BBMWD will conduct annual reconnaissance surveys to determine when and where to apply aquatic herbicides. The other agencies named in the TMDL will document these efforts in an annual report and will perform a more comprehensive survey of aquatic vegetation every five years to evaluate progress toward meeting the long-term targets for macrophyte coverage in the lake. All of aforementioned responsibilities will be codified in a contract between the various stakeholders after the Regional Water Quality Control Board approves this Aquatic Plant Management Plan.

Acknowledgements

This plan was adapted from a similar document submitted to the Santa Ana Regional Water Quality Control Board in partial fulfillment of California grant agreement No. 04-204-558-0. The previous plan was prepared by

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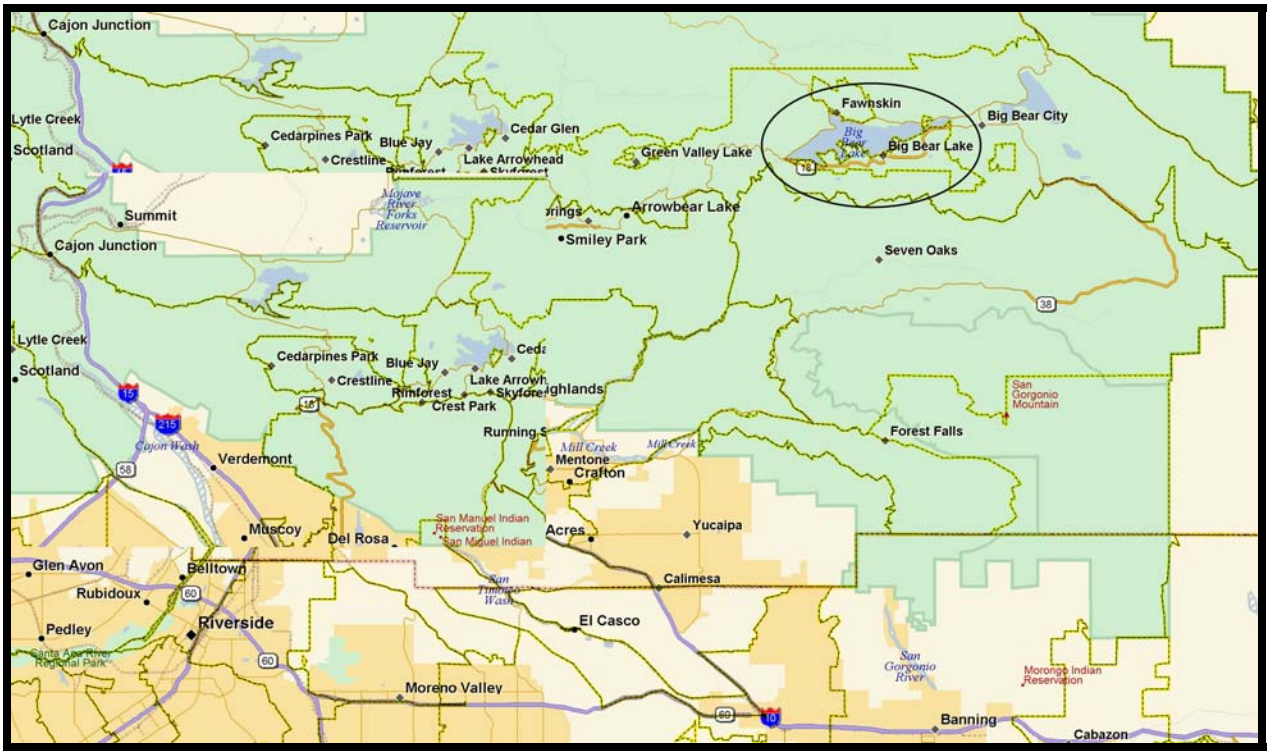
TABLE OF CONTENTS

1.0 INTRODUCTION

Big Bear Lake is a man-made irrigation reservoir that resulted from the construction of Bear Valley Dam in 1884. The reservoir is located in the San Bernardino Mountains of Southern California at an elevation of about 6,700 feet. Since 1977, when the Big Bear Municipal Water District ("District") was formed to stabilize water levels, the primary purpose of the lake has shifted to providing recreational opportunities and aquatic habitat. The District promotes and maintains various recreational amenities, including fishing, boating, swimming, skiing, aquatic habitat, wildlife sanctuary, water quality protection, flood control, shore patrol and other essential public services

Big Bear Lake in San Bernardino County, California



Native aquatic plant communities are an integral part of the lake environment as they provide food, shelter, and nesting sites for many fish, waterfowl and smaller animals. Rooted aquatic plants also stabilize shorelines, reduce sediment suspension, and improve water quality by absorbing excess nutrients from the water column (Gibbons, et al., 1999).

Invasive aquatic vegetation can create nuisance conditions by altering the structure of the lake's ecosystem. In particular, noxious freshwater weeds can crowd-out native plants thereby destroying aquatic habitat. Invasive plants spread rapidly and create dense monocultural canopies that result in decreased water mixing, reduced oxygen exchange and increase nutrient cycling (AERF, 2005). The scientific literature clearly supports the value of maintaining diverse aquatic and semi-aquatic ecosystems. A healthy community of native aquatic plants supports fish and wildlife by providing habitat, food, breading areas, water oxygenation and refuge from predators (AERF, 2005).

It is well-established that the excessive growth of invasive aquatic plants also impairs recreational opportunities in Big Bear Lake (TMDL Technical Report, 2005) . Large stands of noxious species such as Eurasian Water Milfoil and Coontail foul boat propellers, restrict access to shoreline swimming and interfere with sport-fishing activities.

Therefore, it is in the best interest of both the public and the environment to establish and implement a plan to reduce the adverse effects of nuisance and noxious aquatic plants in Big Bear Lake to the maximum extent practicable. The goal of this document is to describe that plan.

1.1 Objectives

In 1998, Big Bear Lake was added to California's list of impaired waterbodies due to excessive invasive aquatic plant species. The scientific evidence supporting this decision was summarized in a special study published by the Santa Ana Regional Water Quality Control Board in 1994.[1] Working collaborative with stakeholders throughout the watershed, the Regional Board initiated several years of intensive studies to better understand the relationship between water quality and the emergence of noxious aquatic plant species in Big Bear Lake.[2]

[1] Courtier, Michelle and Hope Smythe. 1994. Investigation of toxics and nutrients in Big Bear Lake. Santa Ana Regional Water Quality Control Board. Riverside, CA.
[2] Heather Boyd. 2005. Big Bear Lake Nutrient TMDL Technical Report. Santa Ana Regional Water Quality Control Board. Riverside, CA.

In 2006, the Regional Board adopted a Total Maximum Daily Load (TMDL) to protect the water designated beneficial uses in Big Bear Lake.[3] The TMDL established specific regulatory targets for the eradication of nuisance and noxious aquatic weeds. The TMDL also enacted targets for minimum acceptable levels of coverage by native plant species in the lake. (see Table 1).

Table 1: Big Bear Lake Nutrient TMDL Response Targets for Aquatic Plants

Indicator	Target Value
Macrophyte Coverage – (calculated as a five year running average based on measurements of peak macrophyte growth).	30-40% on a total lake area basis; to be attained by 2015 for dry hydrological conditions and by 2020 for all other hydrological conditions
Percentage of Nuisance Aquatic Vascular Plant Species - (calculated as a five year running average based on measurements of peak macrophyte growth).	95% eradication on a total area basis of Eurasian Watermilfoil and any other invasive aquatic plant species; to be attained no later than 2015 for dry hydrological conditions and by 2020 for all other hydrological conditions

The TMDL requires dischargers in the Big Bear Lake watershed to develop and implement a plan describing the specific means by which the aforementioned targets will be achieved. The plan must evaluate the applicability of various in-lake treatment technologies to control noxious and nuisance aquatic plants. The plan must include a description of the monitoring needed to track plant diversity, coverage and biomass. The plan must also describe how the resulting data will be used to assess compliance with the numeric targets identified in the TMDL.

[3] Santa Ana Regional Water Quality Control Board Resolution No. R8-2006-0023 Amending the Water Quality Control Plan for the Santa Ana River Basin to Incorporate a Nutrient TMDL for Dry Hydrological Conditions for Big Bear Lake.

In January, 2010 the Regional Board enacted similar requirements in the NPDES permit governing stormwater discharges in the Big Bear Lake watershed. That permit obligates the dischargers to submit a draft plan by February 26, 2010. This document is intended to fulfill that requirement.

The Aquatic Plant Management Plan (APMP) is one of several initiatives to improve water quality and protect beneficial uses in Big Bear Lake. Other plans and efforts are underway to reduce the internal and external nutrient loads that indirectly encourage the growth of invasive plant species. The focus of the APMP is on describing the more direct measures that will be used to eradicate nuisance and noxious aquatic weeds in the lake.

1.2 *Problem Statement*

Big Bear Lake is an important water supply reservoir and recreational resource. It is moderately productive in terms of nutrient concentration, planktonic algae, and vascular aquatic plants, both rooted and non-rooted. Until 2004, two aquatic macrophytes, Eurasian Watermilfoil (*Myriophyllum spicatum,* EWM) and Coontail (*Ceratophyllum demersum*) dominated the shorelines and littoral zone of Big Bear Lake and directly interfered with many of the lake's designated beneficial uses. Aquatic plant interference with recreational uses was evidenced by the number of calls received by the BBMWD from lake users and dock owners complaining about problems caused by aquatic plants. Prior to the summer of 2003, BBMWD staff indicated that the BBMWD received two to three phone calls each day during the summer from dock owners complaining about the presence of aquatic plants (Sheila Hamilton, personal communication). Examples of other problems reported included: 1) propellers of boats and jet skis entangled or clogged by aquatic plants, 2) swimmers entangled in aquatic plants and 3) fishing impeded by aquatic plants. The impact of excessive aquatic plant growth on other beneficial uses of the lake is more ambiguous. Dense aquatic macrophyte beds can negatively impact lake water quality characteristics (e.g., dissolved oxygen, temperature).

In the early 1970's, the noxious and invasive aquatic plant, Eurasian Watermilfoil, began to interfere with recreational uses of the lake. Although a native aquatic plant in California, Coontail was also deemed a nuisance and invasive plant species as it also developed into extremely dense stands in the lake. Both Eurasian Watermilfoil and Coontail continued to expand and displace the native/natural aquatic plant communities within the lake system. By the summer of 2000, an aquatic plant vegetation survey determined that 781 acres of the 2,971 surface acre lake exhibited excessive growth of EWM and Coontail (ReMetrix, 2001).

In 2002 and 2003, large-scale aquatic herbicide applications designed to target EWM and Coontail were successful in significantly reducing the aerial coverage and relative density of these aquatic plants. During the 2004 growing season, the prior aquatic herbicide treatments combined with extremely low lake levels (i.e., -17 feet below full pool) enabled Curlyleaf pondweed (*Potamogeton crispus)* to become the dominate plant within the lake. Then, in the winter of 2005, record amounts of rainfall delivered 39,000 acre-ft of water to Big Bear Lake and essentially re-filled the waterbody. However, an aquatic plant survey in 2005 discovered that EWM was re-establishing in many locations throughout Big Bear Lake. From these and other observations, it was concluded that EWM as well as other aquatic plants may require a continuous management program in order to protect the beneficial uses of the lake. Since then, annual surveys indicate that regular herbicide treatments have reduced Eurasian Water Milfoil to 288 acres in 2008 and 183 acres in 2009.

The short-term aquatic plant control/management efforts are specifically directed at Eurasian Watermilfoil. The long-term aquatic plant management goals will include efforts to support recolonization of the lake by native plant species. The primary means by which re-vegetation will occur is through the use of aquatic herbicide application(s) to control the overgrowth of noxious aquatic plant species. Modern herbicides are highly selective and target only the EWM without harming desirable native species. This will provide the space necessary for the recovery of native aquatic plant species.

2.0 BACKGROUND

This section provides an overview of the nuisance and noxious aquatic plants recently and historically observed in and around Big Bear Lake, the historical aquatic plant management efforts, a waterbody description of Big Bear Lake, and a discussion of recent lake water quality status.

