Attachment E – Notice of Intent

WATER QUALITY ORDER NO. 2013-XXXX-DWQ
GENERAL PERMIT NO. CAG990005

STATEWIDE GENERAL NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT FOR RESIDUAL AQUATIC PESTICIDE DISCHARGES TO WATERS OF THE UNITED STATES FROM ALGAE AND AQUATIC WEED CONTROL APPLICATIONS

I. NOTICE OF INTENT STATUS (see Instructions)

Mark only one item	A. New Applicator	B. Change of Information: WDID# 5A17KP00003
	C. ☐ Change of ownership or responsibility: WDID#	

II. DISCHARGER INFORMATION

A. Name LAKE COUNTY WATER RESOURCES			
B. Mailing Address 255 N. FORBES ST., ROOM 309			
C. City LAKEPORT	D. County LAKE	E. State CA	F. Zip 95453
G. Contact Person CAROLYN RUTTAN	H. E-mail address carolyn.ruttan@lakecountyca.gov	I. Title Invasive Species Program Coordinator	J. Phone 707-263-2344

III. BILLING ADDRESS (Enter Information *only* if different from Section II above)

A. Name			
B. Mailing Address			
C. City	D. County	E. State	F. Zip
G. E-mail address	H. Title	I. Phone	

IV. RECEIVING WATER INFORMATION

A. Algaecide and aquatic herbicides are used to treat (check all that apply):

1. ☐ Canals, ditches, or other constructed conveyance facilities owned and controlled by Discharger.
   Name of the conveyance system: ______
2. ☐ Canals, ditches, or other constructed conveyance facilities owned and controlled by an entity other than the Discharger.
   Owner's name: ______
   Name of the conveyance system: ______
3. ☒ Directly to river, lake, creek, stream, bay, ocean, etc.
   Name of water body: CLEAR LAKE

B. Regional Water Quality Control Board(s) where treatment areas are located (REGION 1, 2, 3, 4, 5, 6, 7, 8, or 9): Region 5
(List all regions where algaecide and aquatic herbicide application is proposed.)

V. ALGAECIDE AND AQUATIC HERBICIDE APPLICATION INFORMATION

A. Target Organisms: AQUATIC PLANTS, GREEN ALGAE, CYANOBACTERIA

B. Algaecide and Aquatic Herbicide Used: List Name and Active ingredients
SEE SUPPLEMENTAL INFORMATION

C. Period of Application: Start Date MAY 1 End Date SEPTEMBER 30

D. Types of Adjuvants Used: CYGNET PLUS - NONIONIC
CIDE-KICK II - NONIONIC

VI. AQUATIC PESTICIDE APPLICATION PLAN

Has an Aquatic Pesticide Application Plan been prepared and is the applicator familiar with its contents?
☒ Yes ☐ No

If not, when will it be prepared? ______

VII. NOTIFICATION

Have potentially affected public and governmental agencies been notified? ☒ Yes ☐ No

VIII. FEE

Have you included payment of the filing fee (for first-time enrollees only) with this submittal?
☐ YES ☐ NO ☒ NA

IX. CERTIFICATION

"I certify under penalty of law that this document and all attachments were prepared under my direction and supervision in accordance with a system designed to ensure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine or imprisonment. Additionally, I certify that the provisions of the General Permit, including developing and implementing a monitoring program, will be complied with."

A. Printed Name: SCOTT DE LEON

B. Signature: [signature] **Date:** 4/19/2013

C. Title: WATER RESOURCES DIRECTOR

XI. FOR STATE WATER BOARD STAFF USE ONLY

WDID:	**Date NOI Received:**	**Date NOI Processed:**
Case Handler's Initial:	**Fee Amount Received:** **$**	**Check #:**
☐ **Lyris List Notification of Posting of APAP**	**Date** ____________	**Confirmation Sent** ______

COUNTY OF LAKE
WATER RESOURCES
255 N. Forbes Street
Lakeport, California 95453
Telephone 707-263-2344
Fax 707-263-7748
watershed.co.lake.ca.us

Scott De Leon
Director

December 19, 2013

Subject: Attachment to Clear Lake Integrated Aquatic Plant Management Plan submitted as the APMP for the NOI application package for 2013-0002-DWQ

The Clear Lake Integrated Aquatic Plant Management Plan (CLIAPMP), written in 2004 and its associated Ordinance No. 2777 passed by the Lake County Board of Supervisors in 2006, will constitute the APMP required by the new Aquatic Pesticide NPDES permit. The CLIAPMP was the subject of a programmatic EIR in 2004 that was certified in 2006. This Plan has been the backbone of the Lake County Aquatic Plant Management Program for Clear Lake since 2004 and has ensured that the application of aquatic herbicides, algaecides and cyanobactericides to Clear Lake is in compliance with the Clean Water Act.

The CLIAMP dictates that Lake County Department of Water Resources permits all aquatic plant management (including cyanobacteria) on Clear Lake through its Clear Lake Aquatic Plant Management Permit that controls individual property owners', County's and Cities' aquatic plant management activities. Water Resources administers the NPDES permit from the State Water Resources Control Board for discharge of pollutants associated with the application of aquatic pesticides to waters of the United States, under Water Quality Order No. 2004-0009-DWQ. The monitoring and reporting requirements of the NPDES are a transparent method for verifying water quality restoration and protection of beneficial uses of the receiving waters following a treatment event.

The 2004 NPDES Permit is changing for the 2014 season of aquatic pesticide use. The new order, 2013-0002-DWQ, has changes that relate to the Lake County Monitoring and Reporting Plan and Quality Assurance Program Plan. These documents have been updated and included with the NOI.

When the 2004 NPDES Permit is referenced in the CLIAPMP, this is to be replaced by the 2013-0002-DWQ NPDES Permit and the appropriate monitoring and reporting requirements for this new permit.

<u>Gates or control structures used in receiving waters</u>
The new permit requires a list of gates or controlling structures in the receiving waters and an inspection schedule for those gates. This information is absent from the CLIAPMP (although it has been present in each annual Clear Lake NPDES report).

The CLIAPMP is now amended to add the following.
The controlling gate structure for Clear Lake is the Cache Creek Dam that is owned and operated by Yolo County Flood Control and Water Conservation District. Clear Lake is a natural lake and the purpose of Cache Creek Dam is to provide water storage to Yolo County farmers to be metered out at a controlled rate according to need. The maximum volume of

water that can be used by Yolo County is approximately thirteen percent of the Lake's capacity. The dam is approximately 5.2 miles downstream from the main Lake body (mouth of Cache Creek) and there is approximately 1,500 acre feet of water between the mouth and the dam. Lake-wide water samples obtained from the mouth of Cache Creek result in 'No Detect' when tested for active ingredients in the aquatic pesticides used in the County-permitted program due to the huge dilution of the small portion of herbicide-treated water with untreated water. This is then further diluted on its way to the dam so that the water at the gate structure is not impacted by aquatic pesticide applications. The dam's operation has no effect on pesticide applications in Clear Lake. The NPDES Annual Report shall continue to include the Cache Creek dam monthly discharge rate and the lake level using the Rumsey scale during the aquatic plant management season.

COUNTY OF LAKE
WATER RESOURCES
255 N. Forbes Street
Lakeport, California 95453
Telephone 707-263-2344
Fax 707-263-7748
watershed.co.lake.ca.us

Scott De Leon
Director

April 19, 2013

Subject: Supplemental Information for Section V. B. Algaecide and Aquatic Herbicide Used

Manufacturers name	**Active Ingredient**
DMA 4 IVM	2,4-D
Navigate	2,4-D
Weedar 64	2,4-D
Aquacide	2,4-D
Sculpin G	2,4-D
Nautique	copper carbonate
Captain, Captain XTR	copper carbonate
Harpoon	chelated copper
Cutrine-Plus, Cutrine-Ultra	chelated copper
Komeen	chelated copper
Algimycin-PWF	chelated copper
Aquathol K, Aquathol Super K	endothall
Hydrothol 191	endothall
Navitrol	triclopyr triethylamine salt
Triclopyr 3 SL, Ecotriclopyr 3 SL	triclopyr triethylamine salt
Renovate 3, Renovate LZR	triclopyr triethylamine salt
Renovate MAX G	triclopyr triethylamine salt and 2,4-D
Reward, Reward AccuGel	diquat dibromide
SonarOne, Sonar SRP, Sonar PR, Sonar A.S.	fluridone
Roundup Custom	glyphosate
AquaMaster	glyphosate
Aqua Star	glyphosate
AquaPro	glyphosate

Manufacturers name	Active ingredient
Galleon SC,	penoxsulam
Green Clean, Green Clean Pro	sodium carbonate peroxyhydrate
Phycomycin	sodium carbonate peroxyhydrate
PAK 27	sodium carbonate peroxyhydrate
Clearcast imazapyr	imazamox
Habitat	imazapyr
Imazapyr E Pro 2	imazapyr

Clear Lake Integrated Aquatic Plant Management Plan

August 1, 2004

Lake County Department of Public Works
Water Resources Division

TABLE OF CONTENTS

Chara sp. Plant Like Algae

curly leaf pond weed, *Potamogeton crispus*

Definition of Weed :

" A plant that is not valued where it is growing, and usually of vigorous growth"

Appendices 94

coontail,
Ceratophyllum demersum.

A native non-rooted submersed plant. Leaves are somewht stiff or crunchy. Floating coontail and plant parts are wind driven, and so commonly accumulate in downwind areas.

Maps

Tables

Acknowledgements

After periods of restructuring and redirection The Clear Lake Integrated Aquatic Plant Management Plan (hereafter referred to as the "Plan") will help the control effort to go forward.

Whenever a project of this scope takes place there are numerous people to thank. The Plan is the result of many hours of work contributed by several dedicated groups is no exception.

Managing Aquatic Plants Task Force

Clear Lake Advisory Committee

County Staff

Water Resources Division of Department of Public Works
Pamela Francis, Robert Lossius, Skip Simkins, Tony Gallegos, Peggie King
Agriculture Commissioners Office
Mark Lockhart, Maile Field, Peggie King, Denise Patrick, Steve Hajik,

State Agency Staff

California Department of Fish and Game
Mike Rugg, Joel Trumbo
California Department of Food and Agriculture
Bob Hesterberg, Robin Breckenridge, J. Robert Leavitt, Larry Bezark, Frank Zarate

Lakeport Chamber of Commerce

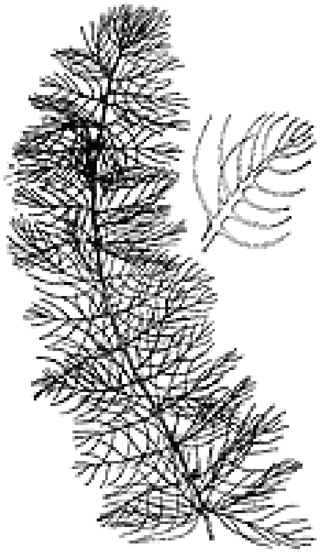
Mellisa Fulton, Peggie King, Jan Connor

Consultants

The Team, **Jones & Stokes**
Shaun Hyde, **SePro Corp**.
Doug Henderson, **ReMetrix Corp**

We apologize for inadvertently missing anyone in the proceeding list.

Large leaf Pondweed
Potamogenton amphifolius



Milfoils, *Myriophyllum* both native and non-native invasive species

We also acknowledge the following resources from which we gleaned much information and in some cases borrowed liberally:

A Citizen's Manual for Developing Integrated Aquatic Vegetation Management Plans (Gibbons et al. 1994) and Aquatic Plants and Fish (Washington Department of Ecology, 1998).

Lake Leland Integrated Plan (1998), Washington Department of Ecology.

Management of Eurasian Watermilfoil in Houghton Lake, Michigan: Workshop Summary, (2001) U.S. Army Corp of Engineers, ERDC/EL TR-01-00.

Managing Aquatic Weeds, Hoyer-Canfield

Interim Plan for Managing Aquatic Plants in Clear Lake, Maile Field, 5/16/01

Clear Lake Aquatic Weed Pilot Project, (Peggie King, 1999), Greater Lakeport Chamber of Commerce and Lake County Department of Public Works, Water Resources Division

Draft Clear Lake Basin Management Plan, 2003

University of California, Berkeley Image Library

University of Florida, Center for Aquatic and Invasive Plant

PLAN OVERVIEW

Clear Lake is a natural, shallow, warm-water lake lying in the Central Coast Range of California. It is the largest natural freshwater freshwater lake that lies within California's borders and is one of the oldest lakes in North America. The lake is located in Lake County in rural Northern California. Lake County's economic health and future well being are closely tied to the health of the lake. The lake is euthrophic (nutrient rich, productive, alive and well) and thus supports an abundant fishery and extensive wildlife as well as a diverse aquatic plant community. The lake is highly regarded for recreation and has visitors from all over California as well as from out of state. It is the water supply for many local communities and residents and its waters are used outside of the county for downstream irrigation.

During most of the second half of the 20th century, the lake was subject to summer blooms of nuisance algae. These nuisance blooms have been attributed at least in part to nutrient loading into the lake from human activity. Partially due to an attempt to manage the algae problem, mainly by limiting nutrient sources, measurable improvements in water quality and clarity have been experienced over the past decade. The lake has now transitioned from being algae dominated to becoming excellent habitat for aquatic plants. This is due partially to the natural characteristics of the lake, being relatively shallow and warm (non-freezing) combined with the increasing clarity of the water allowing sunlight to reach the bottom and the plants, encouraging plant growth.

The initial problem from this increased plant activity as experienced by lake visitors/users and shoreline residents results from "weeds" limiting lake access and usage in many areas. The longer-term threats, especially from more invasive recently introduced species, could either result in the closure of the lake to all activity and severe damage to the county's economy or to extremely expensive county and state emergency eradication efforts if the "weeds" are left unmanaged. While these plants (especially when unwanted) are called weeds, scientifically they are defined as aquatic macrophytes. In this plan "aquatic plants" is generically used to refer to the many species found in Clear Lake. It is important to realize that a healthy lake requires a sustainable healthy aquatic plant community.

The most notorious of the invasive aquatic plant species currently found in the lake is Hydrilla. Hydrilla was discovered in the lake in 1994 and since then has been the target of an eradication effort by the California Department of Food and Agriculture's (CDFA). Hydrilla is, currently, the only aquatic plant species that is actively managed and controlled on a lake-wide basis; the effort is ongoing and so far has been making good progress.

Starting in the late 90's several groups were assembled including citizens, business owners and local and state government agencies to address the required management and control of aquatic plants in Clear Lake. This document is the result of those efforts plus considerable staff time by County personnel. It contains compiled rationale, issues, scientific data and a recommended implementation plan.

The goals of this Plan are designed to best balance the many requirements placed upon any program to manage and control aquatic plants. Requirements include protection of the many beneficial uses (and users) of the lake, the ongoing health of the lake and the environment, and protection of the abundant wildlife found in the area. To ensure proper balance is achieved and maintained requires that such goals consider ongoing data collection, expert technical guidance, and community education and participation.

The Plan provides extensive information on the characteristics of the entire watershed area, the lake, and the aquatic plants found in the lake. This information was gathered and compiled from many sources including an assessment commissioned by the county utilizing the latest hydroacoustic bottom analysis and satellite imagery to provide a baseline of the current lake and its aquatic plant population. All of this data provides the basis for the many decisions and trade-offs that comprise this balanced Plan. The Plan is dynamic and will be adjusted as requirements are updated, new data is collected, and results are monitored.

Also presented are the many considerations of alternative methods available to control aquatic plants. Some of the most common and effective methods in the short term are considered to be damaging in the long term. Some methods are applicable to Clear Lake, some are not. Decisions are reached and rationale discussed. Again, these areas of the Plan will be updated as results are analyzed and new technology and methods are discovered and evaluated.

The implementation plan has been organized into two sections:

- *Working Framework* which sets programmatic boundaries which are controlled by a permitting process

- *Strategic Actions* which give additional substance to the Plan and complements the basic working framework

Working Framework and Permitting

The direct reduction of existing aquatic plants will be achieved through a mixture of the application of approved herbicides by licensed applicators as well as harvesting of existing plants. Both methods require the application for and receipt of a permit from the Lake County Department of Public Works prior to any action.

Although the plan commits us to an integrated approach of herbicides, and harvesting, the ongoing Hydrilla Eradication Program temporarily restricts our ability to harvest in many areas of the lake (harvesting causes plant fragmentation in hydrilla and could potentially spread the plants to new areas), so for an extended period of time we will have to rely more on herbicides than many might prefer. As the Hydrilla infestation is reduced and eliminated we would expect to see a shift in the balance between herbicides and harvesting as influenced by the recommended data collection process and ongoing studies of the results of applications and harvesting in the lake.

Strategic Actions

There is a large range of critically important actions also proposed as part of this plan. These include but are not limited to:

- Data collection of the ongoing extent of aquatic plan growth, and the relative effectiveness of different treatments in the lake
- Integration with the Hydrilla program
- Adaptive Management (using the data to modify the program)
- Reduction of nutrient loads into the lake
- Public Education Programs
- Prevention of the introduction and spread of Invasive Aquatic plants into the lake.
- Enforcement

PROBLEM STATEMENT

The Clear Lake ecosystem is shifting/has shifted from being algae-dominated to being plant-dominated. The causes and effects are not completely understood but there appears to be an inverse relationship between algae and aquatic plant growth. A decrease in algae presence enables aquatic plant growth; the increased amounts of sunlight reaching the lakebed seem to provide plants an advantage over suspended algae. Anecdotal history of the lake from the 1950s through the 1980s indicates a relative absence of aquatic plants and very heavy algae during the warm months with occasional extreme noxious algae blooms. Since the early 1990's there has been a reduction in algae and an increase in aquatic plants. In the middle to late 1990s, submerged aquatic plant growth reached nuisance proportions in several shoreline areas. Consequently, for the first time in memory, rooted aquatic plant growth, rather than algal blooms are interfering with swimming, boating and other beneficial uses of the lake.

Soda Bay, summer of 2000, showing heavy aquatic weed growth limiting access to the lake.

Although improved water clarity is appreciated, the submerged aquatic plants now proliferating have created a nuisance in some areas, preventing safe swimming and boating in some areas. The lake-based tourism related businesses that have developed over the past half-century are being adversely affected. Moreover, aquatic plant growth has increased in the last decade to produce congestion of near shore waters previously unknown to the present generation. The result has been a profound frustration of boaters who are unable to gain access to the lake from private docking facilities. There is also a question related to fisheries impacts. While aquatic macrophytes are an integral part of healthy fish and wildlife habitat, under extreme circumstances aquatic plant growth may lead to degradation of fish habitat.

Stakeholder Issues

Stakeholders include the tourism industry including lakeside resort owners and

"A perceived problem can be a real problem, regardless of the water body conditions."
Hoyer-Canfield

employees as well as second-tier tourism trade businesses; all Lake County residents; waterfront and county wide property owners; native American Tribal members who gather materials for ceremonial or basketry purposes; visitors who use the lake including swimmers, boaters and people who fish either recreationally or for food; the lakeside and downstream water users who irrigate or drink lake water; farmers and other business people; and others tangentially.

Hydrilla Program

In 1994 *Hydrilla verticillata*, an exotic, tenacious submerged aquatic plant, was discovered in Clear Lake. Since then a California Department of Food and Agriculture (CDFA) emergency noxious weed eradication program has been underway. The program is eradicating hydrilla and preventing its spread to downstream irrigation and navigation channels, and potentially, in the case of high water floods, to the Sacramento-San Joaquin River Delta.

Hydrilla reproduces in several ways. 1) The plant produces tubers that have been known to survive in sediments for up to a decade before sprouting; 2) plant fragments broken or cut from parent plant can form new plants (Research has shown that almost 50 percent of Hydrilla fragments having a single whorl of leaves can sprout a new plant); 3) turions, leafy reproductive structures that form at the intersection of branches off the main stem and survive adverse conditions such as cold water temperatures, drying, ingestion and regurgitation by waterfowl, and herbicide applications.

The Clear Lake hydrilla program surveys for the plant, identifies and monitors infestation sites and eradicates all viable plant material. Plant surveys are done with teams of workers that throw modified grappling hooks into plant beds or drag the hooks along the lakebed and then examine their finds. When Hydrilla is found, a minimum of five-acres surrounding the location is treated with a contact herbicide. Then fluridone pellets (commercial name: Sonar) are applied to the lakebed. The hydrilla program developed a map of Clear Lake delineating 80 shore zones around the lake using landmarks, producing a clock-like map. About three-fourths of the zones have been known to host hydrilla at one time or another. The number of finds per year is decreasing by about 50 percent. Clear Lake remains the only water body under CDFA hydrilla eradication that has not been closed to boating. Members of the public are prohibited from manual or mechanical control of submerged aquatic plants within one-quarter mile of find sites. Chemical treatment is allowed by licensed applicators through a permit process.

Hydrilla section

AQUATIC PLANT MANAGEMENT GOALS

Objectives

The objective of this document is to present information that will provide guidance for the environmentally sound management of aquatic plants in Clear Lake. This plan will be adaptive in nature due to the changing regulatory environment, uncertainties about future plant populations, and the whims of natural phenomenon and potential conflicts with other management goals and lack of critical information specific to Clear Lake.

Goals

- Management of aquatic plants on and in Clear Lake shall be based on the multi-use concept.
- Ensure lake-users reasonable and easy access to the lake.
- Define a single-point permitting process for guiding lakefront property owners who wish to control the submerged aquatic plants adjacent to their property.
- Identify methods/treatments of vegetation management, cost effectiveness of varying treatments and other pertinent variables, to guide the decision making process.
- Include provisions to create an Aquatic Plant Management Technical Advisory Group for the evaluation of this plan on an annual basis for the duration of its implementation.
- Whole-Lake Ecosystem Management – with special consideration to exotic invasive species - must be considered.
- Develop monitoring, tracking and evaluation components for the plan, so that ongoing aquatic plant control projects are observed and relevant

data recorded. Utilizing Geographic Information System (GIS).

- ♦ Establish zones of special biological or cultural significance.
- ♦ Develop a program to minimize risk of future introduction of non-native species of plants or animals.
- ♦ Develop an Outreach/Educational program.
- ♦ Identify and obtain funding sources to help accomplish various objectives.

Recommendations for Future Policy Decisions

Management decisions should consider several factors. These principles can be applied to the management of fish and wildlife habitat, recreational areas, navigation, etc.

Define the **management objectives** for the specific area. Objectives should be dynamic and revisited on a regular basis, modified to reflect management effectiveness.

It is important to be **attentive**. Many nuisance or invasive weed problems can be prevented if they are addressed at an early stage. When the situation gets out of hand it is more difficult to control nuisance levels of plants.

Managers should be **realistic**. Invasive weed issues take a lot of time, effort and persistence. A long-term program is necessary to effectively deal with chronic nuisances. A one-time effort will not reduce the problem forever.

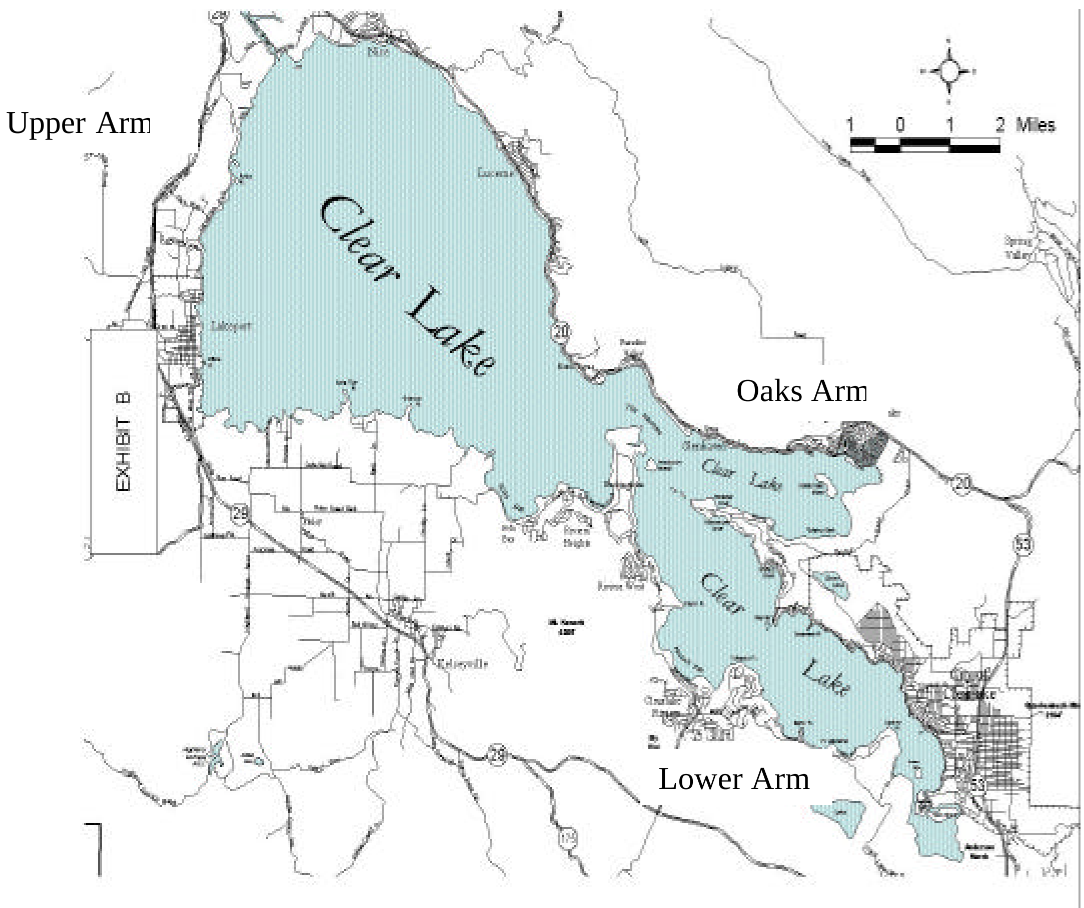
Incorporate an **integrated management** approach. Implement a variety of methods that are site specific, best able to control the particular situation and take the intended use of the affected area into consideration. Not all control methods provide similar results.

Utilize **adaptive management** strategies. This requires the manager to make careful observations and evaluate the effectiveness of weed control efforts. Techniques should be modified if they aren't working and different control strategies incorporated to suit the site-specific conditions. A management program must be prepared to be responsive to changes as they occur.