2.1 Aquatic Plant Species in Big Bear Lake

According to Leidy (2006), the historical record indicates that several aquatic plants, including both Eurasian Watermilfoil and Coontail, were common in Bear Valley Reservoir (now Big Bear Lake) prior to and during the height of resort development in the valley. Specifically, Parish (1917) noted that Eurasian Watermilfoil and Coontail were present in abundance. The shallow impoundment that comprised the Bear Valley Reservoir created optimum conditions for the dispersal of aquatic plants. Therefore, the expansion of aquatic macrophytes occurred long before there was any significant development in the watershed (Leidy, 2005).

A 1979 report by the California Department of Fish & Game provides early documentation regarding the aquatic plant species observed and the overall status of aquatic plants in Big Bear Lake (Siegfried *et al*., 1979). In the 1977 to 1978 time period, a total of eight (8) aquatic plant species were identified in Big Bear Lake. With the exception of Eurasian Watermilfoil and Curlyleaf Pondweed, each of the aquatic plant species identified were considered native to Southern California (Hickman, ed., 1993). Table 2 provides a list of the species identified and where reported, the corresponding dry biomass measurements made. The report indicates that in the 1970's, Eurasian Watermilfoil (*Myriophyllum spicatum*) and Coontail (*Ceratophyllum demersum*) were present in Big Bear Lake in abundance. The study did not include a quantitative biomass evaluation of Coontail, but clearly stated that <u>at that time</u> Coontail dominated the aquatic macrophyte community of the lake over all other species (Siegfried *et al*., 1979).

TABLE 2. 1977-1978 AQUATIC PLANT SPECIES AND BIOMASS IN BIG BEAR LAKE

Species	Common Name	Dry Biomass (g/m^2)	Native or Exotic (c)
Ceratophyllum demersum	Coontail/Hornwort (a)	Most Abundant (b); Biomass not Measured	Native
Potamogeton filiformis	Slender-leaved pondweed (a)(d)	304.2	Native to California, but not native to Bear Valley
Elodea Canadensis	American elodea (a)	114.8	Native
Myriophyllum spicatum	Eurasian Watermilfoil	74.7	Exotic. Native to Eurasia
Myriophyllum sibiricum	Northern Water Milfoil (a)	Identified in the Report; Biomass not Measured	Native to California, but not native to Bear Valley
Potamogetan crispus	Curlyleaf pondweed	47.5	Exotic. Native to Eurasia
Polygonum amphibium var. emersum	Swamp knotweed (a)	Not Identified in the Report	Native
Polygonum amphibium var. stipulaceum	Smartweed	Identified in the Report; Biomass not Measured	Native

Notes:
(a) These plants are considered native aquatic plant species in Southern California (Jepson Manual), but not necessarily Bear Valley.
(b) Was observed as the most abundant aquatic plant in Big Bear Lake, although no attempt to measure biomass were made.
(c) Re-created and referenced from Table 3 in Leidy (2006).
(d) Leidy (2006) proposed a possibility for mis-identification of *Potamogeton filiformis*.

A 2005 aquatic plant survey conducted by AquaTechnex, LLC in Big Bear Lake identified the following aquatic plant species and relative abundance (see Table 3):

TABLE 3. 2006 AQUATIC PLANT SPECIES AND RELATIVE DISPERSION IN BIG BEAR LAKE

Species	Common Name	Relative Dispersion	Native or Exotic (b)
Ceratophyllum demersum	Coontail/Hornwort (a)	1 of 300 pts	Native
Potamogeton filiformis	Slender-leaved pondweed (a)(c)	97 of 300 pts	Native to California, but not native to Bear Valley
Elodea canadensis	American elodea (a)	6 of 300 pts	Native
Myriophyllum spicatum	Eurasian Watermilfoil	Found in the lake, but not reported with native plant survey results.	Exotic. Native to Eurasia
Myriophyllum sibiricum	Northern Milfoil (a)	Not observed, but potentially also present in Big Bear Lake	Native to California, but not native to Bear Valley
Potamogetan crispus	Curlyleaf pondweed	16 of 300 pts	Exotic. Native to Eurasia
Polygonum amphibium var. emersum	Swamp knotweed (a)	Not observed by the survey	Native
Polygonum amphibium var. stipulaceum	Smartweed (a)	56 of 300 pts	Native
*Chara sp. (*d*)*	Chara	27 of 300 pts	Native/ Macro-algae

Notes:
(a) These plants are considered native aquatic plant species in California (Jepson Manual), but not necessarily Bear Valley.
(b) Re-created and referenced from Table 3 in Leidy (2006).
(c) Leidy (2006) suggested a possibility for mis-identification.
(d) Chara is not a vascular aquatic plant, but is a macro-algae.

The 2005 aquatic plant survey indicates that the same aquatic plant taxa present in Big Bear Lake almost three decades ago are still present today. However, the early aquatic herbicide applications (i.e., those in 2002 and 2003) and the water level fluctuations (2004 vs. 2005) shifted the relative abundance of certain aquatic plant species. This shift was the desired outcome of the aquatic herbicide applications.

A recent report by Leidy (2006) suggests that some ambiguity regarding species composition exists. Specifically, Leidy (2006) indicates that a mis-identification may have occurred for the *Potamogetan filiformis* (Slender-leaved pondweed). Using the Jepson Manual, the Leidy report (2006) also identifies two other species of pondweeds that are native to the Bear Valley (i.e., *Potamogeton natans* and *Potamogeton pectinatus*), but which were not noted by the Siegfried *et al*., 1979 study or the 2005 AquaTechnex, LLC survey. Additionally, Leidy's research and review of historical documents infers that Northern Water Milfoil (*Myriophyllum sibiricum*) could potentially be present in Big Bear Lake. Finally, there also appears to be some potential confusion regarding the variety of *Polygonum amphibium* (Swamp knotweed vs. Smartweed) found in Big Bear Lake. According to Leidy (2006), both varieties are potentially present. The observations of Leidy (2006) suggests that historically there is potentially some uncertainty about aquatic plant species identification, however, this plan will resolve these problems by providing for the collection of voucher samples in conjunction with the aquatic plant monitoring efforts.

Coontail and the exotic species, Eurasian Watermilfoil, have been present in Big Bear Lake since the early 1900's. Coontail and EWM have been present in nuisance and invasive densities since the 1970's. Prior to aquatic herbicide applications, aquatic plant monitoring efforts and aquatic plant harvesting records indicated that the percent dominance of EWM had substantially increased from 1978 to 2001. Aquatic herbicide applications in 2002 and 2003 specifically targeted EWM and Coontail and reduced their percent dominance relative to other aquatic plants. Other aquatic plant taxa can be important indicators of stressed or recovering conditions, particularly the pondweeds (*Potamogeton* spp.) and waterweeds (*Elodea canadensis*). According to the Jepson Manual (Hickman, ed., 1993), *Potamogeton crispus* is "uncommon" in California and must be considered non-native. Curlyleaf pondweed is more indicative of eutrophic conditions, compared to the other pondweed species and often attains nuisance densities in lake in which it becomes established (Dr. Mary Ellen Harris, personal communication).

The recently identified (2005) submersed aquatic plant communities throughout Big Bear Lake are presently limited to the presence of only six different species of aquatic plants. Submersed aquatic macrophytes included: 1) Eurasian Watermilfoil, 2) Coontail, 3) American Elodea (*Elodea canadensis*), 4) Curlyleaf Pondweed (*Potamogeton crispus*), 5) Slender-leaf Pondweed (*Potamogeton filiformis*) and 6) Smartweed (*Polygonum amphibium var. stipulaceum)*. Waterstargrass has been identified in the recent past (2001, 2002), but was not identified by the 2005 aquatic plant survey. A list of emergent and aquatic plants in and around Big Bear Lake is provided from the plant species list provided by Leidy (2006) in Attachment 1 of this document. It is expected that similar comprehensive surveys will be needed approximately every 5 years to reassess the relative abundance of desirable and undesirable aquatic plant species.

2.2 Historical Aquatic Plant Management Efforts

Beginning in the early 1980's, the Big Bear Municipal Water District (BBMWD) implemented an Aquatic Plant Harvesting Program to control problems resulting from excessive aquatic plant growth. At the height of the aquatic plant harvesting program, the BBMWD operated up to four aquatic weed harvesters and one Aquamog for the purposes of removing aquatic weeds from the lake during the growing season (i.e., from May to September). The Aquatic Plant Harvesting Program could cut and maintain a maximum of approximately 240 to 250 acres of aquatic plants each growing season. Each harvester could hold two to three tons (wet weight) of harvested aquatic plants per trip so that a range of 1,500 to 4,500 wet tons of plant material would be mechanically removed from Big Bear Lake each year. Harvesting efforts were focused in areas of high recreational use, such as public boat launch ramps and private docks.

As time passed, it became apparent that harvesting efforts were no longer sufficient to protect the lake's recreational beneficial uses directly affected by the non-native and nuisance aquatic macrophytes (EWM and Coontail). By the year 2000, the BBMWD harvesting records indicated that the combined presence of Eurasian Watermilfoil and Cootail constituted 94 percent of the total aquatic plant biomass found in the lake. Further, these aquatic plants occupied 781 acres of the lake's littoral zone, which is approximately 91 percent of the entire littoral zone and more than 25 percent of the total surface area (normalized to full pool) of Big Bear Lake (ReMetrix, 2001). Note: For purposes of this estimation, the total littoral zone area is assumed to be 850 acres of lake bottom for water depths ranging from 0 to 18 feet at full pool.

The littoral zone is defined as “the shallow zone along the shore of a lake; that portion of a water body extending from the shoreline lakeward to the greatest depth occupied by rooted aquatic plants” (Holdren, C., W. Jones, and J. Taggart. 2001). Recent hydroacoustic aquatic plant data clearly showed that aquatic plants in Big Bear Lake occupy water depths from 0 to 18 feet, and that the most dense stands of aquatic macrophytes are located in water depths ranging from 0 to 10 feet. Additionally, in 2002, estimates of average aquatic plant biomass were high, ranging from 306 g/m^2 to 651.9 g/m^2 during the growing season. Again, nearly all of this biomass was due to the dense stands of either EWM and/or Coontail.

The BBMWD understood that an alternative means of reducing the excessive growth of non-native (i.e., Eurasian Watermilfoil) and nuisance (i.e., Coontail) aquatic plant species could be achieved by the proper use of an aquatic herbicide. Application of an aquatic herbicide would result in a substantial reduction in the biomass of the targeted non-native and nuisance aquatic plants. In 2002, the BBMWD initiated a campaign to reduce the presence of Eurasian Watermilfoil (*Myriophyllum spicatum*) and Coontail (*Ceratophyllum demersum*) through aquatic herbicide applications to select areas of Big Bear Lake. The aquatic herbicide treatment technology selected was a fluridone-based aquatic herbicide formulation known as SONAR®.

The 2002 Aquatic Herbicide Application treated a total of 270 littoral zone acres of Eurasian Watermilfoil and Coontail. The 2003 Aquatic Herbicide Application treated an additional 144 littoral zone acres of these same plants, for a total of 414 acres treated in two consecutive years. Additionally, aquatic macrophyte hydroacoustic survey data and biomass samples were collected both prior to and after aquatic herbicide applications so that treatment success could be evaluated. Unfortunately, these aquatic plant monitoring data were generally limited to only herbicide-treated areas of the lake.

Pre- and post-treatment assessments of aquatic plant biomass surveys were performed within the aquatic herbicide treatment areas. These pre- and post-treatment vegetation assessments demonstrated the success of aquatic plant herbicide applications in treated areas of Big Bear Lake. As mentioned previously, the results indicated that plant species composition did not change much in a short-term period, despite vegetation control measures and water level changes. However, the changes in biomass and percent dominant plant species (by dry weight) were dramatic for pre- and post-treatment comparisons. The overall biomass of the invasive and nuisance species decreased by at least 85 percent within all herbicide treatment areas. The exotic species, the EWM, and the nuisance species, Coontail were clearly the dominant species prior to treatment, and the least dominant post-treatment. Increases in the presence and biomass of the Curlyleaf Pondweed (*Potamogeton crispus*) were observed in 2004 (319h Report, 2004). However, Curlyleaf Pondweed is also an exotic, non-native aquatic macrophyte. In addition, a 2005 lake-wide survey of aquatic plants discovered that EWM was still present in Big Bear Lake and that its re-growth was occurring in many areas of the lake.