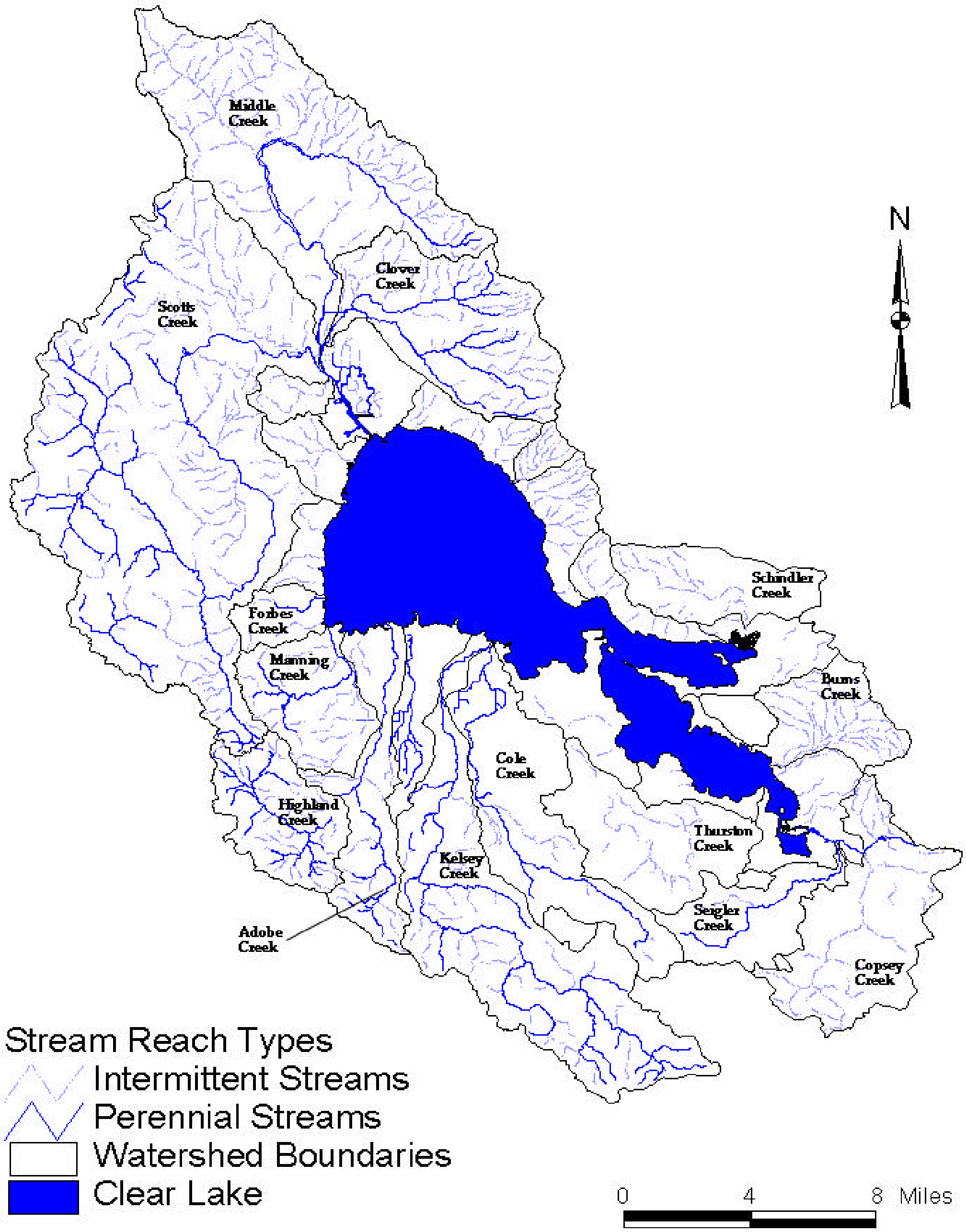
WATERSHED AND LAKE CHARACTERISTICS

Watershed Characteristics

The Clear Lake watershed, an area of approximately 500 square miles, is in the northern Coast Range geomorphic province of California. The topography is generally steep and rugged, but the watershed includes some gently sloping valleys and terrace remnants draining though primarily mineral soils. Elevations range from 4,299 feet at the top of Mount Konocti to 1,318 feet at the level of Clear Lake.



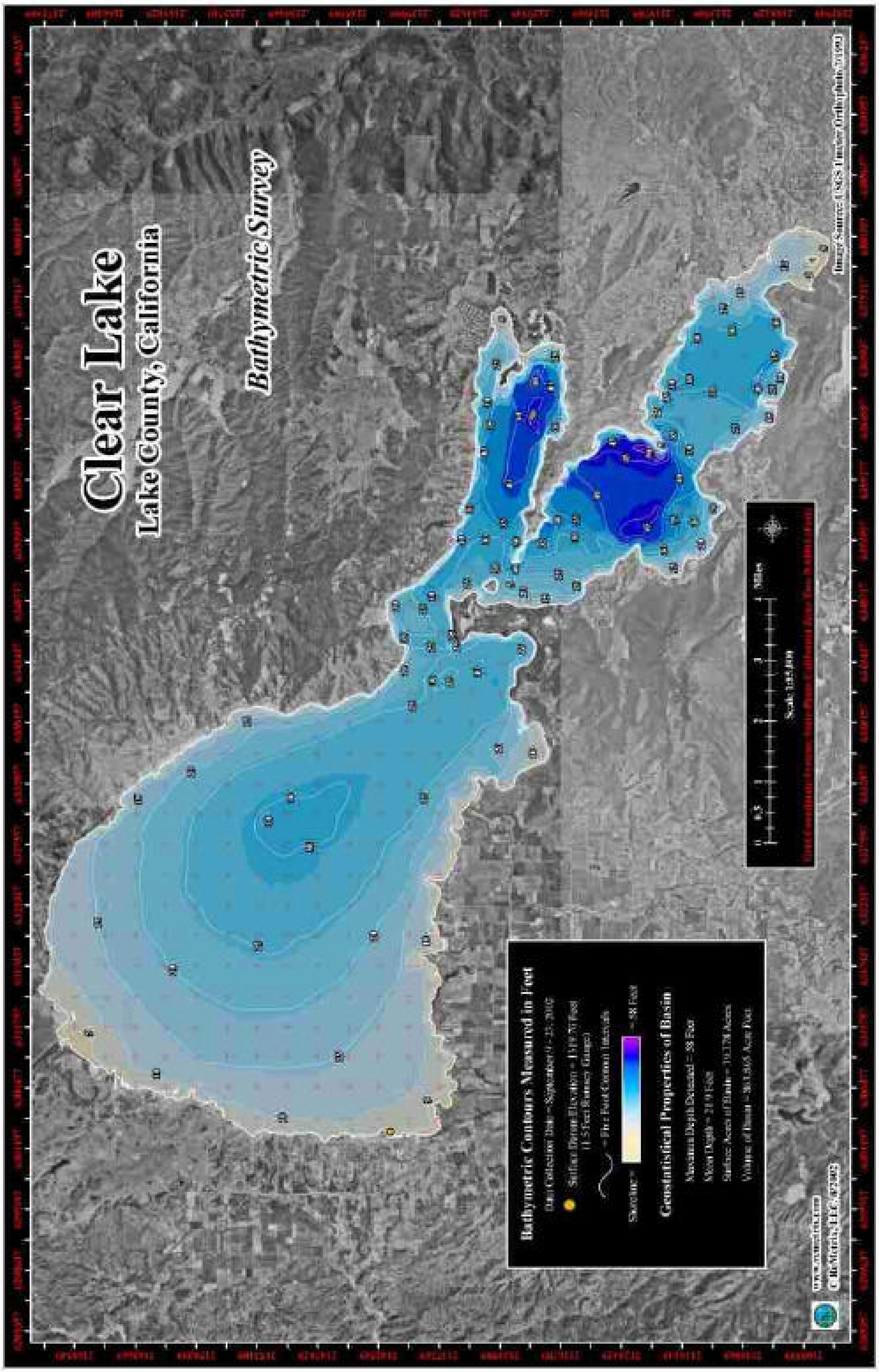
Clear Lake Basin Watershed Map



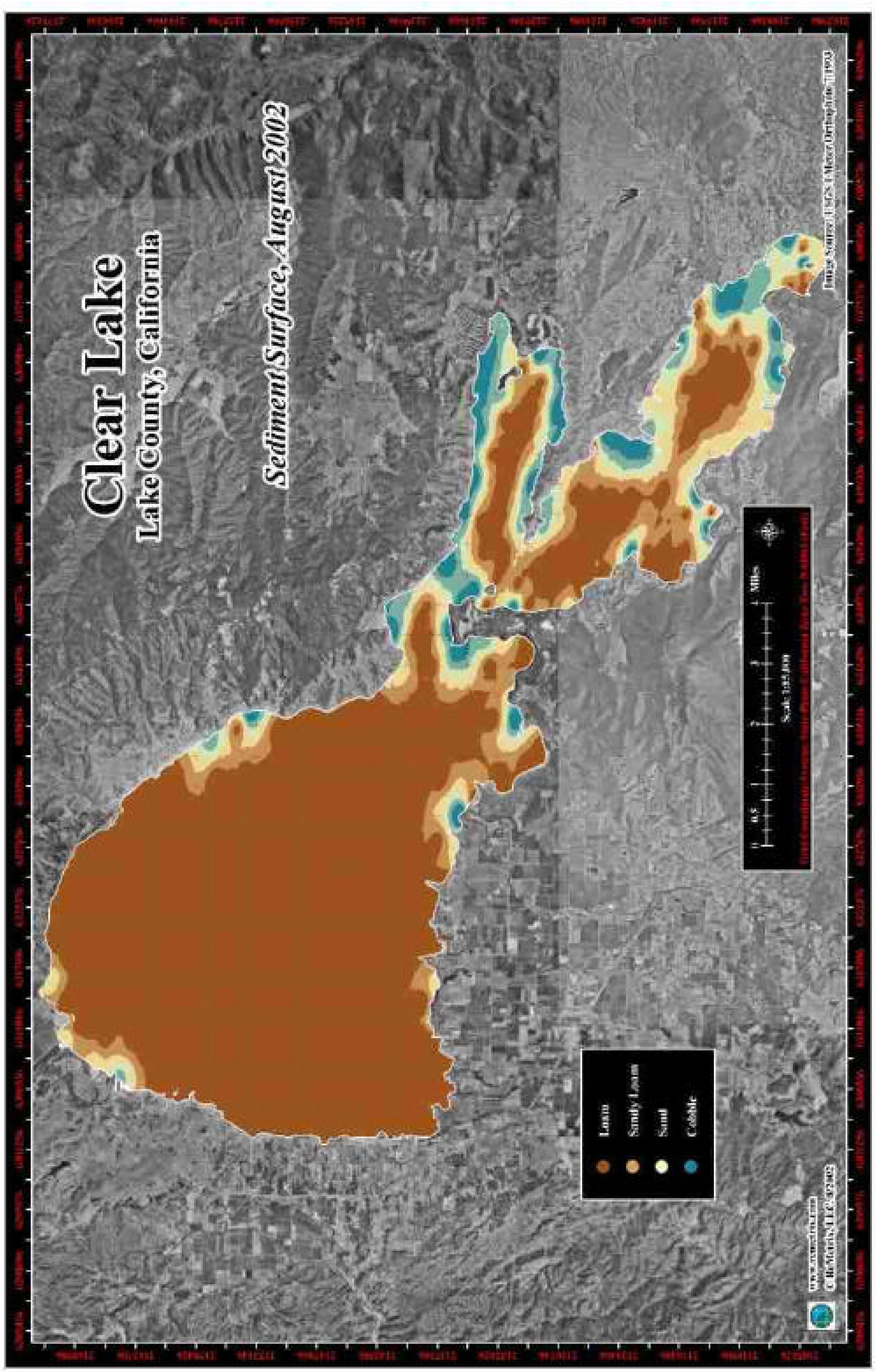
Fifty percent of the lake inflow is from the Scotts Creek and Middle Creek watersheds (Richerson et al. 1994), which enter the lake through Rodman Slough. Clear Lake discharges into Cache Creek through the Clear Lake Dam, which is approximately 5 miles downstream of the lake. The 5-mile portion of Cache Creek between Clear Lake and the Clear Lake Dam is often referred to as the Clear Lake outlet channel. Other major tributaries to Clear Lake include Adobe Creek, Kelsey Creek, and Schindler Creek. The groundwater flow into Clear Lake is estimated to be about 1,100 acre-feet (af) and a very small fraction (<0.3%) compared to the contributions from rainfall and river runoff (Richerson et al. 1994). The Big Valley and Upper Lake groundwater basins are estimated to contribute about 85% of the total groundwater inflow to the lake.

Lake Characteristics

Located in the central Coastal Range of Northern California approximately 90 miles north of San Francisco, Clear Lake is the largest natural freshwater lake located entirely in California. The lake has over 100 miles of shoreline and a surface area of slightly more than 44, 000 acres (68 square miles, 17,806 hectares). The 68-square-mile lake has a 105-mile-long shoreline and is generally divided into 3 main areas known as the Upper Arm (31,700 ac.), Lower Arm (9,200 ac.), and Oaks Arm (3,100 ac). The mean depth of each arm is approximately 23 ft., 34 ft., and 36 ft., respectively. The majority of the lake bottom has a depth ranging from 20 to 50 feet and a storage capacity of approximately 313,000 acre-feet (af) between 0 and 7.56 feet Rumsey. The lake is 18 miles long (7.5 miles wide at its maximum width) and drains approximately 500 square miles. Although quite large in area, Clear Lake is also very shallow, with an average depth of 26 feet and a maximum depth of 45 feet (some volcanic vents have been measured significantly deeper). The Upper Arm of the lake is most uniform and shallow.


Clear Lake
Lake County, California
Bathymetric Survey
Bathymetric Contours Measured in Feet
Geostatistical Properties of Basin

The lake sediments are primarily silt and other fine sediments, although in several areas rock outcropping continue out into the lake bottom.



Beneficial Uses

Natural Resources and Recreational Uses

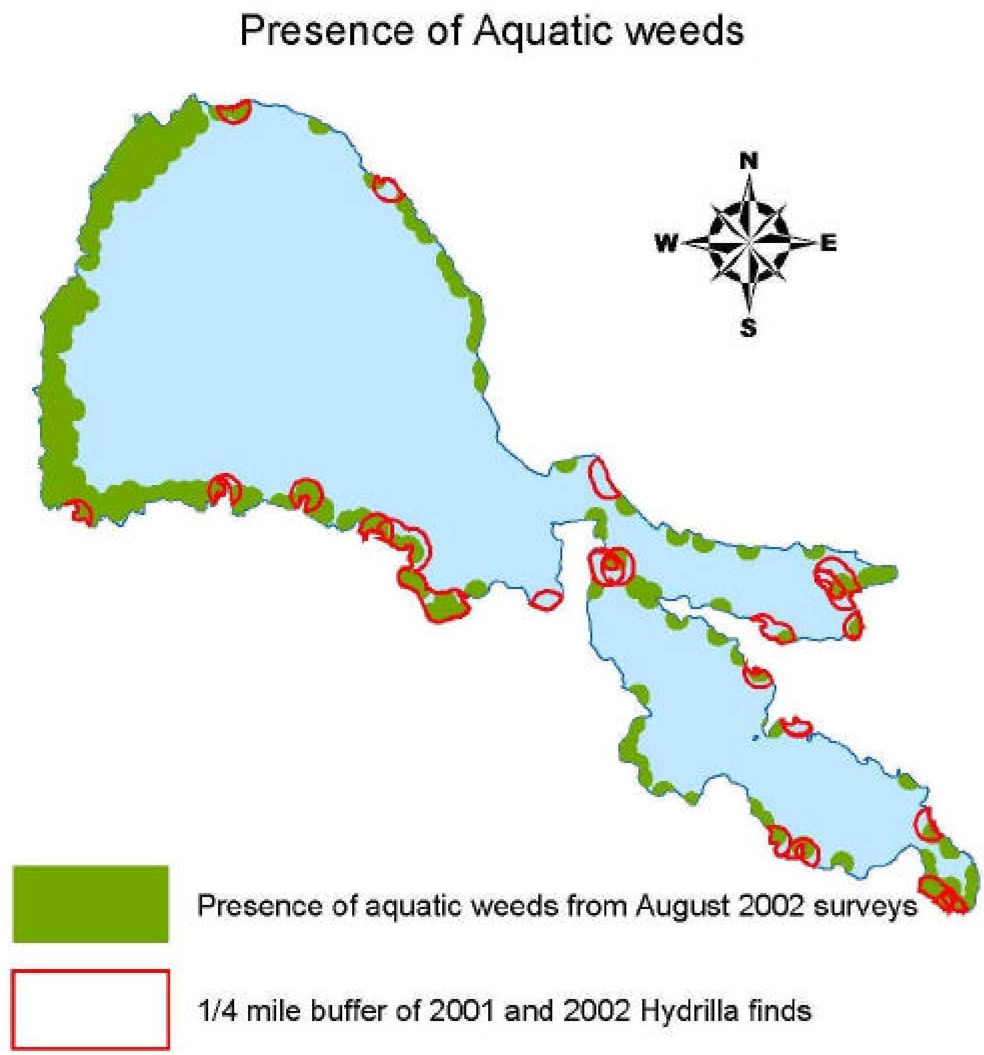
Clear Lake is a regional resource for recreation-based tourism, with large sections of the 105 miles of shoreline developed with homes and resorts, most of which are connected to the lakeshore with piers and docks. The towns of Clearlake Oaks, Lucerne, Nice, Lower Lake, and the incorporated cities of Lakeport, and Clearlake border the lake. The lake is an important source of domestic and agricultural water supplies. The County maintains 5-launch and 7-swim area public access sites at various points around the lake. There are also parks with lake access operated in the cities of Clearlake and Lakeport in addition to the Clear Lake State Park located on the southern shore. Beyond its importance for summer fisherman, swimmers, and boaters, the lake supports a year around fishery and provides abundant boating opportunities.

Fishing leads County recreation in popularity. Known as the Bass Capital of the West, Clear Lake provides numerous opportunities for bass fishing enthusiasts and generates substantial revenue for the County. Anglers enjoy recreational fishing, derbies, and tournaments at the County's lakes and reservoirs. Each year more than 25 fishing tournaments take place on Clear Lake. Florida-strain largemouth black bass, yellow and blue channel catfish, white and black crappie, green sunfish, and bluegill are among the sports fish in Clear Lake.

The Native Americans of the Clear lake Basin use its natural resources for social, cultural as well as ecomomic purposes.The local Pomo Tribes, known for their basketry skills, gather materials in the riparian zone around the lake and throughout the county.

Irrigation and Potable Water Source

The lake provides water for both drinking and irrigation. The following map shows some of the locations of Water Treatment Plant Intakes within a half mile (due to security issues the exact location is no longer available to the general public). In addition there are private water intakes used primarily for landscape irrigation and possible drinking water at undisclosed locations around the lake. Many of these are unregulated and undocumented individual systems. Commercial agriculture also pumps water from the lake for irrigation.



Fish and Wildlife Uses

Clear Lake historically and presently contains valuable fish and wildlife resources that are not only important to consumptive users, but also to the ecological integrity of the lake and surrounding area. All types of aquatic vegetation including submersed, emergent, and floating-leaved are significant components of all lake ecosystems and are critical to support successful reproduction and recruitment, and provide food resources either directly or indirectly, for growth for a wide variety of aquatic animals.

Plans should focus on maintaining natural habitats and attempt to reestablish native aquatic vegetation. Native submersed aquatic plants provide an important component to Lake Systems that enhance fish and wildlife resources. However, in the absence of native submersed plants, the exotic aquatic plants can furnish habitat to fish and other aquatic animals and provide benefits to the ecosystem. Yet fundamental questions about aquatic plants - fish and wildlife interactions remain: a) can this invasive species provide quality fish and wildlife habitat (as do native plants); and b) at what levels of growth and abundance do negative impacts of this plant outweigh any potential positive attributes?

Clear Lake and tributary streams generally support an abundant and productive warmwater fishery, supporting an estimated 29 fish species, with 13 native and 16 introduced species of fish (USDA Forest Service 1999, Jones & Stokes Associates 1997). Common fish species in Clear Lake and tributaries include largemouth and smallmouth bass, channel and white catfish, bluegill, brown bullhead, crappie, threadfin shad, carp, and rainbow and brown trout. Native fish species in Clear Lake include the Clear Lake Hitch, of cultural significance to local Tribes, and Sacramento Roach. The hitch, roach, catfish, and rainbow trout use lower reaches of tributary streams for spawning during the spring (March–June). The Clear Lake Splittail is presumed extinct (Moyle et al. 1995).

The composition and population levels of fish species in Clear Lake and tributary streams have been affected largely by the introduction of nonnative fish species and the direct and indirect alteration of habitats (USDA Forest Service 1999). Exotic species have altered natural predator-prey relationships, and bass and carp are known to be voracious predators of native hitch and roach species (Moyle et al. 1995). Loss of aquatic and lakeshore vegetation has resulted in a loss of cover and foraging habitat for fish species. Juvenile life stages fish species, such as the native Clear Lake hitch, require cover in tule beds or other aquatic vegetation to avoid predators such as introduced carp and bass species (Moyle et al. 1995).

As part of its valued tourism resource, Clear Lake provides wildlife habitat for a variety of waterfowl and songbirds. Although a substantial amount of the lake's shoreline has been modified by development, there are many areas that still support these uses. Even developed shoreline areas, if some tules or other rooted aquatic plants are allowed to remain, can provide cover, feeding, and nesting areas for birds and other animals.

There are several areas around the lake that host nesting Osprey, including the northshore, Soda Bay, Rodman Slough, and areas near the City of Clearlake. Bald Eagles winter here and there are now four known nesting pairs - one on the northshore near Paradise Cove, one in the lower arm of the lake near Jago Bay, one south of Lakeside County Park, and one in Buckingham.

During the summer the lake is home to Western and Clarks Grebes, Pied-billed Grebes, American Coots, Great Blue Herons, Green Herons, Black-crowned Night Herons, Bitterns, Kingfishers, Double-crested Cormorants, Osprey, Bald-Eagles, and Golden-Eagles to name only a few of the wide variety of birds. During the winter, migrating Common Mergansers, Common Loons, Buffleheads, Common Goldeneye, Eared Grebes, Great White Egrets, and other animals frequent Clear Lake. Rodman Slough is a migratory stopover known as a "migrant trap" where migrating songbirds often touch down on their journey south. Migrating warblers are often found there in spring and fall as they are at the McVicar Preserve which is adjacent to Anderson Marsh State Historic Park on the south end of the Lake. A huge variety of songbirds, both migrant and resident frequent all riparian and marsh areas on the lake, including Marsh Wrens, Warblers, woodpeckers, sparrows, juncos, Western Bluebirds, finches, American Robins, and more.

Tule habitat is very important to all these species - there is concern that tules are being over-taken by water primrose and control of this infestation has been suggested. On the other hand, careful monitoring of the impacts of chemical treatment needs to be carried out. The vast weedmats undoubtedly provide some feeding areas for birds like Pied-billed Grebes and coots, but tule habitat is by far the most valuable.

The lake is also important to a variety of wild mammalian species, e.g. deer, bobcat, mink, muskrat, opossum, skunk, raccoon, otter, which live around the lake and rely upon its waters for survival.

While the fish and wildlife management community generally recognizes the need to limit the impacts related to aquatic plants, there is still much concern and debate surrounding the type and level of control available for managing these plants in Clear Lake.