This discovery led the BBMWD to conclude that efforts to eradicate and control EWM must be continued into the future. Since 2008, a new herbicide (Renovate OTF) has proven to be effective to reduce dense stands of Eurasian Water Milfoil. During the summer of 2009, 183 surface acres were treated and the nuisance plant conditions were eliminated for the remainder of the recreational season. Additional control measures may be needed to prevent some native species, such as Coontail, from creating nuisance conditions.

2.3 Big Bear Lake Watershed and Lake Characteristics

The Big Bear Lake watershed drainage basin encompasses 37 square miles of area and includes Big Bear Lake as well as 10 to 20 ephemeral or perennial streams. Precipitation, in the form of snowfall, rainfall, and surface runoff is the sole source of water supply to the watershed, and therefore, to the lake. Due to a strong rain shadow effect, precipitation varies significantly across the Big Bear Lake watershed with the western end of the watershed receiving an average of 36 inches a year, while the eastern end receives an average of 12 inches a year.

The United States Forest Service (USFS) is the largest landowner in the Big Bear Lake watershed. In addition to USFS lands, other dominant land uses identified for the watershed include resort, residential, and high density urban. Table 4 provides a detailed distribution of land uses (with pervious and impervious areas) within the watershed.

TABLE 4. Impervious & Pervious Land Use Distributions in the Watershed (a)

Land Use	Impervious	Pervious	Total	% of Watershed
Forest North (b)	38 ac.	7,595 ac.	7,633 ac.	33
Forest South (b)	35 ac.	6,876 ac.	6,911 ac.	30
Resort	35 ac.	669 ac.	704 ac.	3
Residential	580 ac.	3,287 ac.	3,867 ac.	17
HDU (c)	644 ac.	644 ac.	1,288 ac.	6
Watershed contributory area	1,302 ac.	19,071 ac.	20,403 ac.	88
Big Bear Lake	-	-	2,808 ac.	12
Total Watershed	1,332 ac.	19,071 ac.	23,211 ac.	100

Notes:
(a) Re-created from the Nutrient TMDL Document (Regional Board, 2005).
(b) Forest North refers to forested land facing north, while Forest South refers to forested land facing south.
(c) HDU = High Density Urban

Big Bear Lake is approximately 7 miles in length (depending on water level) and approximately 0.5 mile in width. The length of the waterbody is oriented in a west-east direction. During maximum (full) pool, water level of the lake has a surface elevation of 6,743.2 ft, a water surface area of approximately 2,971 acres and maximum lake storage of about 73,320 acre-feet (af). A summary of lake characteristics is given in Table 5.

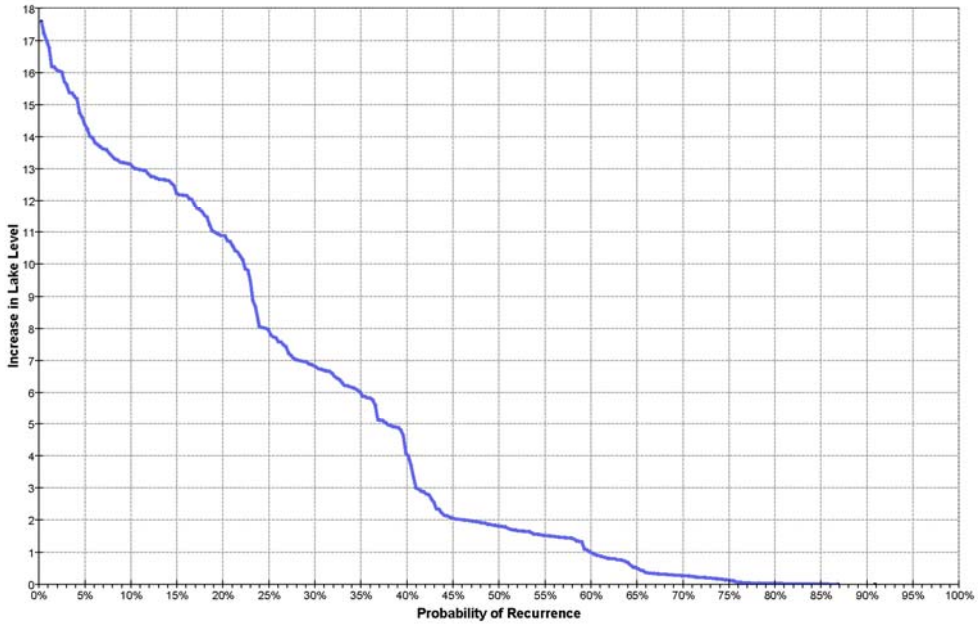
TABLE 5. Big Bear Lake Characteristics (a)

Lake Elevation	6,743.2 feet
Lake Length	7 miles
Average Lake Width	0.5 miles
Shoreline	22 miles
Maximum Depth at Dam	72.33 feet
Maximum Lake Storage Capacity	73,320 acre-feet
Mean Depth at Maximum Pool	24.7 feet
Average Lake Storage Capacity	58,500 acre-feet/year
Mean Depth at Average Pool	19.7 feet
Big Bear Valley Length	12.5 miles
Average Inflow	17,300 acre-feet/year
Average Outflow at Dam	5,510 acre-feet/year
Average Evaporation Rate	11,300 acre-feet/year
Hydraulic Retention Time (b)	11 years

Notes:
(a) Re-created from the Nutrient TMDL Document (Regional Board, 2005).
(b) HRT = average lake storage capacity/average outflow at dam.

Eighty percent of the time, the Big Bear Lake water level is less than five feet down from full pool (see Fig. 1).[4] In average rainfall years, the lake level is maintained so that it fluctuates no more than plus or minus 5 feet. But, during prolonged drought periods, the lake level can drop as much as 17 feet below full pool.

Fig 1: Lake Level Recurrence Frequency



[4] Big Bear Watermaster. 2008. Thirty-second annual report for calendar year 2008. Redlands, CA

2.4 Big Bear Lake Water Quality

Research literature indicates that aquatic plants play a role in nutrient cycling in lakes and reservoirs. Barko and James (1997) have stated that submerged macrophytes are unique among rooted aquatic vegetation because they link the sediment with overlying water and that this linkage has important implications for nutrient cycling. Given the ecological significance of nitrogen and phosphorus in aquatic systems and the importance of sediment in supplying nitrogen and phosphorus to submerged macrophytes, it is potentially important to consider the effects of macrophyte growth on the availability of nutrients as well as their significance as a nutrient source and nutrient sink within the system. The available water quality data for Big Bear Lake are briefly summarized below. Although it is not the intent of this Plan to address the relationship between water quality and aquatic macrophytes, the water quality data are described herein to provide a basic overview of water quality conditions within Big Bear Lake. Therefore, this summary is provided for informational purposes only.

More intensive water quality monitoring of Big Bear Lake was initiated in June 2001. At that time, the water level and corresponding water volume of Big Bear Lake were in a state of decline. Due to an extended period of drought in Southern California, lake water levels steadily declined from June 2001 until approximately November 2004. In June of 2001, lake level was about 7.0 ft below full pool (lake surface elevation of 6,743 feet). By the end of August 2002, lake level was almost 13 ft below full pool, and at the end of August of 2003, lake level decreased to 14 ft below full pool. By the end of the summer of 2004, lake levels had decreased to approximately 17 ft below full pool. Decreasing lake levels affected lake water quality measurements as constituents became more concentrated in the available water volume. Then, in the winter of 2004-2005, record amounts of rain fell within the Big Bear Lake watershed and an estimated 39,600 acre-ft of water inflow was received by Big Bear Lake. At the end of the summer of 2005, water level was restored to approximately only 3 ft below full pool and a water volume of 64,275 acre-ft, respectively. The immense water volume received by the lake served to dilute water quality constituent concentrations.

Concurrent with lake water level fluctuations, the BBMWD was conducting lake management activities that also had an effect on lake water quality. In 2002 and 2003, aquatic herbicide applications were performed that substantially reduced the aquatic plant biomass in Big Bear Lake. Then in 2004, a full-scale alum application was conducted. The full-scale alum application was employed as a direct phosphorus mitigation measure to both bind and precipitate bio-available phosphorus in the water column and to control the release of nutrient phosphorus from the lake sediments. The impact and effectiveness of the full-scale alum treatment on sediment nutrient release rates and water quality concentrations were described in the report entitled, *Big Bear Lake 2004 Full-Scale Alum Application* (BBMWD, June 2005) and again re-described in the sediment report prepared by Anderson and Wakefield-Schmuck (2006).

In Big Bear Lake, water quality monitoring is conducted at established open-water main lake sampling stations. The water quality station identifications and sample types for Big Bear Lake are as follows:

- Dam – MWDL1 or TMDL Site No. 1 – Photic Zone Composite
- Dam – MWDL1 or TMDL Site No. 1 - Discrete bottom
- Gilner Point – MWDL2 or TMDL Site No. 2 – Photic Zone Composite
- Gilner Point – MWDL2 or TMDL Site No. 2 - Discrete bottom
- Mid Lake Middle – MWDL6 or TMDL Site No. 6 – Photic Zone Composite
- Mid Lake Middle – MWDL6 or TMDL Site No. 6 - Discrete bottom
- Stanfield Middle – MWDL9 or TMDL Site No. 9 – Photic Zone Composite
- Stanfield Middle – MWDL9 or TMDL Site No. 9 - Discrete bottom

Water quality data collected during the extended drought which ended in the winter of 2004-5 reflect what is considered to be a critical condition of the lake from a management perspective. Decreasing lake levels affected lake water quality measurements as constituents became more concentrated in the water volume due to the combined influence of evaporation, sediment-water recycling, and decreased flushing rate.

Water quality in Big Bear Lake varies spatially and seasonally. Spatially, the highest median levels of total phosphorus, total nitrogen, chlorophyll *a*, total suspended solids (TSS), volatile suspended solids (VSS), and pH were observed at the shallow, eastern end of the lake. In contrast, the highest median total dissolved nitrogen, ammonia-nitrogen and nitrate-nitrite levels were generally observed in the deeper, western end of the lake. These spatial trends were observed for 2001, 2002, and 2003 water quality data. The observed spatial trends for the water quality constituents appear to generally correspond with prevailing lake conditions. At the eastern end of the lake, the higher levels of total phosphorus, total nitrogen, chlorophyll a, TSS, VSS, and pH were likely attributed to the presence of shallower water, a greater degree of vertical mixing resulting in increased entrainment of nutrients and sediment re-suspension, which in turn give rise to more eutrophic conditions. The reverse spatial trend in median ammonia-nitrogen and nitrate-nitrite levels are attributed to the higher sediment release rates for ammonia-nitrogen in the deeper lake waters due to the focusing of degradable material near the dam (Kirby, 2005). Interpretation of lake water quality data for 2004 was affected by conduct of the full-scale alum application on the lake. The 2004 full-scale alum treatment involved the application of liquid aluminum sulfate to over 1,300 acres of lake surface area. Sediment nutrient release rates (sediment flux rates) strongly indicate that the alum treatment was successful in reducing the release of phosphorus from lake sediments. The more recent water quality data (2004 and 2005) demonstrate the influence of water volume on several of the nutrient water quality parameters measured. In photic zone samples, total and dissolved phosphorus as well as total nitrogen and total dissolved nitrogen were almost 50 percent lower in 2005 (lake water volume 60,000+ acre-feet) compared to the levels observed in 2004 (lake water volume ~30,000 acre-feet). Tables 6 and 7 present a summary of the growing season median nutrient results for Big Bear Lake. Although, the influence of water volume is not always clearly evident, it should be kept in mind that many other variables might be impacting the interpretation of water quality results. For example, a comparison of the 2003 and 2004 growing season median level for phosphorus forms, in light of water volume, is not possible since the full-scale alum application occurred in 2004. Additionally, nutrient water quality concentrations may have been influenced by the presence and/or absence of aquatic plants and the degree of water inflow for a preceding winter. Lake water quality data collected in 2005 reflects the water quality condition of Big Bear Lake under almost full pool conditions, one year after an alum application.