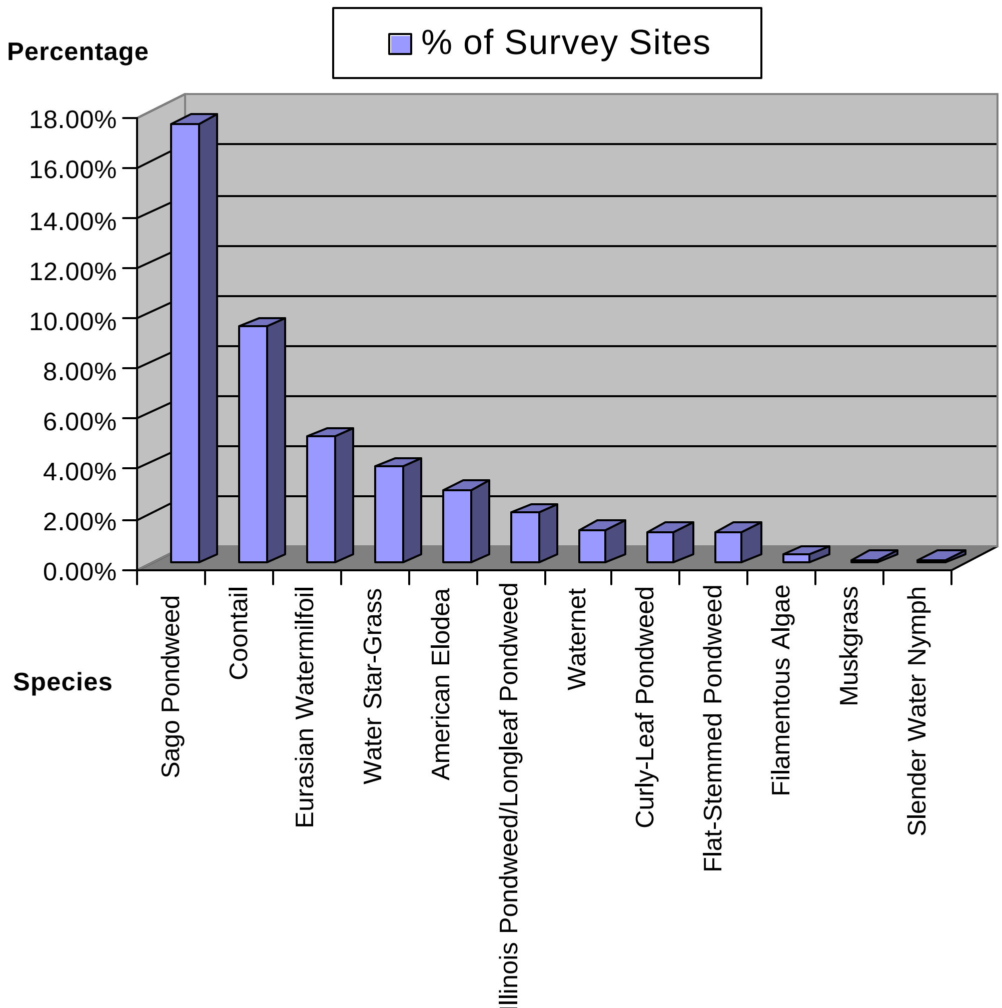
AQUATIC PLANT CHARACTERIZATION

Aquatic Plant Community: Past and Present

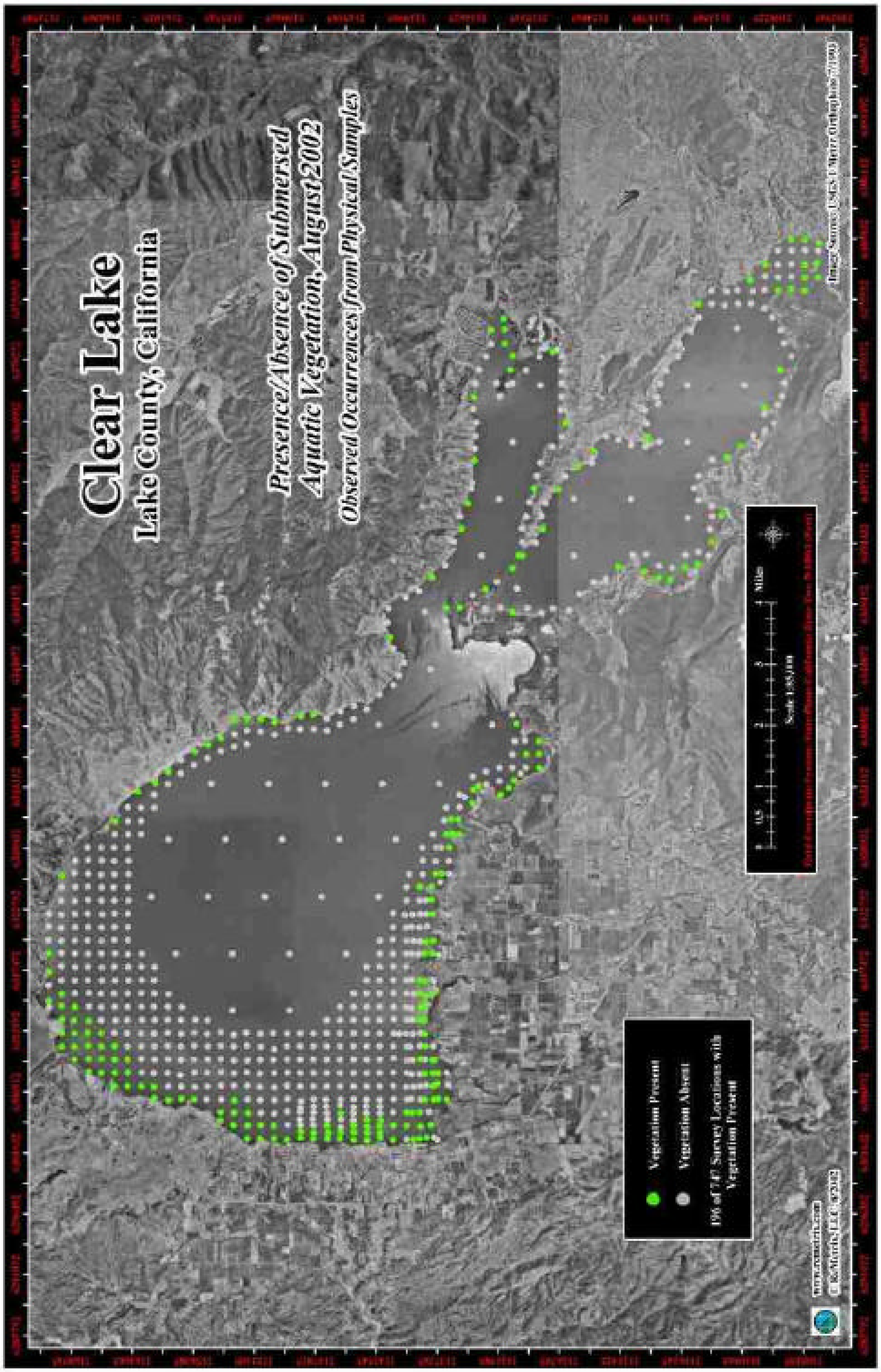
Before European settlement, there was an estimated 9,300 acres of freshwater wetlands in the basin, with 7,520 acres removed during the last 150 years. Land use and land conversions have directly and indirectly resulted in the removal of wetland habitat (Richerson et al. 1999). Aquatic vegetation in shallow water habitats was formerly common in Clear Lake (Coleman 1930). Significant remaining stands of tule marsh vegetation include the Anderson Marsh, Rodman Slough, and an area south of Lakeport and west of the Clear Lake State Park. Major tule marshes are an important habitat resource. Not only do the tules provide spawning and nesting areas for fish, they also are nesting areas for birds such as Western Grebes. For example, the area from south Lakeport all the way down to the County Park contains vital Western and Clark's Grebe nesting habitat. The summer of 2004 saw hundreds, if not thousands of nesting grebes in this area. Some pairs fledged as many as two or three babies and continued to breed well into July. Tules are vital to the Grebes because they build their nests from tules, and then attach them to the tules. The County has enacted a shoreline ordinance with provisions for not allowing any net loss of the existing tule marsh areas.

The most extensive submerged aquatic plant beds are located in the shallow western end of Upper Arm of the lake and scattered along significant portions of the remaining nearshore. Though these beds are problematic to navigation and certain ecological processes, they also serve as a source for plant fragment "rafts" that float into adjacent open-water areas, thereby creating problems there, as well. It is estimated that upwards of two-thirds of the shoreline of Clear Lake has nuisance aquatic plant growth occurring seasonally.

An extensive assessment of aquatic vegetation on Clear Lake has only recently been undertaken, (2002 season). Vegetation was present in 196 of the 747 sample sites (26%). The most abundant species found was Sago pondweed. The distribution of Sago pondweed occurred primarily in the main basin of Clear Lake. Sago was identified at nearly double the locations as the second most abundant species, Coontail. Eurasian watermilfoil, third in abundance, was found in 5% of all sample sites, and 19% of vegetated sites. The Eurasian watermilfoil was primarily distributed in the southeastern arms of the lake.



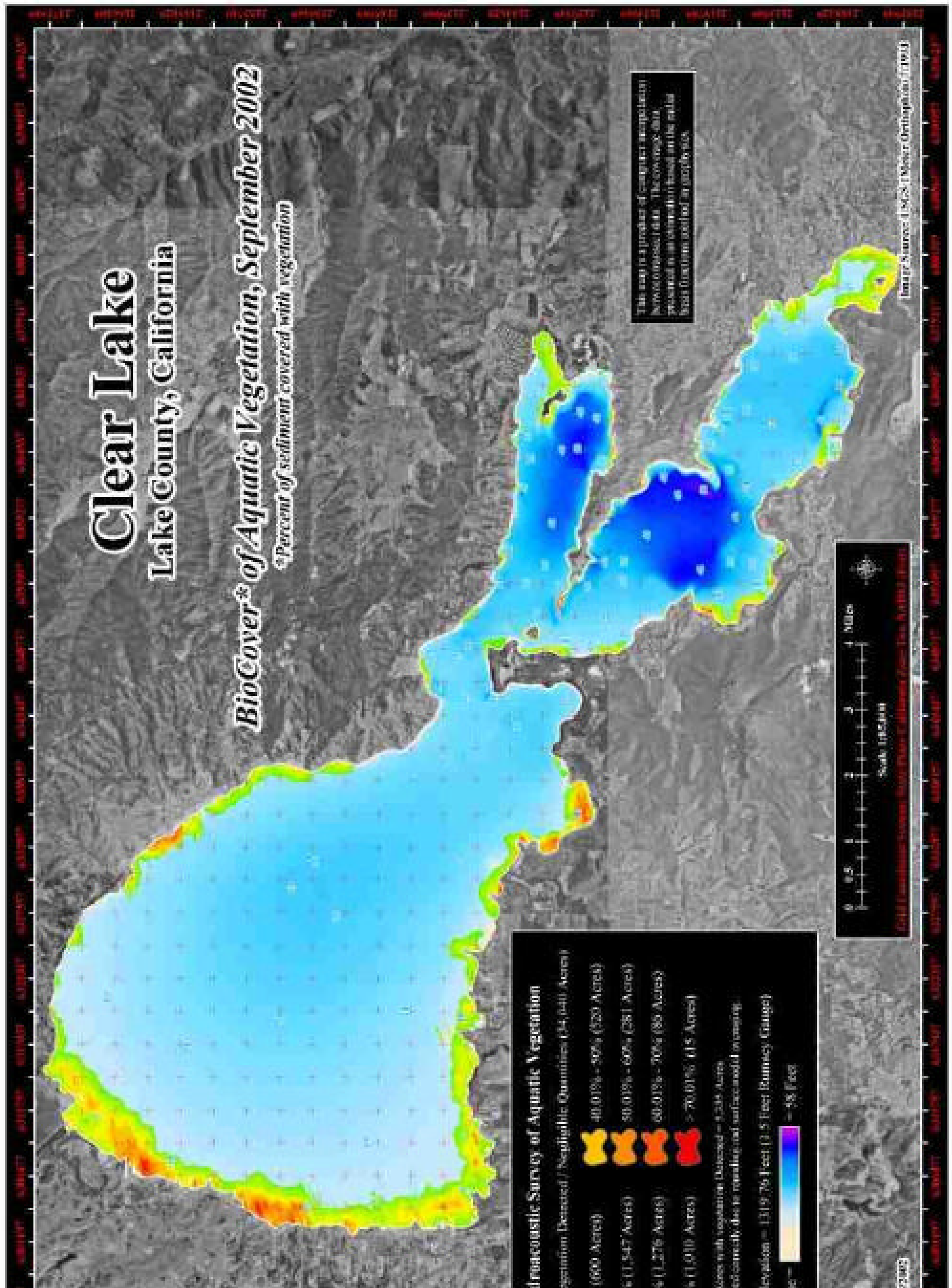
Overall vegetation distribution is concentrated along the western and southern littoral zones of the lake. Geographic distribution of each individual species is represented on the attached maps (see Appendix F).


Clear Lake
Lake County, California
Presence/Absence of Submersed
Aquatic Vegetation, August 2002
Observed Occurrences from Physical Samples
Vegetation Present
Vegetation Absent

Vegetation BioCover (Bottom Coverage) Analysis

The hydroacoustic data was also analyzed for overall vegetation bottom coverage, a measurement referred to as 'biocover.' Hydroacoustic data is not affected by water clarity, so it is the most reliable and efficient means to map vegetation bottom coverage. Similar to the bathymetric data analysis, the bottom coverage data for all the transects were plotted using GIS mapping software. The software then uses algorithms to interpolate bottom coverage between the transects. For this analysis, the model used is based on the geophysical minimum curvature method. The result is a full-lake vegetation bottom coverage map and associated statistics (see Appendix). The bottom coverage data does not make a distinction between species, which is the reason for also conducting the Vegetation Species Analysis.

The results of the bottom coverage analysis show that much of the littoral zone of the lake is vegetated. The shoreline gaps in bottom coverage are mostly areas that are very rocky or deep and do not support vegetation, or are places where the model did not interpolate bottom vegetation presence between transects. One unusual area that shows little bottom coverage is a section of the north-northeast littoral zone. The reasons that this area has sparse biocover were not determined in the scope of this study.

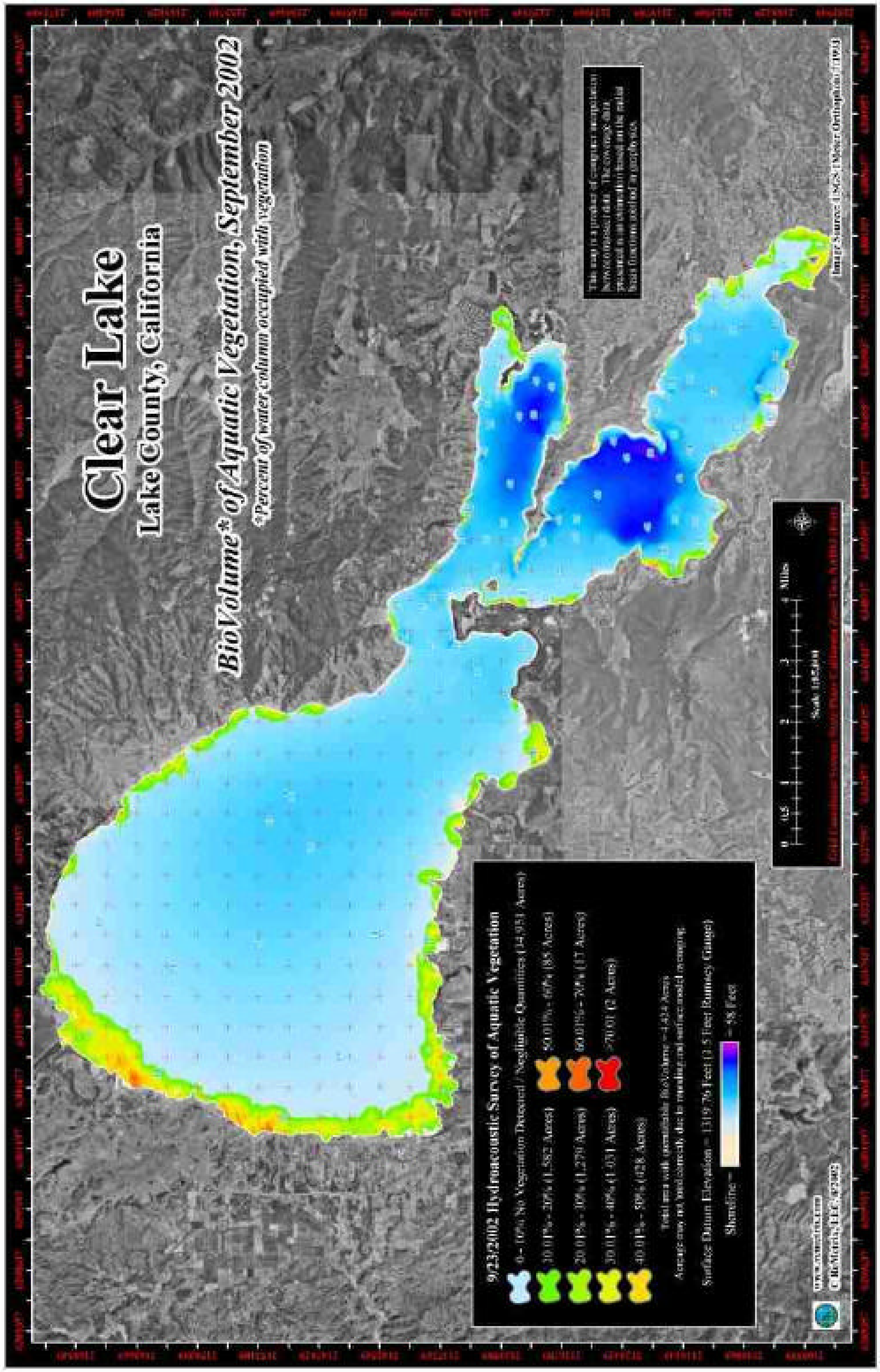

Clear Lake
Lake County, California
BioCover* of Aquatic Vegetation, September 2002
*Percent of sediment covered with vegetation
9/23/2002 Hydroacoustic Survey of Aquatic Vegetation

Vegetation BioVolume Analysis

Each hydroacoustic data point contains information on mean plant height, bottom coverage of vegetation, and water depth. Plant height and bottom coverage data can be combined with water depth information to produce a new metric called plant 'biovolume,' a representation of the fraction of the water column filled with submersed vegetation. For example, in 6 feet of water with a 3-foot mean plant height and 100% plant bottom coverage, plant biovolume would equal 50%. If plant height were reduced to 1.5 feet in this example, biovolume would decrease to 25% despite no difference in plant bottom coverage. Biovolume calculations allow quantification of how much of the water column is affected by nuisance plant growth resulting in reduced navigation, habitat quality, etc.