TABLE 6. GROWING SEASON MEDIAN PHOSPHORUS LEVELS (NEEDS UPDATE)

PARAMETERS	Units	August Lake Vol. (acre-ft)	In-Lake Main Sites	Main In-Lake TMDL Stations			
				Dam Site No. 1	Gilner Pt. Site No. 2	Mid-Lake Site No. 6	Stanfield Site No. 9
Photic Zone Samples							
May - October							
2001 - Total Phosphorus	µg/L	50,742	57.0	43.0	41.0	55.0	66.0
2002 - Total Phosphorus	µg/L	39,943	40.0	37.0	37.0	47.0	64.0
2003 - Total Phosphorus	µg/L	37,219	64.0	54.0	63.0	67.0	102.0
2004 - Total Phosphorus	µg/L	31,750	60.0	48.5	52.5	61.0	100.5
2005 - Total Phosphorus	µg/L	64,275	37.5	31.0	31.5	33.5	52.0
2001 - Dissolved Phosphorus	µg/L	50,742	19.5	24.0	16.0	21.0	17.0
2002 - Dissolved Phosphorus	µg/L	39,943	17.5	17.0	17.0	19.0	18.0
2003 - Dissolved Phosphorus	µg/L	37,219	28.0	28.0	28.0	30.0	28.0
2004 - Dissolved Phosphorus	µg/L	31,750	23.5	22.5	23.5	24.0	33.0
2005 - Dissolved Phosphorus	µg/L	64,275	12.0	11.0	11.0	11.5	18.5
2001 - Orthophosphate (PO_4-P)	µg/L	50,742	6.5	5.0	8.0	7.0	6.0
2002 - Orthophosphate (PO_4-P)	µg/L	39,943	5.0	5.0	6.0	5.0	1.5
2003 - Orthophosphate (PO_4-P)	µg/L	37,219	5.5	7.0	7.0	4.0	4.0
2004 - Orthophosphate (PO_4-P)	µg/L	31,750	3.0	1.5	1.5	2.3	3.0
2005 - Orthophosphate (PO_4-P)	µg/L	64,275	5.0	4.5	4.5	5.0	6.0

TABLE 7. GROWING SEASON MEDIAN NITROGEN LEVELS (NEEDS UPDATE)

PARAMETERS	Units	August Lake Vol. (acre-ft)	In-Lake Main Sites	Main In-Lake TMDL Stations			
				Dam Site No. 1	Gilner Pt. Site No. 2	Mid-Lake Site No. 6	Stanfield Site No. 9
Photic Zone Samples							
May - October							
2001 - Total Nitrogen	µg/L	50,742	1,192	1,016	1,073	1,195	1,288
2002 - Total Nitrogen	µg/L	39,943	1,114	1,065	1,078	1,133	1,266
2003 - Total Nitrogen	µg/L	37,219	1,364	1,292	1,363	1,470	1,679
2004 - Total Nitrogen	µg/L	31,750	1,426	1,354	1,395	1,467	1,631
2005 - Total Nitrogen	µg/L	64,275	845	797	805	849	920
2001 - Dissolved Nitrogen	µg/L	50,742	876	916	868	869	882
2002 - Dissolved Nitrogen	µg/L	39,943	918	918	903	932	958
2003 - Dissolved Nitrogen	µg/L	37,219	1,065	1,100	1,052	1,071	1,093
2004 - Dissolved Nitrogen	µg/L	31,750	1,126	1,125	1,147	1,121	1,128
2005 - Dissolved Nitrogen	µg/L	64,275	676	664	662	663	689
2001 - Nitrate-Nitrite	µg/L	50,742	5.0	8.0	5.0	2.5	2.5
2002 - Nitrate-Nitrite	µg/L	39,943	2.5	2.5	2.5	5.0	2.5
2003 - Nitrate-Nitrite	µg/L	37,219	2.5	2.5	2.5	2.5	2.5
2004 - Nitrate-Nitrite	µg/L	31,750	2.5	3.8	2.5	2.5	2.5
2005 - Nitrate-Nitrite	µg/L	64,275	2.5	2.5	2.5	2.5	2.5
2001 - Ammonia-Nitrogen	µg/L	50,742	50	100	60	38	35
2002 - Ammonia-Nitrogen	µg/L	39,943	15	34	22	12	11
2003 - Ammonia-Nitrogen	µg/L	37,219	27	64	28	23	19
2004 - Ammonia-Nitrogen	µg/L	31,750	27	52	47	14	16
2005 - Ammonia-Nitrogen	µg/L	64,275	18	27	20	18	14

To date, the water quality results for Big Bear Lake suggest that water volume has a substantial impact on water quality. Furthermore, the degree of water volume will control whether or not the lake will be well-mixed and polymictic or able to vertically stratify for a period of time. This in turn, will affect both photic zone and bottom discrete concentrations of nutrients. Seasonal peaks in phosphorus species, total nitrogen, and chlorophyll *a* occur during the late summer and fall. Seasonal peaks for most of the water quality constituents were much more pronounced in 2003 than in either 2001 or 2002. This may have been due to the continued decline in lake water levels and/or due to the consecutive years of aquatic herbicide treatment (2002 and 2003 aquatic herbicide application) resulting in a decrease in the nutrient sink that the plants and periphytic algae would have provided. In 2002, the seasonal peak in nitrate-nitrite levels appeared to coincide with the snow melt season in the watershed and suggest external loading as the primary source of this inorganic nitrogen source to the lake. Although surface runoff to the lake appeared somewhat limited at this time (based on tributary observations), nitrate-nitrite may have been transported to the lake through lateral subsurface flow and leaching from surrounding soils. Seasonal trends in ammonia-nitrogen levels in the lake appeared to increase with increasing water temperatures, and a relatively higher concentration found in bottom discrete samples versus photic zone composite samples suggesting that the organic decomposition in the sediments are the primary source of this nutrient to the lake.

Despite the lake's polymictic nature, weak thermal stratification does occur during the spring and summer months. This weak thermal stratification is significant enough to limit exchange between surface and bottom waters within the lake. This results in the low dissolved oxygen levels in the deeper waters of the lake. Lake conductivity measurements appeared to respond to precipitation inflows. During the snow melt/spring runoff and wet season, lake conductivity measurements tended to decrease. This demonstrates the importance of dilution and flushing rate on the water quality of the lake, especially during low inflow years.

The highest water temperatures at all of the main lake monitoring stations were observed in July and August of each year. By the first to middle of September, water temperatures would usually begin to decline for Big Bear Lake, reflecting the impact of the lake's elevation on the seasonal cycle observed for water temperatures. As expected, the lowest concentrations of dissolved oxygen generally occurred during the summer or early fall. However, there were several occasions when low dissolved oxygen concentrations were observed in May and June. The findings suggest that dissolved oxygen level is a function of both water temperature and the oxygen demand of the hypolimnion and sediments due to organic decomposition.

2.5 Pilot Programs to Eradicate Eurasian Water Milfoil

In Big Bear Lake, the interference of excessive aquatic plant growth on the recreational beneficial uses of Big Bear Lake was managed by performing a pilot application of aquatic herbicides over two years (2002 and 2003). The aquatic herbicide applications, in conjunction with decreased lake water levels, were shown to effectively control the excessive aquatic macrophyte growth and substantially decrease the amount of plant biomass occupying the littoral zone (BBMWD, 2004). However, the extensive plant biomass reductions also eliminated a storage reservoir for nutrients during the growing season (BBMWD, 2004). Aquatic plant removal also increased entrainment of nutrients, thus contributing to an increase in water column nutrient concentrations. Finally, the use of aquatic herbicides released a significant amount of nutrient-rich organic materials (in the form of decaying plant tissues) to the water column and lake sediments (Berkowitz and Anderson, 2005). In turn, these actions could have resulted in increased nutrient availability and more frequent algal blooms. Each of the above management measures acted to shift the lake's steady state equilibrium from a clear, aquatic macrophyte-dominated system toward a more turbid, algal-dominated system. Therefore, additional control measures will likely be needed to reduce nutrient releases from lake-bottom sediments. These measures are described in a separate plan to be submitted to the Regional Board in April, 2010.

3.0 NOXIOUS AND NUISANCE AQUATIC PLANT MONITORING PROGRAM

A systematic means of monitoring the status of aquatic plants in Big Bear Lake is a critical component for measuring the success of the APMP. Long-term aquatic plant monitoring data regarding aquatic plant locations, species composition, relative density and relative percent abundance are needed to develop adaptive management.

3.1 Aquatic Plant Monitoring Approach

A comprehensive survey will be performed to characterize the abundance, diversity and relative percent coverage of aquatic vegetation in Big Bear Lake. The Monitoring Program will utilize three stages of monitoring. These stages are: Stage 1 - Littoral Circumventing, Stage 2 – Littoral Transecting, and Stage 3 - Management-specific Monitoring. These stages are described in greater detail below (see Section 3.4). In short, Stage 1, Littoral Circumventing provides for aquatic plant monitoring parallel to the shoreline of the lake. Stage 2, Littoral Transecting provides for aquatic plant monitoring perpendicular to the lake shoreline. The combined use of Stage 1 and Stage 2 aquatic plant monitoring provides a systematic and repeatable means for assessing the overall status of aquatic plants in Big Bear Lake. Stage 3 monitoring provides a means for locating specific plants of interest (i.e. Eurasian Water Milfoil). For all aquatic plant point observations, the GPS coordinates, lake surface elevation, water depth, aquatic plant species, plant relative density, and relative plant abundance will be recorded. In addition, voucher samples of each aquatic plant species identified by Stage 1 and Stage 2 surveys will be taken for taxonomic identification verification. Voucher specimens will be sent to the U.S. Army Corps of Engineers, Lewisville, Texas or U.C. Davis for verification. After verification, voucher specimens will be returned to the BBMWD to provide an aquatic plant library of species found within the lake.

3.2 Aquatic Plant Monitoring Schedule

The comprehensive lake vegetation survey will be performed every five years at the peak of the growing season . In addition, an annual Stage 3 reconnaissance-level survey will be performed each spring to identify areas that require herbicide treatment. Regular lake patrols and data from public call logs will be used to schedule follow-on spot treatments throughout the summer months.

More frequent surveys are unnecessary because the lake ecosystem changes very slowly. Moreover, the proposed schedule fits well with the TMDL triennial review process. Baseline surveys were performed in 2006. Therefore, the next comprehensive analysis will be conducted in the summer of 2011. The results will be submitted to the Regional Board as part of the next annual report due in February of 2012.

The dischargers named in the TMDL will be responsible for contracting the comprehensive lake vegetation surveys (Stage 1 and Stage 2 sampling and the BBMWD will provide on the water support services and office/computer use to the consultant for data processing). BBMWD will be responsible for performing the annual reconnaissance-level pre-treatment surveys, conducting the daily lake patrols and recording the public call logs. In addition, BBMWD will be responsible for maintaining all the records required by the California Department of Pesticide Regulation related to the herbicide applications.

3.3 Aquatic Plant Monitoring Parameters

Stage 1 Littoral Circumventing is simply the point visual observation of aquatic plants through use of a single rake sample or visual observation tube at 1.5 m water depth approximately every 100 m parallel to the shoreline. Since the perimeter of the Big Bear Lake shoreline averages 30,000 m in distance, observations taken at every 100 m parallel to the shoreline will result in approximately 300 points of observation. At every visual observation point, the following will be recorded:

- Sample date and sample time;
- Location of each sampling point by GPS coordinates;
- Water depth and lake surface elevation;
- Presence or absence of aquatic plants;
- Aquatic plant species (if plants are present);
- Relative aquatic plant density (if plants are present); and,
- Relative percent abundance of each aquatic plant species.

If aquatic plants are present, each aquatic plant species found on the rake sampling device will be identified, and relative plant densities assessed. Relative plant densities will be assessed by determining the number of plant stems captured by a single rake sample. Relative plant density will be defined as low when 1 to 2 vertical stems are collected from the sediment per rake sample, moderate at 3 to 6 stems per rake sample, high at 7 to 10 stems per rake sample and saturated at 10 or more stems per rake sample. Note: In the case of *Elodea canadensis* (common Elodea) the relative plant density should be related to area of sediment visible from viewer because of that plant's growth characteristic. Therefore, low density would be more than 75% of sediment surface visible, moderate at 50% sediment surface visible, high at 25% of the sediment surface visible and saturated at less than 25% of sediment surface visible from viewer. If the plants have canopied and have extensive growths on the water surface, as is often the case for EWM, that area shall be classified as saturated.

After relative percent density is determined, the relative percent abundance of each species will also be recorded. When there are 10 or fewer stems retrieved by the rake sampler, relative abundance will be determined by counting the number of stems of a given species and then dividing by the total number of stems observed. When there are more than 10 stems per rake sample, the relative abundance will be determined simply by estimating the species stem count distribution in 10 percent increments. The process of determining relative aquatic plant abundance should be fairly simple based on the low number of species observed within the lake over the past two decades. If species cannot be identified at the time of sampling, a sample will be obtained for later identification with the appropriate plant keys.

It should be noted that relative aquatic plant density and abundance information can later be translated to numbers that correspond to area coverage. For example, a single rake will sample a known surface area (approximately 0.2 to 0.3 m^2 area). Similarly, the viewing area at 1.5 m water depth is approximately 0.3 m^2 when using a 0.15 m viewing tube. The information associated with each rake sample, can then be converted to a square meter area.

The recorded GIS data will adhere to the following protocols:

1. GPS data will be collected using a Global Positioning System (GPS) unit with differential correction using a satellite-based augmentation system (SBAS). Corrected GPS measurements will be within 1-meter (m) horizontal accuracy.
2. GPS data will be reported using NAD83 datum coordinates (decimal degrees, five (5) decimal places), northing, easting, and UTM Zone 11. Other information recorded will include sample date, time, water depth (m), aquatic plant species, relative aquatic plant density, and relative species abundance.
3. GPS data will be post-processed and converted into a geographic information system (GIS) shapefile compatible with an ArcGIS 9.X Platform. All metadata shall compiled with FGDC standards.
4. Post-processed ASCII format file containing aquatic plant transect data, GIS compatible shapefile with metadata will be produced.
5. Raw survey notes recorded during survey shall be included in metadata file.

Stage 2 Littoral Transect monitoring will be conducted by first locating a station previously established by the Stage 1, Littoral Circumventing monitoring. Transect lines will be spaced approximately 400-m to 500-m apart and run perpendicular to the lake shoreline. Observation points along the transect lines will record the same aquatic plant data as recorded during Stage 1 efforts and will be collected at the 1.5 m, 2.5 m, 3.5 m, and 4.5 m water depths. Data at the 1.5 m water depth point will not be re-collected (as it was already collected during the Stage 1 efforts however, the GPS coordinates will be used to locate the starting point of each transect line. The length of each transect line (i.e., from the 1.5 m data point to 4.5 m data point) will be influenced by the slope of the lake bottom. Shorter transect lengths will indicate steeper lake bottom slopes, while longer transect lengths will reflect lake bottom slopes more gentle in nature. The littoral transect monitoring will provide approximately 75 separate transect lines for Big Bear Lake. Again, the same aquatic plant information will be recorded at each observational station as described in the Stage 1 sampling. At every sample rake point and/or visual observation point, the following will be recorded:

- Sample date and sample time;
- Location of each sampling point by GPS coordinates;
- Water depth and lake surface elevation;
- Presence or absence of aquatic plants;
- Aquatic plant species (if plant are present);
- Relative aquatic plant density (if plants are present); and,
- Relative percent abundance of each aquatic plant species.

If aquatic plants are present, each aquatic plant species found on the rake sampling device will be identified, and relative plant densities assessed. Relative plant densities will be assessed by determining the number of plant stems captured by a single rake sample. Relative plant density will be defined as <u>low</u> when 1 to 2 vertical stems are collected from the sediment per rake sample, <u>moderate</u> at 3 to 6 stems per rake sample, <u>high</u> at 7 to 10 stems per rake sample and <u>saturated</u> at 10 or more stems per rake sample. Note: In the case of *Elodea canadensis* (common Elodea) the relative plant density should be related to area of sediment visible from viewer because of that plant's growth characteristic. Therefore, <u>low</u> density would be more than 75% of sediment surface visible, <u>moderate</u> at 50% sediment surface visible, <u>high</u> at 25% of the sediment surface visible and <u>saturated</u> at less than 25% of sediment surface visible from viewer. If the plants have canopied and have extensive growths on the water surface, as is often the case for EWM, that area shall be classified as saturated.

After relative percent density is determination, the relative percent abundance of each species will also be recorded. When there are 10 or fewer stems retrieved by the rake sampler, relative abundance will be determined by counting the number of stems of a given species divided by the total number of stems observed. When there are more than 10 stems per rake sample, the relative abundance will be determined simply by estimating the species stem count distribution in 10 percent increments. The process of determining relative aquatic plant abundance should be fairly simple based on the low number of species observed within the lake over the past two decades.

It should be noted that relative aquatic plant density and abundance information can later be translated to numbers that correspond to area coverage. For example, a single rake will sample a known surface area (approximately 0.2 to 0.3 m^2 area). Similarly, the viewing area at 1.5 m water depth is approximately 0.3 m^2 when using a 0.15 m viewing tube. The information associated with each rake sample, can then be converted to a square meter area.

The recorded GIS data will adhere to the following protocols:

1. GPS data associated with transects will be collected using a Global Positioning System (GPS) unit with differential correction using a satellite-based augmentation system (SBAS). Corrected GPS measurements will be within 1-meter (m) horizontal accuracy.
2. GPS data will be reported using NAD83 datum coordinates (decimal degrees, five significant figures), northing, easting, UTM Zone 11. Other information recorded will include sample date, time, water depth (m), aquatic plant species, relative aquatic plant density, and relative species abundance.
3. Observations will be collected from the 2.5-m, 3.5-m, and 4.5-m water depths along each transect. In addition, secchi disk depth will be recorded at the 4.5-m depth.
4. GPS data will be post-processed and converted into a geographic information system (GIS) shapefile compatible with an ArcGIS 9.X Platform. All metadata shall compiled with FGDC standards.
5. Post-processed ASCII format file containing aquatic plant transect data, GIS compatible shapefile with metadata will be produced. This file will also include data on the length of each transect from the 1.5-m starting point to the 4.5-m ending point.
6. Raw survey notes recorded during survey shall be included in metadata file.

3.4 Aquatic Plant Biomass Sub-Sampling

After the completion of Stage 1 and Stage 2 aquatic plant monitoring, aquatic plant total biomass samples will be collected at 24 randomly selected sampling points. The 24 total biomass sampling points will be randomly selected based upon the distribution of relative plant density categories (i.e., low, moderate, high, and saturated). For example, if 50% of the monitoring points were categorized as low relative plant density and the remaining 50% of the monitoring points were categorized as high relative plant density, then 12 total biomass samples would be randomly selected from the monitoring points labeled as low relative plant density and the other 12 samples from points labeled as high relative plant density. Total biomass samples will be collected using the quantitative rake sampling method. Both wet and dry mass measurements will be recorded. The purpose for collecting the total biomass data is to ensure the ability to estimate nutrient loads from aquatic plant senescence in the future.

Stage 3 Management-Specific Monitoring. Stage 3 monitoring will employ a visual reconnaissance and, if needed, a point-intercept method, to better document the locations and surface area coverage of Eurasian Water Milfoil. The location and relative aquatic plant density information will then be used to make decisions regarding the location of treatment areas via the use of map polygons (See Section 5.0). The areal size of the polygon and average water depth within the polygon treatment area will provide the information needed for aquatic herbicide applications.

If utilized, the objective of the point-intercept approach for aquatic plants is to generate point observation measurements at regularly spaced locations within a given area. For Big Bear Lake, the suggested spacing interval will be approximately every 20-m horizontally within the 5m-depth (18-feet) contour. These points can be found in the field using GPS and GIS equipment. Under Stage 3 monitoring, areas located for EWM eradication and control efforts will most likely be dominated by EWM. All GPS coordinates and geographic information system (GIS) shapefiles will be managed as already described.

3.5 Equipment

Equipment required for the emergent and aquatic plant monitoring efforts include the following:

- GPS Unit with software downloadable to GIS format;
- Standard Rake Sampler (15-inches in length);
- One View Tube;
- Boat; and
- Miscellaneous field supplies.

Design of the quantitative rake sampler will follow Gibbons and Gibbons, 1985 or similar device.

3.6 Data Management

For aquatic plant monitoring, all of the field information will be overlaid on the most recent bathymetric map for Big Bear Lake for mapping and analysis purposes. All data will be captured when taking the GPS coordinates. Data dictionaries will be created in the Trimble DGPS unit used for field locations. The data collected will be directly downloaded for use into the GIS after post-processing of the GPS coordinates. A map will then be produced that shows aquatic plant species and locations as well as aquatic plant relative density information.

The selected contractor for aquatic plant monitoring activities will provide the monitoring results in both hard copy and electronic formats. All data will also be available in Microsoft® Excel spreadsheets.

Ultimately, the Big Bear Lake Beneficial Use map and/or priority management/regulatory areas will also be overlaid on the aquatic plant maps to highlight areas in need of aquatic plant management action.

4.0 AQUATIC PLANT NUMERICAL INDEX

In an attempt to develop a tool to aid in future aquatic plant management decisions as well as track the relative environmental habitat value of aquatic plant communities, a preliminary Aquatic Plant Numerical Index (APNI) system was developed. This Aquatic Plant Numerical Index utilizes the data collected during aquatic plant monitoring under Stage 1 and Stage 2 efforts and translates that data to numerical values to allow an unbiased means of assessing the need for aquatic plant management activities in the lake. The index is based on presence or absence of native or non-native species, relative species composition, and relative density as described in the monitoring protocol given in the previous section.

Although coverage area can also be incorporated into this type of aquatic plant index, for Big Bear Lake the potential littoral zone area is highly variable from location to location due to water level fluctuations from year to year (see TetraTech, 2004). A vertical variation of 17 feet below normal full pool elevation leads to littoral area instability within a given location and transitional plant community structure. Most importantly, the vertical instability of the water surface elevation makes year-to-year comparison based on area difficult. To overcome this variability in euphotic littoral area, two aquatic plant index numbers will be produced. One will use data collected following the Stage 1 littoral circumventing monitoring method and the other from the Stage 2 littoral transect monitoring method. Aquatic plant index based on Stage 1 data will characterize the shoreline community and an aquatic plant index based on Stage 2 data will characterize the shallow bays within the lake. This will allow relative assessment of aquatic plant community structure and environmental habitat status independent of area.

The index number is calculated by assigning a number value to the collected field data at each observation station (see Table 8). The series of numbers in Table 8 is totaled to produce the index number at that location or observation station. To calculate an <u>average</u> index number within a specific zone, the index number is added to every index number within the <u>zone of interest</u> and then divided by the number of observation locations used to generate an average index number for that zone. “Zones of interest” will be established using GIS systems and during the process of evaluating the utility of the Aquatic Plant Numerical Index. At this time, it is anticipated that “zones of interest” will be established within Boulder Bay, Metcalf Bay, Grout Bay, the eastern side of Eagle Point. “Zones of interest” will also be established along rectangular stretches adjacent to the Big Bear Lake shoreline.

TABLE 8. Aquatic Plant Index Value Assignments

Data	Species Value	Composition Value	Density Value
Species			
Plants Present	1		
Plants Absent	0		
Native	1 if present, 0 if absent	1 if present, 0 if absent	0 if absent, 1 if between 1 and 2 stems per rake sample, 2 if between 3-6 stems per rake sample, 3 if between 7-10 stems per rake sample, and 4 if more then 10 stems per rake sample.
Non-Native	0 if absent, 2 if present	0 if absent, and 1 if 5% or less, 2 if 5-25%, 3 if 25-50%, and 4 if more than 50% of the plant community composition	0 if absent, 1 if between 1 and 2 stems per rake sample, 2 if between 3-6 stems per rake sample, 3 if between 7-10 stems per rake sample, and 4 if more then 10 stems per rake sample

Table 9 presents an example of the numerical index assignment and calculation based on Stage 1 or Stage 2 monitoring for a good habitat aquatic community and one that would be prioritized for management action.

TABLE 9. Examples of Aquatic Plant Index Calculation

Balanced Aquatic Plant Community				
Data	Species Value	Composition Value	Density Value	Total Values
Species				
Present	1			1
Absent	0			0
Native	1	1	1	3
Non-Native	0	0	0	0
Index Number				4
Aquatic Plant Community in need of management action				
Data	Species Value	Composition Value	Density Value	Total Values
Species				
Present	1			1
Absent	0			0
Native	1	1	1	3
Non-Native	2	4	4	9
Index Number				13

Using the Aquatic Plant Numerical Index approach, the threshold for aquatic plant management action is based on the presence and density of non-native species and the adverse impacts that native plants may have on recreational lake uses when plant densities become too dense. If utilized in the future, this preliminary Aquatic Plant Numerical Index will be modified to incorporate the Beneficial Use Map.