The results of the biovolume analysis suggest that only 104 acres of the lake have biovolume above 50%. This is about 2% of the total submersed vegetated area of the lake.

When considering the effects of significant biovolume, it is important to consider the ecological and recreational impacts of biovolume to those areas. While areas of significant biovolume may be relatively low, often those areas are in key ecological or recreational pockets of a lake (due to shallow water depth, nutrient inputs, and/or increased water column disturbances).


Clear Lake
Lake County, California
BioVolume* of Aquatic Vegetation, September 2002
*Percent of water column occupied with vegetation
9/23/2002 Hydroacoustic Survey of Aquatic Vegetation

Predictive Analysis

A predictive map showing areas of increased risk for significant biocover in included in the Appendix. This map was based on analyzing the extent of the littoral zone, the presence/absence of vegetation, the distribution of biocover and biovolume, the sediment compositions, and the locations of particular species existing in the lake (particularly Eurasian watermilfoil).

Three predictive categories were delineated for this map: high potential for continued vegetation development, elevated potential for vegetation establishment, and low potential for vegetation growth. Sediment composition played an insignificant role in the predictive model for Clear Lake because sediment macro-types are largely homogenous throughout the lake. The possible exceptions are areas of rocky/cobbly shoreline. However, while these areas have a reduced likelihood of noticeable biocover, they still possess some likelihood because vegetation was observed in some of these areas.

The area labeled 'elevated potential for vegetation establishment' represents the portions of the lake that meet most or all of the above-defined criteria for vegetation presence in Clear Lake, but which are not currently vegetated. Depending on changes in the lake water conditions (water clarity, nutrient inputs, etc.) or lake plant species, these areas show the greatest potential to support submersed aquatic plant communities. This area of elevated potential totals 8,578 acres, or nearly 22% of the lake.

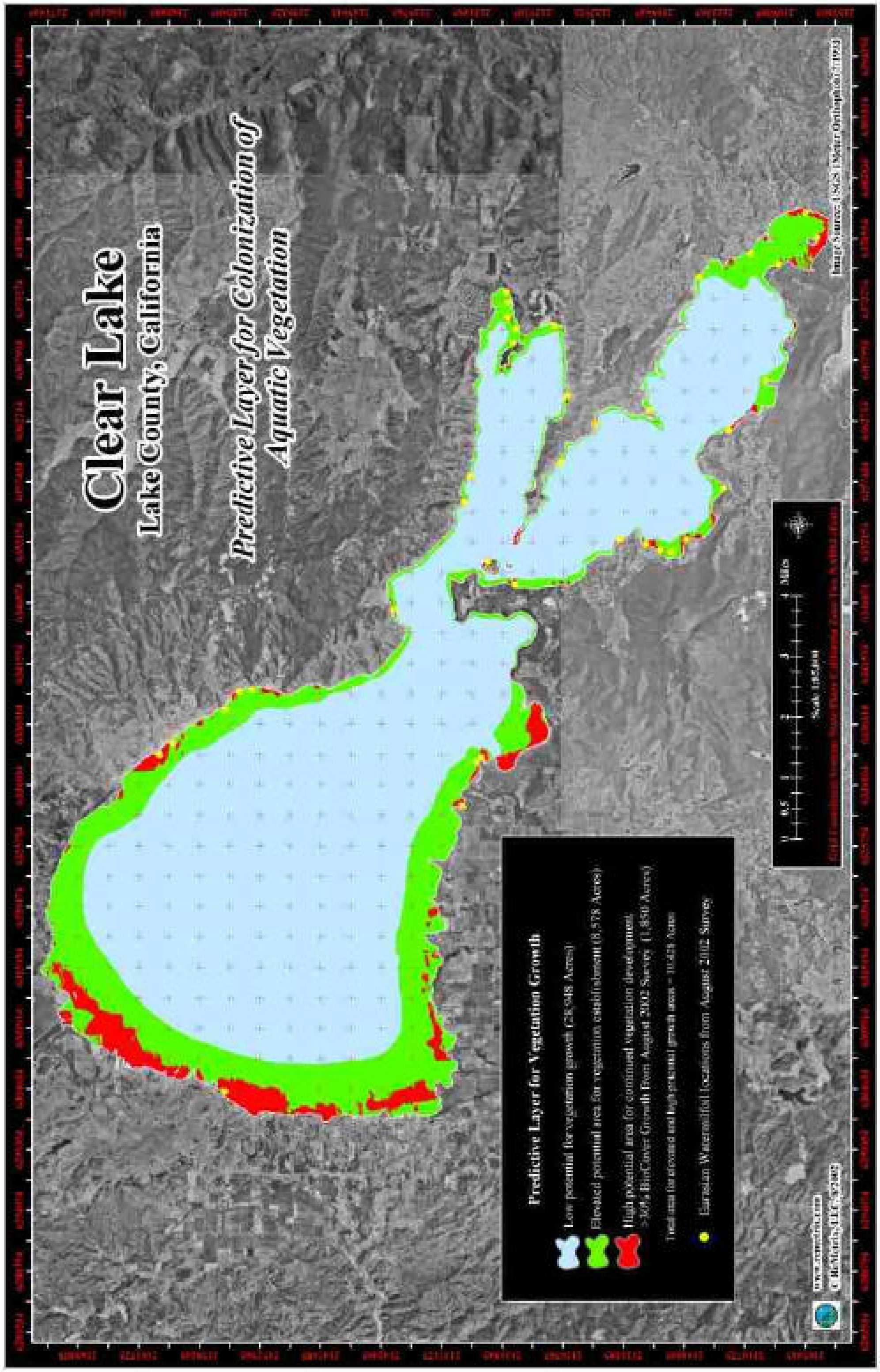

Clear Lake
Lake County, California
Predictive Layer for Colonization of Aquatic Vegetation
Predictive Layer for Vegetation Growth

Table 1 **List of Species sampled during August/September 2002 ReMetrix survey**

Ceratophyllum demersum (Coontail)
Potamogeton pectinatus (Sago pondweed)
Scirpus validus (Softstem bulrush)
Ludwigia peploides (Creeping water primrose)
Myriophyllum spicatum (Eurasian watermilfoil)
Heteranthera dubia (Water star-grass)
Potamogeton nodosus/illinoensis (Longleaf pondweed/Illinois pondweed)
Najas flexilis (Slender Water Nymph)
Elodea canadensis (American Elodea)
Potamogeton crispus (Curly-leaf pondweed)
Scirpus acutus (Hardstem bulrush)
Chara sp. (Muskgrass)
Potamogeton zosteriformis (Flat-Stem Pondweed)
Filamentous Algae

(See Appendix F for distribution maps for each species)

Table 2 **Lake County Vector Control Aquatic Plant List:
Additional documented species known to be present in Clear Lake**

Azolla filiculoides (Water velvet)
Azolla mexicana (Water velvet)
Cephalanthus occidentalis (Button bush)
Eichhornia crassipes (Water Hyacinth)
Hydrilla verticillata
Lemna sp. (Duckweed)
Nuphar polysiphonium (Cow lily)
Nymphaea sp. (Water lily)
Phragmites australis (= communis)
Polygonum amphibium var. *emersum* (Smartweed, Knotweed)
Polygonum spp. (several species) (Smartweed, Knotweed)
Potamogeton americanus (American pondweed)
Potamogeton linearis
Potamogeton natans (Floating-leaf pondweed)
Potamogeton nodosus
Sagittaria sp. (Arrowhead, Duck potato)
Salix goddingii (Willow)
Scirpus californicus (Southern bulrush)
Scirpus validus (Softstem bulrush)
Typha angustifolia (Cattail)
Typha domingensis (Cattail)
Typha latifolia (Cattail)

Hydrilla

Hydrilla topped-out in upper arm of Clear Lake, in1994, before treatment.

The following section and associated maps are excerpts from the CDFA Hydrilla Program Annual Progress Report for 2001, 2002, and 2003.

Hydrilla was found in Clear Lake on August 1. 1994 during a routine detection survey conducted by personnel from CDFA and CAC. The CDFA and Lake County biologists responded rapidly and applied copper aquatic herbicide to some infested areas within two weeks of the first detection.

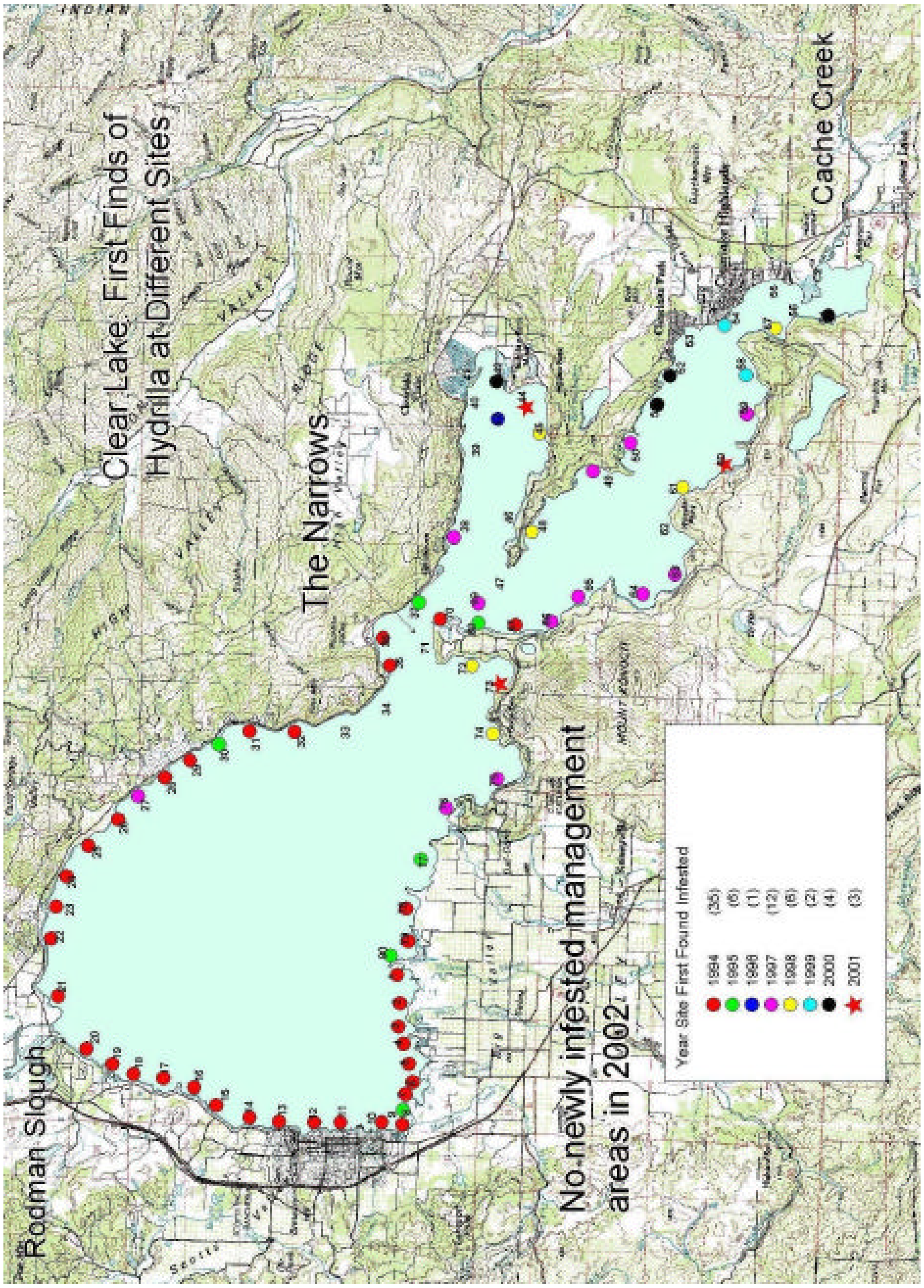
An initial delimiting survey found 175 to 200 acres along the shoreline of the upper arm of the lake were infested. Infestation levels varied from a few scattered plants to dense populations. In addition, in both 1994 and 1995, thousands of hydrilla fragments were visible at some of the boat ramps in the upper end of the lake.

The Clear Lake California Department of Fish and Game Hydrilla Project personnel divided the lake's shoreline into 80 management units plus 3 management areas along the Clear Lake outlet channel in order to better track and plan the eradication effort. These management units were based upon landmarks for ease of identification; they are not of equal size.

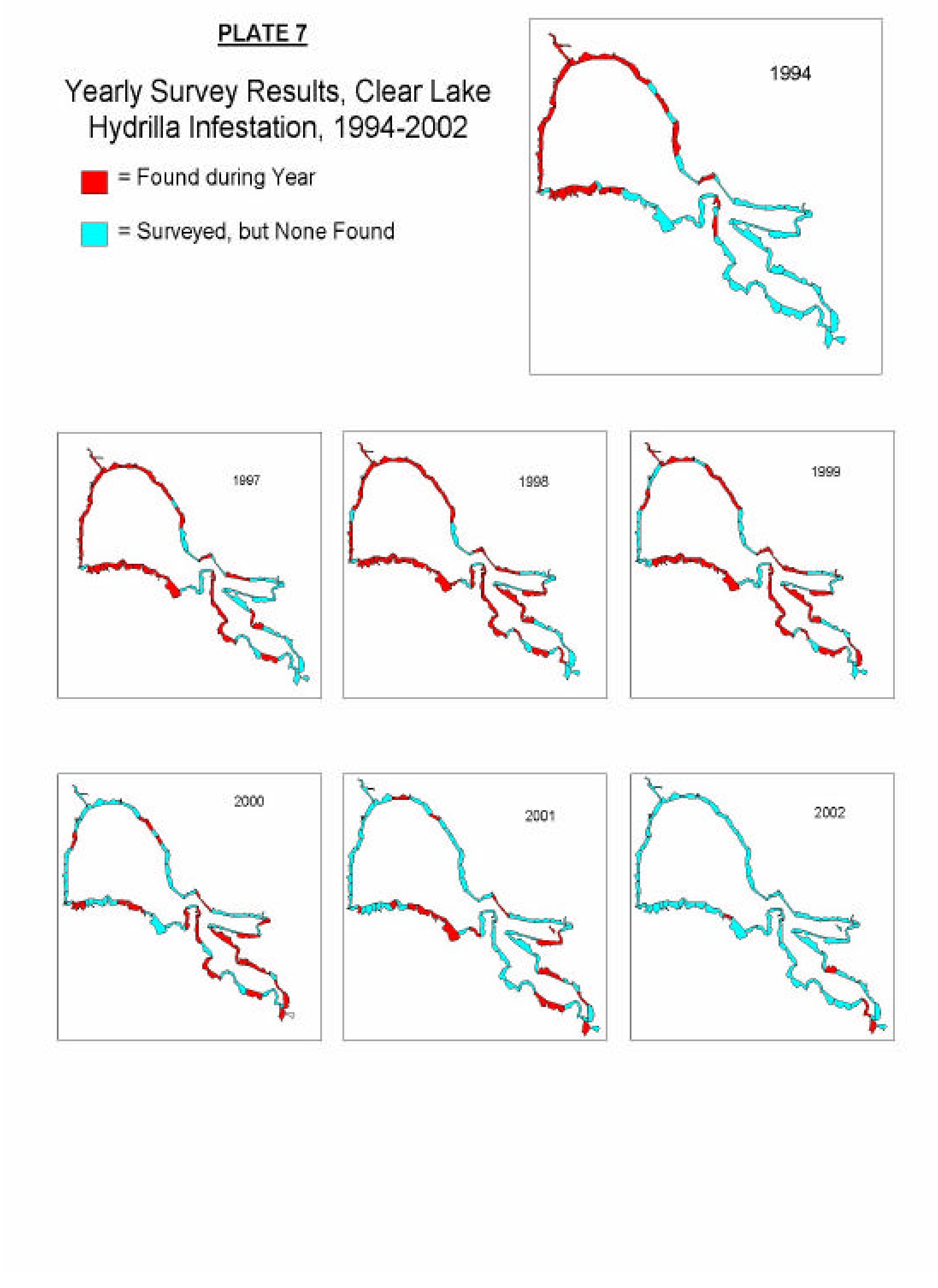
In general the Clear Lake Project crew starts in late April and early May and focuses their detection efforts on the known infested areas. These areas are all fairly near the shoreline, out to about 500 feet from the shore. There has been a decrease in the number of plant finds every year since the plant population has been low enough to count discrete finds. In addition, the number of infested management units has decreased from a maximum of 54 in 1998 to six in 2002.

Despite the decrease in the total number of hydrilla finds in 2001, the Clear Lake Project survey crew did find hydrilla in one previously uninfested management unit. number 44, and in one unit where hydrilla had not been found since 1999, number 75. In 2002, the crews did not find any hydrilla in previously non-infested units. In 2003 one new find of hydrilla was found in unit 25.

Starting in 2000, some management units have been free for over three years and are no longer actively treated. Because of the success of the Clear Lake Project, the number of such previously infested, but now non-infested and non-treated units has increased every year since 1999.



In 1994, only two infested areas were located in the lower arms of the lake, southeast of the Narrows. In 2001 and 2002, there were 22 infested areas that were located southeast of the Narrows. Moreover, since 1998, there has been an increase in 13 units in the lower arms as compared to an increase of only two units in the upper arm. In addition, most of the previously infested but now non-infested units are in the upper section of the lake.



Hydrilla Section excerpts taken from CDFA Hydrilla Program Annual Report for 2001 and 2002.

PUBLIC INVOLVEMENT

The Plan has sought specific guidance for viable aquatic plants control options. Starting with, input from stakeholders such as the Managing Aquatic Plants (MAP) Task Force, Clear Lake Advisory Subcommittee (CLAS), Clear Lake Rimlanders Association, the R and R Association, local city officials, and interested members of the general public whose comments and recommendations have been thoughtfully considered. In addition, critical input was obtained from government agencies the CDFA, RWQCB, CDFG, CDPR, NRCS and the Corps of Engineers, as well as, consultants and university staff.

Public involvement in the Aquatic Plant Management currently has evolved through three stages:

1. Pilot Project evaluating control methods, funded by a California Boating and Waterways grant, administered by a partnership of Greater Lakeport Chamber of Commerce and County Department of Public Works.
2. The Managing Aquatic Plants Task Force, a citizen stakeholder group which provided a venue for education and consensus building. Oversight provided by County Agriculture Commissioner's Office.
3. Clear Lake Advisory Subcommittee, review and oversight of previous 2 stages. In addition reviewed and commented on developing interim and long-term programs by Water Resource Division of County Public Works Department.

Each of these groups' contributions will be summarized in the following section. Continued public involvement and outreach is an essential and ongoing goal of this program.

Pilot Program

In 1996 California Senate Bill No. 1416 was passed authorizing Boating and Waterways to grant funds to Lake County to conduct a pilot project. The bill was passed as an emergency statute allocating $147,000 to explore options for nuisance aquatic weed control methods that could be compatible with the hydrilla eradication program conducted by the California Department of

Food and Agriculture on Clear Lake. $15,000 of these dollars was allocated to the Department of Fish and Game for program support. Funding allocations were available as follows: 1996-97 $45,000, 1997-98 $43,000, and 1998-99 $44,000. The grant expired on December 31, 1999. The Greater Lakeport Chamber of Commerce (Chamber) initiated the process to procure funding, however the Department of Boating and Waterways could not give the money directly to the Chamber which led to the partnership between the Chamber and the Lake County Department of Public Works (DPW). The pilot program worked 2 years evaluating several applied management techniques. (See Appendix D, Evaluation of Control Measures).

On November 1999, several options for future management of nuisance aquatic vegetation control were presented to the Lake County Board of Supervisors, ranging from taking no action to governmental control. The outcome of the hearing directed the Agriculture Department to: pursue the development of a management program for non-hydrilla aquatic vegetation; to seek funding to develop an environmental impact report and administer a permit to assure that chemicals only be applied by a licensed certified aquatic applicator.

This project provided an opportunity to gather information and assisted in the initiation of a process that has lead to focused, dynamic management objectives for the Clear Lake water body in order to maintain and enhance its natural beauty and meet public trust obligations.

Managing Aquatic Plants Task Force Mission:

It is our mission to develop an effective, consensus-based plan of aquatic plant management for Clear Lake which balances the needs of local residents, lakefront property owners, civic, and business leaders, regulatory agencies, and the recreational public with the habitat needs of fish and wildlife.

Managing Aquatic Plants Task Force (MAP)

Local concern regarding problems associated with the aquatic plant infestations, centered on future impacts on recreational opportunities, fish and wildlife resources, and ecological health of lake, ultimately resulted in the formation of the Managing Aquatic Plants-Task Force (MAP) in 1999, by the Lake County Agricultural Commissioners office.

MAP Task Force was comprised of representatives of the California Department of Fish and Game (CDFG) the Lake County Department of Public Works (DPW), lakeshore property owner, restaurant and resort owners, environmental groups and other interested parties. The MAP Task Force was a temporary Lake County Board of Supervisors appointed committee, established to direct the process for the control and/or elimination of aquatic plants in the lake, and to address the problems associated with nuisance aquatic plant growth.

In addition MAP developed a draft plan, hosted a Weed Faire, developed two pamphlets, began GPS work, and orchestrated public involvement in aquatic weed management issues.

Clear Lake Advisory Subcommittee (CLAS)

The MAP Task Force was dissolved in January of 2002. Its role was taken on by the already established subcommittee to the County Resource Management Committee (RMC), which reports to the County Board of Supervisors (BOS) on lake related issues. The Clear Lake Advisory Subcommittee (CLAS) is composed of stakeholder groups and BOS appointed members representing a balanced cross-section of interests. The advisory group traces its history back almost two decades. Starting as the Algae Committee it reported directly to the BOS on algal related issues. CLAS has since been restructured over time and broadened its reach to include lake issues in general. The subcommittee functions on a watershed approach to Lake Management, which is manifest in the ongoing Clear Lake Basin Management Plan for which this committee is also providing oversight.

EVALUATION OF CONTROL ALTERNATIVES

It is clear that actions can be undertaken to greatly reduce the amount of invasive non-native aquatic plants in the system, and keep noxious aquatic plants populations at a reasonably low level, while restoring and conserving the recognized benefits of a diverse native aquatic plant community. Proven techniques for controlling aquatic plants fall into the following categories: Environmental, Mechanical, Chemical, Biological, Cultural and Preventative. What works in one situation may not work in another.

Detailed descriptions of the management options can be found in the appendices of this report. The follow sections attempt to give the reader a quick overview of the various options and issues in relation to their use on Clear Lake. To more clearly understand the techniques please refer to the appendix section.

Environmental Controls

Water Drawdown involves exposing plants and root systems to prolonged freezing and loss of water. The use of Drawdown as an aquatic plant management tool is more common for use in reservoirs and ponds than in natural lakes. Drawdown is not feasible in Clear Lake.

Non Toxic Dyes are chemicals that prevent penetration of necessary light energy to developing plants that may in turn reduce aquatic macrophyte growth. Non Toxic Dyes are not feasible in Clear Lake.

Fertilization: Critical plant nutrients in short supply may be added to cause an algal bloom that shades out rooted plant growth. Fertilization is not feasible in Clear Lake, due to 303d listing as a nutrient impaired water body and not being economically feasible.

Mechanical/Physical Controls

Mechanical control techniques have been in use for centuries to battle nuisance growth of both terrestrial and aquatic plants.

Techniques that inflict physical damage to plants range from hand-operated implements to very specialized mechanized equipment. Simply cutting rooted plants below the water surface, by either hand-operated or mechanized cutters, may lead to death and eventual decomposition for some species. However, for many typically problematic perrenial species (e.g. Eurasian Water Milfoil, Egeria, and Hydrilla), cut shoot material may continue to thrive if not removed by some secondary process. One feasible process recommended in this plan is to treat the immediate area being cut with a contact herbicide to kill escaped fragments when havesting fragmentation propogated species.

Harvesting does not result in long-term reductions in growth because root crowns and roots are left intact. Duration of control for most species would be minimal, generally less than one season. Cut plants must be removed from the water or destroyed with contact herbicide. Fragments are numerous, making clean up difficult and laborious. Harvesting is considered a short-term technique that temporarily removes nuisance plants. To achieve maximum removal of plant material, harvesting is usually performed during summer when submersed and floating-leafed plants have grown to the water's surface.

Harvester's come in a variety of sizes.

Conventional single-staged harvester boats combine cutting, collecting, storing, and transporting vegetation into one piece of machinery. Cutting machines are also available which perform only the cutting function. Maximum cutting depths for harvesters and cutting machines range from 5 to 8 feet with a swath width of 6.5 to 12 feet.

Harvesting operations result in the immediate, non-selective removal of the upper shoot portions of targeted plant stands. In areas where excessive plant growth has led to degraded habitat and water quality, harvesting often provides temporary improvement to conditions. A specific location can be targeted leaving an area open for fish and wildlife. There is usually little interference with recreational use of the water body during harvesting operations. By cutting only the top 5 ft of the plant, some habitat remains. Harvesting dense stands of aquatic plants may promote good fish growth in harvested areas and allow predator fish to forage more effectively.

Conventional aquatic plant harvester systems can not be utilized to control the plant fragment masses in the shallow water and near shore areas. Conventional harvester systems generally have a minimum operating draft of more than 3 ft, and therefore, would not be able to collect fragment masses in shallow water areas. Smaller fish, turtles, and macroinvertebrates are themselves subject to becoming harvested, especially in dense plant stands that hinder their escape (Booms 1999). Nichols (1991) suggests that harvesting nontarget native species that reproduce by seed, regenerate poorly from fragments, or regrow slowly are at a competitive disadvantage to plants with growth characteristics similar to Eurasian Water Milfoil. Fragment production by harvesting has often been mentioned as a detrimental consequence of this technique, since generated fragments can serve as a source for dispersal to new areas.

Harvesting costs depend on a variety of factors such as program scale, composition and density of vegetation, equipment used, maintenance, skill of personnel, and site-specific constraints. Detailed costs are not uniformly reported, so comparing project costs of one program to another can be difficult. Currently, contract aquatic plant harvesting operations cost about $750.00 per acre on non-prevailing wage rate projects and $1000.00 per hour if prevailing wage is required (Houghton Lake 2001). Using a recent estimate of control at one acre per day, contracting would be very costly. The current purchase price for a new harvesting system is approximately $110,000 plus an ongoing operations and maintenance expense each year.

The following are recommendations for mechanical control in Clear Lake. Use conventional harvesters in open water areas for short-term control of actively growing aquatic plant beds for the following scenarios:

- For control in small areas where herbicides can not be used or where environmental conditions (e.g. high water exchange) prevent effective control by diluting required herbicide concentrations.

- For creating boat lanes across extensive weed beds.

- For treatments within or near sensitive areas (e.g. water intakes, protected fish and wildlife active nursery rearing areas).

Presently the use of mechanical methods is very restricted in Clear Lake, due to the ongoing Hydrilla Eradication Program. If hydrilla is sucessfully eradicated from the lake, in the coming years, there will be opportunities for the expansion of mechanical methods. The Plan needs to carefully consider other invasive species prone to spread from fragments when considering present and future use of this control method.