Under the preliminary index system, the non-native plant presently of concern within Big Bear Lake is Eurasian Watermilfoil (*Myriophyllum spicatum*). However in the future, management of other non-native and native aquatic plant species may be necessary depending on their locations and densities as well. For example, although not currently a problem in Big Bear Lake, the native Coontail (*Ceratophyllum demersum*) may again attain nuisance status and require management activities.

Table 10 provides an example of the preliminary Aquatic Plant Numerical Index relationship to potential aquatic plant management actions for a specific targeted zone. Again, if this preliminary Aquatic Plant Numeric Index is determined to be a valuable management tool, this index will likely be modified to account for lake beneficial uses and priority beneficial use zones.

TABLE 10. Aquatic Plant Index Number versus Management Actions

Index Number	Management Action
0	Consider introduction of native aquatic plants
1-4	No action
5	Control action if index score due to non-native plants
6	Control action needed but low priority
7-9	Control action necessary
10-13	Immediate control with maximum intensity

Stage 1 and Stage 2 aquatic plant monitoring data will be input into the index so that it may be used on a trial basis. Additionally, if the Aquatic Plant Numeric Index is found useful, it may be modified or refined in the future. In addition to incorporating the Beneficial Use Map of Big Bear Lake, the Aquatic Plant Numeric Index may be reworked to include other variables or indicators of aquatic plant management needs. Finally, other means of assessing aquatic plant interference with the lake's recreational uses will include: 1) keeping records of the number of people that require lake patrol assistance due to aquatic plants, 2) documenting complaints about lake navigability, and 3) documenting complaints from dock owners.

5.0 AQUATIC PLANT CONTROL STRATEGIES

Eurasian watermilfoil is a submersed, rooted, perennial dicot that is submersed except for the upper flower-bearing portions. Native to Eurasia and North Africa, the history of the spread of this species in the United States is unclear due to its initial confusion with a phenotypically similar species, Northern milfoil (*M. sibiricum*). According to AERF (2005), this plant is now considered one of the worst aquatic weeds in North America. Eurasian watermilfoil is a highly aggressive invasive aquatic species. Its rapid growth rate enables this milfoil to cover water surfaces and form thick underwater stands. Such rapid growth displaces the native vegetation over a few years. EWM is tolerant of low water temperatures and can begin spring growth earlier than other aquatic plants. EWM spreads by the dispersal of plant fragments into water currents in lakes and reservoirs.

5.1 Eradication Treatment Technologies

This nationally pervasive and potentially detrimental noxious aquatic weed has been intensively studied to identify effective control techniques (CDA, 2000; AERF, 2005). The treatment technologies currently utilized for Eurasian Water Milfoil include the following:

Mechanical – Mechanical control of Eurasian Water Milfoil has been identified as a short- to medium-term strategy deployed for small to moderate infestations. Mechanical controls established for EWM include: 1) Hand pulling, 2) Harvester, 3) Rototiller and 4) Cutter. The advantages of using harvesters are that it immediately opens up harvested areas and removes the upper canopy and shade-producing portion of the plants. However, a disadvantage of harvesting is that fragments of Eurasian Water Milfoil are left in the water and these fragments contribute to the re-growth and re-spreading of the plant. Secondly, the literature shows that harvesting impacts fish and insect populations by removing them in the harvested plant material. Thirdly, cutting plant stems too close to the bottom of the lake results in re-suspension of sediments and nutrients. Finally, the operation of harvesters is a fairly expensive endeavor. The BBMWD utilized both harvesters and rototiller control methods for over 20 years. Despite their long history of efforts using these methods, Eurasian Water Milfoil continued to expand in the lake. Also, the BBMWD has verified the expenses associated with harvesting activities.

Physical – Methods of physical control used for Eurasian Water Milfoil include employment of: 1) Benthic Barriers, 2) Dredging, 3) Drawdown, and 4) Shading. The use of benthic barriers and/or shading is limited by both size, treating no more than 1.0 acre per site, and the absence of selectivity. Dredging is extremely expensive, while drawdown is counter to the BBMWD's overall lake management mission.

Herbicide – According to the AERF (2005), the use of herbicides for the control of invasive and nuisance plant species represents one of the most widely used and effective management options available. Specifically, herbicide control of aquatic weeds is often the first step in a long-term integrated control program. Further, no herbicide product can be labeled for aquatic use if it has more than one in a million chance of causing significant harmful effects to human health, wildlife, or the environment (AERF, 2005).

There are many herbicides available for the control of EWM. Since EWM is a dicot, it is amenable to selective control using herbicides that specifically target this group. Aquatic herbicides used in Big Bear Lake against EWM include various formulations of Sonar (active ingredient = Fluridone) and Renovate OTF (active ingredient = Triclopyr). These aquatic herbicides are classified as systemic herbicides. Systemic herbicides are translocated throughout the plant and are slower acting, but they often result in mortality of the entire plant. Sonar formulations can be selective for EWM alone, however, in order to achieve selectivity for EWM alone, herbicide application rates and plant responses must be examined on a site-specific basis. Fortunately, according to the Sonar manufacturer (SePro), EWM is one of the most sensitive aquatic plant species controlled by this product. Attachment 2 provides the Sonar formulation product labels. These product labels provide information regarding the aquatic plants controlled by this herbicide. Unlike Sonar formulations, Renovate OTF is selective for EWM alone, independent of the applied dosage. Other plant taxa found in Big Bear Lake are not adversely affected by treatment with this product. Attachment 3 provides the product label for Renovate OTF.

5.2 Control Objectives for Non-native Aquatic Plants

The main purpose of the Aquatic Plant Management Plan is the continued eradication of Eurasian Water Milfoil. BBMWD will rely on aquatic herbicides to achieve this objective. The aquatic herbicide used will most likely be a Sonar formulation or Renovate OTF. The BBMWD has the necessary National Pollutant Discharge Elimination System (NPDES) permits required for the application of each of these herbicides. EWM treatment areas will be established after the completion of aquatic plant monitoring activities. Treatment areas will be limited to those locations found to be almost exclusively dominated by EWM with high relative density values. If Sonar is used (but will most likely be Renovate OTF) this approach would minimize the impact of Sonar to sensitive native aquatic plant species (e.g., Common Elodea and Coontail). If Renovate OTF is used, sensitivity of native aquatic plant species should not be an issue, as Renovate OTF is selective for EWM only in Big Bear Lake. All aquatic herbicide applications will be performed in accordance with applicable individual or General NPDES permit specifications by or under the direct supervision of a State licensed applicator.

6.0 ADAPTIVE RESPONSE ON PLANT MANAGEMENT STRATEGIES

Ultimately, aquatic plant control is needed for Big Bear Lake to: 1) protect recreational, aquatic life, and wildlife beneficial uses, 2) enhance aquatic habitat that has been degraded by shifts in native plant community structure and/or 3) reduce the density of aquatic plants that lead to water quality declines, such as lowering of dissolved oxygen, or physical densities that limit shelter and food gathering.

In the future, the approach to controlling nuisance and noxious aquatic plants in Big Bear Lake will be influenced in part by the large littoral area of the lake and historical plant coverage. The large littoral zone area in need of management leads to the use of herbicides as the most cost effective methodology to manage the aquatic plants in the lake. However, the aquatic plant management approach will need to be refined so that when needed, control of EWM alone can be achieved and acceptable approaches for the control of native nuisance aquatic plant species may be developed.

Because one goal of the Nutrient TMDL program is to limit EWM to less than 5% of the aquatic plant community in the lake, control of EWM will always be a high priority for managing recreational resources in the lake. This Big Bear Lake Aquatic Plant Management Plan will incorporate the use of a Beneficial Use Map previously developed by BBMWD.

7.0 SCHEDULE OF DELIVERABLES

#	Description	Due Date	Responsible Agency
1	Comprehensive Aquatic Vegetation Survey (including voucher specimens, data collection, analysis and reporting and integrating results with 3D map)	Every 5 years beginning in August, 2011. Results submitted with annual report beginning in February, 2012	TMDL Dischargers
2	Pre-Treatment Reconnaissance-Level Survey (including GIS mapping)	Annually in spring	BBMWD
3	Aquatic Herbicide Applications (including required permits, product, personnel, and DPR reporting)	Annually in late spring and bi-weekly spot treatment throughout the growing season.	BBMWD
4	TMDL Annual Data Reports	Annually beginning in February, 2011	TMDL Dischargers
5	Mechanical Weed Harvesting	As needed	BBMWD

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Specimen Label

SePRO

Sonar* SRP

Herbicide

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

Active ingredient:

fluridone: 1-methyl-3-phenyl-5-[3-(trifluoromethyl)phenyl]-4(1*H*)-pyridinone 5.0%

Inert ingredients 95.0%

Total 100.0%

Contains 2 pounds active ingredient per 40 pound container.

EPA Reg. No. 67690-3 EPA Est. No. 39578-TX-1
FPL 072902 SC-73-3260

Precautionary Statements

Hazards to Humans and Domestic Animals

Keep Out of Reach of Children

CAUTION PRECAUCION

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

Harmful if Swallowed, Absorbed Through Skin, or if Inhaled

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

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

Statement of Practical Treatments

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

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

STORAGE AND DISPOSAL

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

Storage: Store in original container only. Do not store near feed or foodstuffs. In case of leak or spill, contain material and dispose as waste.

Pesticide Disposal: Wastes resulting from use of this product may be used according to label directions or disposed of at an approved waste disposal facility.

Container Disposal: Triple rinse (or equivalent). Then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or by incineration, or if allowed by State and Local authorities, by burning. If burned, stay out of smoke.

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

Sonar* SRP Herbicide

Environmental Hazards

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

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

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

Directions for Use

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

General Information

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

Sonar SRP is not corrosive to application equipment.

The label provides recommendations on the use of a chemical analysis for the active ingredient. SePRO Corporation recommends the use of an Enzyme-Linked

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

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

General Use Precautions

- **Obtain Required Permits:** Consult with appropriate state or local water authorities before applying this product. Permits may be required by state or local public agencies.
- **NEW YORK STATE:** Application of Sonar SRP is not permitted in waters less than two (2) feet deep.
- **Hydroponic Farming:** Do not use Sonar SRP treated water for hydroponic farming.
- **Greenhouse and Nursery Plants:** Do not use Sonar SRP treated water for irrigating greenhouse or nursery plants. Use of an approved assay should confirm that residues are <1 ppb.
- **WATER USE RESTRICTIONS FOLLOWING APPLICATIONS WITH SONAR SRP (DAYS)**

Application Rate	Drinking†	Fishing	Swimming	Livestock/Pet Consumption	Irrigation††
Maximum Rate (150 ppb) or less	0	0	0	0	See irrigation instructions below

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

†† Note below, under Irrigation, the specific time framesor fluridone residues that provide the widest safety margin for irrigating with fluridone treated water.

- **Potable Water Intakes:** Concentrations of the active ingredient fluridone up to 150 ppb are allowed in potable water sources; however, in lakes and reservoirs or other sources of potable water, DO NOT APPLY Sonar SRP at application rates greater than 20 ppb within one-fourth mile (1320 feet) of any functioning potable water intake. At application rates of 8-20 ppb, Sonar SRP MAY BE APPLIED where functioning potable water intakes are present. **Note: Existing potable water intakes which are no longer in use, such as those replaced by connections to potable water wells or a municipal water system, are not considered to be functioning potable water intakes.**
- **Irrigation:** Irrigation with Sonar SRP treated water may result in injury to the irrigated vegetation. SePRO Corporation recommends following these precautions and informing those who irrigate from areas treated with Sonar SRP of the irrigation time frames or water assay requirements presented in the table below. These time frames and assay recommendations are suggestions which should be followed to reduce the potential for injury to vegetation irrigated with water treated with Sonar SRP. Greater potential for crop injury occurs where Sonar SRP treated water is applied to crops grown on low organic and sandy soils.

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

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

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

Furthermore, when rotating crops, do not plant members of the Solanaceae family in land that has been previously irrigated with fluridone concentrations in excess of 5 ppb. It is recommended that an aquatic specialist be consulted prior to commencing irrigation of these sites

Plant Control Information

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

Vascular Aquatic Plants <u>Controlled</u> by Sonar SRP†

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

Shoreline Grasses:
paragrass (*Urochloa mutica*)

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

Vascular Aquatic Plants <u>Partially Controlled</u> by Sonar SRP:

Floating Plants:
Salvinia (*Salvinia* spp.)

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

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

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

Vascular Aquatic Plants <u>Not Controlled</u> by Sonar SRP:

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

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

Shoreline Grasses:

maidencane (*Panicum hemitomon*)

Note: algae (chara, nitella, and filamentous species are not controlled by Sonar SRP)

Application Directions

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

Application to Ponds

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

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

Application to Lakes and Reservoirs

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

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

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

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

2. Split or Multiple Applications to Whole Lakes or Reservoirs

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

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

B. Partial Lake or Reservoir Treatments

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

1. Application Sites Greater Than 1/4 Mile from a Functioning Potable Water Intake

For single applications, apply Sonar SRP at application rates from 45 to150 ppb. Split or multiple applications may be made, however, the sum of all applications cannot exceed 150 ppb per annual growth cycle. Split applications should be conducted to maintain a sufficient concentration in the target area for a period of 45 days or longer. The use of FasTEST is recommended to maintain the desired concentration in the target area over time.

2. Application Sites Within 1/4 Mile of a Functioning Potable Water Intake

In treatment areas that are within 1/4 mile of a potable water intake, no single application can exceed 20 ppb. When utilizing split or repeated applications of Sonar SRP for sites which contain a potable water intake, FasTEST is required to determine the actual concentration in the water. Additionally, the sum of all applications cannot exceed 150 ppb per annual growth cycle.

Application Rate Calculation - Ponds, Lakes and Reservoirs

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

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

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

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

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

Application to Drainage Canals, Irrigation Canals and Rivers

Static Canals:

In static drainage and irrigation canals, Sonar SRP should be applied at the rate of 20 to 40 pounds per surface acre.

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

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

Application Rate Calculation – Drainage Canals, Irrigation Canals and Rivers

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

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

WARRANTY DISCLAIMER

SePRO Corporation warrants that this product conforms to the chemical description on the label and is reasonably fit for the purposes stated on the label when used in strict accordance with the directions, subject to the inherent risks set forth below. **SePRO Corporation makes no other express or implied warranty of merchantability or fitness for a particular purpose or any other express or implied warranty.**

INHERENT RISKS OF USE

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

LIMITATION OF REMEDIES

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

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

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

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

Specimen Label

SePRO

Sonar* PR

Precision Release

Herbicide

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

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

EPA Reg. No. 67690-12 EPA Est. No. 39578-TX-1
FPL 091802 SPC-342142

Precautionary Statements

Hazards to Humans and Domestic Animals

Keep Out of Reach of Children

CAUTION PRECAUCION

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

Harmful if Swallowed, Absorbed Through Skin, or if Inhaled

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

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

Statement of Practical Treatments

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

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

Notice Statement: Read entire label before using. Use only according to label directions.

Environmental Hazards

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

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

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

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

Sonar* PR Precision Release Herbicide

Directions for Use

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

Storage and Disposal

Do not contaminate water, food, or feed by storage or disposal.
Storage: Store in original container only. Do not store near feed or foodstuffs. In case of leak or spill, contain material and dispose as waste.
Pesticide Disposal: Wastes resulting from use of this product may be used according to label directions or disposed of at an approved waste disposal facility.
Container Disposal: Triple rinse (or equivalent). Then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or by incineration, or if allowed by State and Local authorities, by burning. If burned, stay out of smoke.

General Information

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

Sonar PR Precision Release is not corrosive to application equipment.

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

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

General Use Precautions

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

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

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

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

• **WATER USE RESTRICTIONS FOLLOWING APPLICATIONS WITH SONAR PR PRECISION RELEASE (DAYS)**

Application Rate	Drinking†	Fishing	Swimming	Livestock/Pet Consumption	Irrigation††
Maximum Rate (150 ppb) or less	0	0	0	0	See irrigation instructions below

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

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

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

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

†For purposes of Sonar PR Precision Release labeling, a pond is

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

Where the use of Sonar PR Precision Release treated water is desired for irrigating crops prior to the time frames established above, the use of FasTEST assay is recommended to measure the concentration in the treated water. Where FasTEST has determined that concentrations are less than 10 parts per billion, there are no irrigation precautions for irrigating established tree crops, established row crops or turf. **For tobacco, tomatoes, peppers or other plants within the Solanaceae Family and newly seeded crops or newly seeded grasses such as overseeded golf course greens, do not use Sonar PR treated water if concentration are greater than 5 ppb. Furthermore, when rotating crops, do not plant members of the Solanaceae family in land that has been previously irrigated with fluridone concentrations in excess of 5 ppb. It is recommended that an aquatic specialist be consulted prior to commencing irrigation of these sites.**

Plant Control Information

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

Vascular Aquatic Plants Controlled by Sonar PR Precision Release†

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

Shoreline Grasses:
paragrass (*Urochloa* mutica)

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

Vascular Aquatic Plants Partially Controlled by Sonar PR Precision Release:

Floating Plants:
Salvinia (*Salvinia* spp.)

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

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

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

Vascular Aquatic Plants Not Controlled by Sonar PR Precision Release:

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

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

Shoreline Grasses:
maidencane (*Panicum hemitomon*)

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

Application Directions

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

Application to Ponds

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

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

Application to Lakes and Reservoirs

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

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

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

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

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

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

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

1. Application Sites Greater Than 1/4 Mile from a Functioning Potable Water Intake
For single applications, apply Sonar PR Precision Release at application rates from 45 to150 ppb. Split or multiple applications may be made, however, the sum of all applications cannot

exceed 150 ppb per annual growth cycle. Split applications should be conducted to maintain a sufficient concentration in the target area for a period of 45 days or longer. The use of FasTEST is recommended to maintain the desired concentration in the target area over time.

2. Application Sites Within 1/4 Mile of a Functioning Potable Water Intake

In treatment areas that are within 1/4 mile of a potable water intake, no single application can exceed 20 ppb. When utilizing split or repeated applications of Sonar PR Precision Release for sites which contain a potable water intake, FasTEST is required to determine the actual concentration in the water. Additionally, the sum of all applications cannot exceed 150 ppb per annual growth cycle.

Application Rate Calculation - Ponds, Lakes and Reservoirs

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

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

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

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

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

Application to Drainage Canals, Irrigation Canals and Rivers

Static Canals:

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

Moving Water Canals and Rivers:

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

Static or Moving Water Canals or Rivers Containing a Functioning Potable Water Intake

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

Application Rate Calculation – Drainage Canals, Irrigation Canals and Rivers

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

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

WARRANTY DISCLAIMER

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

INHERENT RISKS OF USE

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

LIMITATION OF REMEDIES

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

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

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

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

Specimen Label

SePRO

Renovate® 3

Herbicide

Herbicide

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

Active Ingredient:

triclopyr: 3,5,6-trichloro-2-pyridinyloxyacetic acid, triethylamine salt.....44.4%

Inert Ingredients.....55.6%

Total.....100.0%

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

Keep Out of Reach of Children

DANGER PELIGRO

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

Precautionary Statements

Hazards to Humans and Domestic Animals

Corrosive • Causes irreversible eye damage • Harmful if swallowed or absorbed through skin • Prolonged or frequently repeated skin contact may cause allergic reaction in some individuals

Do not get in eyes or on skin or clothing.

Personal Protective Equipment (PPE)

Applicators and other handlers must wear:

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

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

FIRST AID	
In the eyes	• Hold eye open and rinse slowly and gently with water for 15 - 20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye. • Call poison control center or doctor for treatment advice.
If on skin or clothing	• Take off contaminated clothing. • Rinse skin immediately with plenty of water for 15 - 20 minutes. • Call a poison control center or doctor for treatment advice.
If swallowed	• Call a poison control center or doctor for treatment advice. • Have person sip a glass of water if able to swallow. • Do not induce vomiting unless told to do so by a poison control center or doctor. • Do not give anything by mouth to a unconscious person.

Have the product container or label with you when calling a poison control center or doctor, or going for treatment. You may also contact INFOTRAC at 1-800-535-5053 for emergency medical treatment.

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

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

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

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

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

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

EPA Reg. No. 62719-37-67690 EPA Est. No. 464-MI-1
FPL 021903 SPC - 381116

SePRO Corporation Carmel, IN 46032, U.S.A.

Renovate® 3 Herbicide

Engineering Controls

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

USER SAFETY RECOMMENDATIONS

Users should:

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

Environmental Hazards

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

Physical or Chemical Hazards

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

Directions for Use

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

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

AGRICULTURAL USE REQUIREMENTS

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

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

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

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

NON-AGRICULTURAL USE REQUIREMENTS

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

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

STORAGE AND DISPOSAL

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

Pesticide Storage: Store above 28° F or agitate before use.

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

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

Container Disposal (Metal): Do not reuse container. Triple rinse (or equivalent). Then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or by other procedures approved by state and local authorities.

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

General: Consult federal, state, or local disposal authorities for approved alternative procedures.

General Information

For Aquatic and Wetland Sites

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

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

General Use Precautions and Restrictions

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

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

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

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

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

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

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

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

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

Avoiding Injurious Spray Drift

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

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

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

Spray Drift Management
Avoiding spray drift at the application site is the responsibility of the applicator. The interaction of many equipment and weather related factors determine the potential for spray drift. The applicator and the grower are responsible for considering all these factors when making decisions.

The following drift management requirements must be followed to avoid off-target drift movement from aerial applications:

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

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

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

Aerial Drift Reduction Advisory

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

Controlling Droplet Size:

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

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

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

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

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

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

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

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

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

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

Plants Controlled by Renovate 3

Woody Plant Species

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

Annual and Perennial Broadleaf Weeds

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

Aquatic Weeds

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

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

Application Methods

Floating and Emerged Weeds

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

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

Apply when plants are actively growing.

Surface Application

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

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

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

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

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

Renovate 3 Application Rate (quart/acre)

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

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

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

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

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

Submerged Weeds

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

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

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

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

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

Concentration of Triclopyr Acid in Water (ppm ae)

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

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

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

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

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

$$= (800 \times 3.912) - 160$$

$$= 2970 \text{ feet}$$

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

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

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

$$= 892 \text{ feet}$$

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

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

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

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

Wetland Sites

Wetlands include flood plains, deltas, marshes, swamps, bogs, and transitional areas between upland and lowland sites. Wetlands may occur within forests, wildlife habitat restoration and management areas and similar sites as well as areas adjacent to or surrounding domestic water supply reservoirs, lakes and ponds. For control of woody plants and broadleaf weeds in these sites, follow use directions and application methods on this label for terrestrial sites associated with wetland areas.

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

Purple Loosestrife (*Lythrum salicaria*)

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

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

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

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

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

Terrestrial Sites Associated with Wetland Areas

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Terms and Conditions of Use

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

Warranty Disclaimer

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

Inherent Risks of Use

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

Limitation of Remedies

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

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

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

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

Form No. A-00-SPG-02 (05)

								Employee Cost					Cost of Treatment	
Date	Zone	Dock %	Lake %	Prep/Drive Time	Total Min.	Dock Time	Lake Time	Dock	Lake	Total lbs.	# lbs. Dock	# lbs. Lake	Dock	Lake
31-Jul	5	20.00%	80.00%		30	6	24	$4.62	$18.48	240	48	192	$167.52	$670.08
30-Jul	5	20.00%	80.00%		25	5	20	$3.85	$15.40	180	36	144	$125.64	$502.56
30-Jul	6	70.00%	30.00%		25	17.5	7.5	$13.48	$5.78	80	56	24	$195.44	$83.76
30-Jul	7	50.00%	50.00%		15	7.5	7.5	$5.78	$5.78	80	40	40	$139.60	$139.60
30-Jul	8	50.00%	50.00%	4 Hrs.	35	17.5	17.5	$13.48	$13.48	240	120	120	$418.80	$418.80
30-Jul	9	50.00%	50.00%		35	17.5	17.5	$13.48	$13.48	200	100	100	$349.00	$349.00
30-Jul	10	30.00%	70.00%		10	3	7	$2.31	$5.39	60	18	42	$62.82	$146.58
30-Jul	15	50.00%	50.00%		40	20	20	$15.40	$15.40	280	140	140	$488.60	$488.60
29-Jul	6	50.00%	50.00%		20	10	10	$7.70	$7.70	60	30	30	$104.70	$104.70
29-Jul	7	50.00%	50.00%		5	2.5	2.5	$1.93	$1.93	40	20	20	$69.80	$69.80
29-Jul	8	50.00%	50.00%		35	17.5	17.5	$13.48	$13.48	120	60	60	$209.40	$209.40
29-Jul	9	50.00%	50.00%		35	17.5	17.5	$13.48	$13.48	140	70	70	$244.30	$244.30
29-Jul	10	50.00%	50.00%	3.45 Hrs.	30	15	15	$11.55	$11.55	200	100	100	$349.00	$349.00
29-Jul	11	10.00%	90.00%		50	5	45	$3.85	$34.65	320	32	288	$111.68	$1,005.12
29-Jul	12	50.00%	50.00%		45	22.5	22.5	$17.33	$17.33	160	80	80	$279.20	$279.20
29-Jul	16	60.00%	40.00%		5	3	2	$2.31	$1.54	40	24	16	$83.76	$55.84
29-Jul	17	50.00%	50.00%		30	15	15	$11.55	$11.55	240	120	120	$418.80	$418.80
28-Jul	10	10.00%	90.00%		30	3	27	$2.31	$20.79	180	18	162	$62.82	$565.38
28-Jul	11	20.00%	80.00%		75	15	60	$11.55	$46.20	400	80	320	$279.20	$1,116.80
28-Jul	12	75.00%	25.00%	3.25 Hrs.	30	22.5	7.5	$17.33	$5.78	200	150	50	$523.50	$174.50
28-Jul	16	40.00%	60.00%		60	24	36	$18.48	$27.72	280	112	168	$390.88	$586.32
28-Jul	17	60.00%	40.00%		30	18	12	$13.86	$9.24	180	108	72	$376.92	$251.28
28-Jul	18	40.00%	60.00%		60	24	36	$18.48	$27.72	380	152	228	$530.48	$795.72
23-Jul	20	100.00%			35	35	0	$26.95	$0.00	40	40	0	$139.60	$0.00
23-Jul	23	80.00%	20.00%	2.16 Hrs.	40	32	8	$24.64	$6.16	160	128	32	$446.72	$111.68
23-Jul	24	90.00%	10.00%		35	31.5	3.5	$24.26	$2.70	120	108	12	$376.92	$41.88
22-Jul	21	90.00%	10.00%		45	40.5	4.5	$31.19	$3.47	240	216	24	$753.84	$83.76
22-Jul	22	25.00%	75.00%	5.25 Hrs.	60	15	45	$11.55	$34.65	400	100	300	$349.00	$1,047.00
22-Jul	23	20.00%	80.00%		15	3	12	$2.31	$9.24	160	32	128	$111.68	$446.72
22-Jul	25	20.00%	80.00%		45	9	36	$6.93	$27.72	280	56	224	$195.44	$781.76
21-Jul	21	90.00%	10.00%		25	22.5	2.5	$17.33	$1.93	160	144	16	$502.56	$55.84
21-Jul	22	20.00%	80.00%		40	8	32	$6.16	$24.64	220	44	176	$153.56	$614.24
21-Jul	23	30.00%	70.00%	5.3 Hrs.	10	3	7	$2.31	$5.39	60	18	42	$62.82	$146.58
21-Jul	25	10.00%	90.00%		40	4	36	$3.08	$27.72	200	20	180	$69.80	$628.20
21-Jul	46		100.00%		45	0	45	$0.00	$34.65	260	0	260	$0.00	$907.40
30-Jun	35	50.00%	50.00%	1.3 Hrs.	30	15	15	$11.55	$11.55	180	90	90	$314.10	$314.10
30-Jun	36	30.00%	70.00%		40	12	28	$9.24	$21.56	340	102	238	$355.98	$830.62
26-Jun	35	50.00%	50.00%		15	7.5	7.5	$5.78	$5.78	120	60	60	$209.40	$209.40
26-Jun	36	20.00%	80.00%	2 Hrs.	45	9	36	$6.93	$27.72	240	48	192	$167.52	$670.08
26-Jun	37		100.00%		30	0	30	$0.00	$23.10	240	0	240	$0.00	$837.60
25-Jun	36		100.00%	5 Hrs.	40	0	40	$0.00	$30.80	320	0	320	$0.00	$1,116.80
25-Jun	37	20.00%	80.00%		80	16	64	$12.32	$49.28	600	120	480	$418.80	$1,675.20
23-Jun	33		100.00%	105 Hrs.	45	0	45	$0.00	$34.65	320	0	320	$0.00	$1,116.80
19-Jun	46	20.00%	80.00%	5 Hrs.	75	15	60	$11.55	$46.20	560	112	448	$390.88	$1,563.52
19-Jun	47		100.00%		105	0	105	$0.00	$80.85	760	0	760	$0.00	$2,652.40
18-Jun	25	100.00%			10	10	0	$7.70	$0.00	40	40	0	$139.60	$0.00
18-Jun	48	20.00%	80.00%	2.8 Hrs.	255	51	204	$39.27	$157.08	1760	352	1408	$1,228.48	$4,913.92
18-Jun	49		100.00%		30		30	$0.00	$23.10	280	0	280	$0.00	$977.20
11-Jun	29	50.00%	50.00%		5	2.5	2.5	$1.93	$1.93	40	20	20	$69.80	$69.80
11-Jun	30	50.00%	50.00%		10	5	5	$3.85	$3.85	80	40	40	$139.60	$139.60
11-Jun	35	10.00%	90.00%		30	3	27	$2.31	$20.79	160	16	144	$55.84	$502.56
11-Jun	48		100.00%	5 Hrs.	40	0	40	$0.00	$30.80	280	0	280	$0.00	$977.20
11-Jun	52		100.00%		5	0	5	$0.00	$3.85	40	0	40	$0.00	$139.60
11-Jun	53	20.00%	80.00%		30	6	24	$4.62	$18.48	200	40	160	$139.60	$558.40
11-Jun	54		100.00%		60	0	60	$0.00	$46.20	520	0	520	$0.00	$1,814.80
10-Jun	49		100.00%		5	0	5	$0.00	$3.85	40	0	40	$0.00	$139.60
10-Jun	51		100.00%		5	0	5	$0.00	$3.85	40	0	40	$0.00	$139.60
10-Jun	55		100.00%	6.3 Hrs.	40	0	40	$0.00	$30.80	320	0	320	$0.00	$1,116.80
10-Jun	56		100.00%		20	0	20	$0.00	$15.40	160	0	160	$0.00	$558.40
10-Jun	57		100.00%		30	0	30	$0.00	$23.10	160	0	160	$0.00	$558.40
4-Jun	2	20.00%	80.00%		20	4	16	$3.08	$12.32	120	24	96	$83.76	$335.04
4-Jun	14	50.00%	50.00%		25	12.5	12.5	$9.63	$9.63	160	80	80	$279.20	$279.20
4-Jun	15	50.00%	50.00%		50	25	25	$19.25	$19.25	240	120	120	$418.80	$418.80
4-Jun	20	50.00%	50.00%	5 Hrs.	5	2.5	2.5	$1.93	$1.93	40	20	20	$69.80	$69.80
4-Jun	21	50.00%	50.00%		30	15	15	$11.55	$11.55	280	140	140	$488.60	$488.60
4-Jun	22	30.00%	70.00%		30	9	21	$6.93	$16.17	240	72	168	$251.28	$586.32
4-Jun	29	50.00%	50.00%		10	5	5	$3.85	$3.85	40	20	20	$69.80	$69.80
4-Jun	58		100.00%		10	0	10	$0.00	$7.70	80	0	80	$0.00	$279.20
2-Jun	5	20.00%	80.00%		30	6	24	$4.62	$18.48	160	32	128	$111.68	$446.72
2-Jun	6	70.00%	30.00%		15	10.5	4.5	$8.09	$3.47	80	56	24	$195.44	$83.76
2-Jun	8	50.00%	50.00%		10	5	5	$3.85	$3.85	60	30	30	$104.70	$104.70
2-Jun	9	50.00%	50.00%		15	7.5	7.5	$5.78	$5.78	100	50	50	$174.50	$174.50
2-Jun	10	10.00%	90.00%		25	2.5	22.5	$1.93	$17.33	160	16	144	$55.84	$502.56
2-Jun	11		100.00%		5	0	5	$0.00	$3.85	40	0	40	$0.00	$139.60
2-Jun	14	50.00%	50.00%	3.41 Hrs.	20	10	10	$7.70	$7.70	200	100	100	$349.00	$349.00
2-Jun	15	50.00%	50.00%		30	15	15	$11.55	$11.55	240	120	120	$418.80	$418.80
2-Jun	20	50.00%	50.00%		10	5	5	$3.85	$3.85	80	40	40	$139.60	$139.60
2-Jun	21	50.00%	50.00%		40	20	20	$15.40	$15.40	320	160	160	$558.40	$558.40
2-Jun	22	30.00%	70.00%		45	13.5	31.5	$10.40	$24.26	240	72	168	$251.28	$586.32
2-Jun	29	30.00%	70.00%		15	4.5	10.5	$3.47	$8.09	80	24	56	$83.76	$195.44
2-Jun	32	10.00%	90.00%		15	1.5	13.5	$1.16	$10.40	80	8	72	$27.92	$251.28
26-May	11	30.00%	70.00%		20	6	14	$4.62	$10.78	120	36	84	$125.64	$293.16
26-May	12	50.00%	50.00%		30	15	15	$11.55	$11.55	200	100	100	$349.00	$349.00
26-May	13	50.00%	50.00%		30	15	15	$11.55	$11.55	240	120	120	$418.80	$418.80
26-May	16	50.00%	50.00%	3.3 Hrs.	75	37.5	37.5	$28.88	$28.88	560	280	280	$977.20	$977.20
26-May	17	50.00%	50.00%		45	22.5	22.5	$17.33	$17.33	360	180	180	$628.20	$628.20
26-May	18	50.00%	50.00%		20	10	10	$7.70	$7.70	80	40	40	$139.60	$139.60
26-May	19	60.00%	40.00%		60	36	24	$27.72	$18.48	480	288	192	$1,005.12	$670.08
11-May	19		100.00%		75	0	75	$0.00	$57.75	320	0	320	$0.00	$1,116.80
11-May	20	50.00%	50.00%		100	50	50	$38.50	$38.50	400	200	200	$698.00	$698.00
11-May	22	50.00%	50.00%		30	15	15	$11.55	$11.55	200	100	100	$349.00	$349.00
11-May	23	50.00%	50.00%		30	15	15	$11.55	$11.55	200	100	100	$349.00	$349.00
11-May	24	50.00%	50.00%	1.3 Hrs.	20	10	10	$7.70	$7.70	120	60	60	$209.40	$209.40
11-May	25	50.00%	50.00%		35	17.5	17.5	$13.48	$13.48	240	120	120	$418.80	$418.80
11-May	26	50.00%	50.00%		20	10	10	$7.70	$7.70	120	60	60	$209.40	$209.40
11-May	27	50.00%	50.00%		25	12.5	12.5	$9.63	$9.63	160	80	80	$279.20	$279.20
11-May	28	25.00%	75.00%		20	5	15	$3.85	$11.55	120	30	90	$104.70	$314.10
11-May	50		100.00%		45	0	45	$0.00	$34.65	240	0	240	$0.00	$837.60
		3505.00%	**6295.00%**	**0**	**3,405**	**1,115**	**2,290**	**$859**	**$1,763**	**21,600**	**6,638**	**14,962**	**$23,166.62**	**$52,217.38**

	Dock %	Lake %	Prep/Drive Time	Total Min.	Dock Time	Lake Time	Employee Cost	lbs	# lbs. Dock	# lbs. Lake	Treatment Cost
			Fuel per Day								
30 days Harvesting			$24.50	14,400			$2,592.00				
10 days Mapping				4,800			$3,024.00				