Biological Controls

Biological control is the use of parasitoid, predator, pathogen, antagonist, or competitor populations to suppress a pest population, making it less abundant and thus less damaging than it would otherwise be. Control organisms may be insects (or other arthropods), pathogens, or vertebrate herbivores. The biological methods of control are limited at this time. Introduction of non-native organisms is highly regulated by governmental agencies, and research requirements are substantial and expensive. The current budget crisis in California has resulted in several cuts in these programs further delaying potential introductions. Although surveys for classical biological control agents (agents that control the exotic plant in its native range) have been conducted no classical agents have been released from quarantine (Lars Anderson, pers. comm.) and it is unlikely that classical agents will be available in the near future.

Grass carp were brought into the United States from Malaysia in the 1960's and have been used to control aquatic weeds extensively in the South. Sterile triploid carp varieties have been developed, to eliminate breeding and thereby limit population to stocked fish. They have been used in parts of California (e.g. Imperial Irrigation District canals). However, even these sterile individuals are not allowed by state statute in areas such as Clear Lake, nor necessarily suitable or affordable if permitted. *(See Appendix D).* Grass carp are not an option in Clear Lake.

Successful biological control results in a suppression of the pest plant, not its elimination. Because of the potentially cyclical nature of control and the lower predictability of control temporally, biological control is most useful for long term control in lower priority sites and over large areas where other management actions would be less feasible or cost effective. High priority areas, where effective and rapid control is needed (e.g., boat channels, swimming beaches, docks), should be managed with other approaches.

Chemical Control

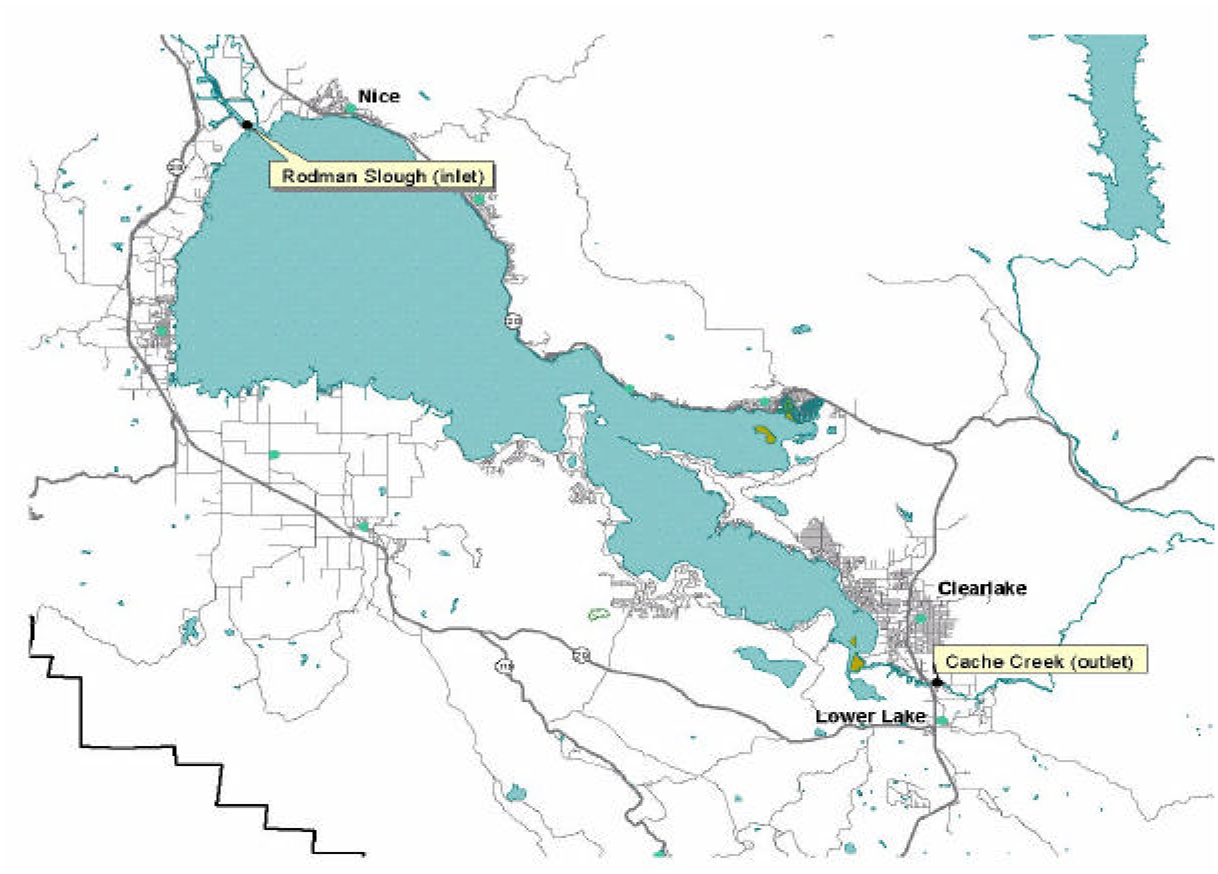
Aquatic plants have been successfully managed using various formulations of systemic and contact herbicides for several decades. While several formulations of both systemic and contact herbicides are registered by the U.S. Environmental Protection Agency for controlling aquatic plants, not all of those products are currently registered in the State of California and are therefore unavailable for use on Clear Lake. When treating submersed plants, herbicide effectiveness depends upon dose and contact time (also known as concentration and exposure time relationships or CET), which is in turn dependent upon the water exchange, a characteristic of the treatment zone.

Herbicides are divided into two groups, contact and systemic, by mode of action. Contact type herbicides rely exclusively on physical contact with the target plants. Systemic herbicides, unlike contact herbicides, translocate throughout the plant and under ideal conditions can provide complete control of the target weed. These herbicides are primarily absorbed by the leaf and stem tissues and move to the actively growing apical regions of roots and shoots, killing the entire plant.

The modes of action of many herbicides are directed at photosynthesis (plants), and therefore, when used according to label recommendations these compounds have no direct impacts on fish and wildlife. In many instances, using herbicides to remove or reduce nuisance levels of invasive aquatic vegetation can have many positive impacts on lake ecosystems. However, using aquatic herbicides can result in some types of indirect ecological impacts on lakes, but any negative impacts are usually short term. When aquatic herbicides are used for controlling vegetation in a broad-spectrum manner, desirable native submersed plants growing in the treated area can also be removed or injured. If all submersed plant biomass is quickly destroyed in an area, indirect ecological effects can occur, such as: release of nutrients into the water column from quickly decaying vegetation (nutrients that would become available for phytoplankton and filamentous algae), removal of oxygen by the increased biological oxygen demand (BOD) during plant decay process and the removal of structure and food sources for aquatic organisms and wildlife.

The waters of Clear Lake are considered public and therefore only licensed applicators have been allowed to apply herbicides to the waters of the lake. On March 12, 2001, the Ninth Circuit Court of Appeals decided that discharges of pollutants from the use of aquatic pesticides to waters of the Western United

States require coverage under an NPDES permit, (Headwaters, Inc. v. Talent Irrigation District). A general permit has been developed by the State Water Resources Control Board (SWRCB) in order to provide coverage for broad categories of aquatic pesticide use in California. This General Permit covers the uses of properly registered and applied aquatic pesticides that constitute discharges of "pollutants" to waters of the United States. Part of the NPDES permit of herbicide monitoring involves sampling for the active ingredient (ai) residue of all approved herbicides.
(See Appendix I)

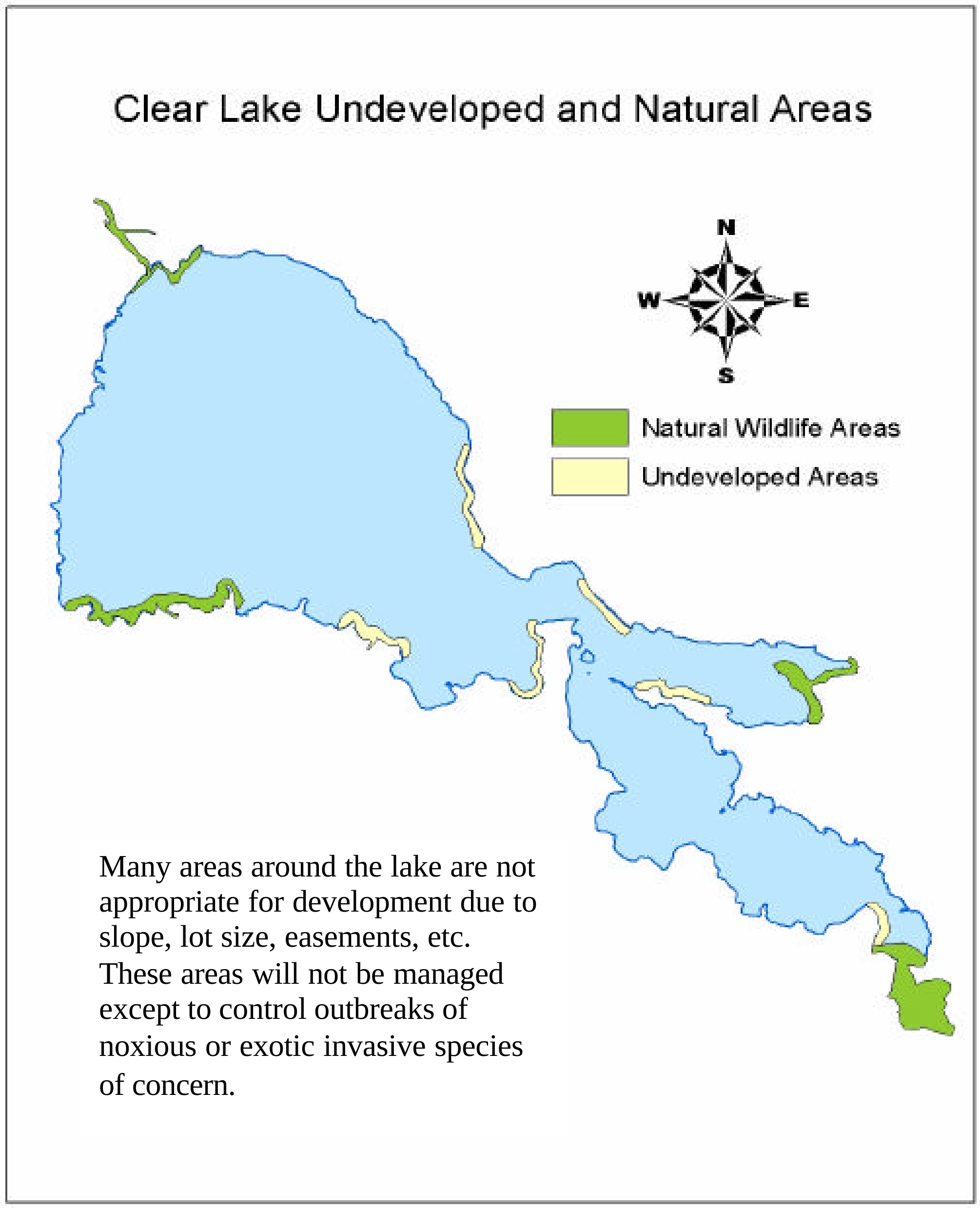


The above map indicates the monthly monitoring at the main inlet and outlet of the lake (primary sampling sites as required by NPDES permit). In addition, dissipation studies for residues of active ingredient (ai) are monitored over several days for random individual applications throughout the lake by County staff.

Cultural Control

Many of the problems associated with aquatic plants are more social than biological in importance. Selected use areas attempt to control people rather than plants, as in the establishment of natural areas.

There is a public resistance to developing lake zones to control recreational activities on the lake. Enforcement is also a serious consideration.



No Action Alternative

There are several situations in which taking no action is appropriate. Consensus on control strategy may be unattainable or simply taking no action may be more favorable alternative. However, this is rarely, if ever, the case when dealing with invasives and not considered a good policy. No action might be the choice while waiting for new, more effective or environmentally friendly strategies to be developed.

If taking no action is considered, it is important to consider the eventual consequences to the target water body and perhaps surrounding water bodies, particularly in the case of a non-native invasive weed such as Brazilian Elodea and Eurasian Milfoil. The effects of dense weeds on water quality, fish and wildlife habitat, aquatic organisms, and recreation and tourism are all concerns to be addressed when considering the no action alternative. In order to maintain a perspective, the consequences of taking no action should be weighed against the costs and benefits of various plant control options.

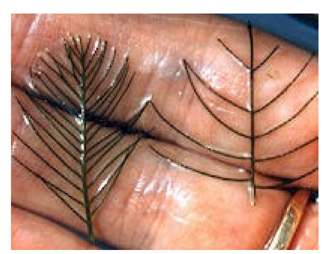
The residents of Lake County and visitors to the area are very unhappy about the excessive aquatic plants and their impacts to recreation in the lake, and, currently, they are looking for an effective control.

Considering the fact that there are no large-scale control options without associated risks, the no-action alternative has appeal, but too has risks as noted above. Though the negative impacts of native and other exotic plant encroachments throughout the littoral zone of Clear Lake are substantial, some of these impacts, such as swimming safety, can be addressed only through chemical or mechanical control.

Because of the complexities involving the tourism, the local economy and safety in Clear Lake, taking no-action on the aquatic weeds is not appropriate.

Preventative Techniques

A prevention program that educates the public about noxious aquatic weeds is a valuable and important part of aquatic management planning. Weed control is not weed prevention. Education is a great prevention tool. This can be accomplished in the form of continued newsletters, flyers, and newspaper articles. More neighborhood workshops for training in the recognition of



Eurasian Water Milfoil

troublesome aquatic plants can help citizens with the early detection of different noxious weeds. Public awareness of the problem can make a difference in the spread of exotic plants. Signs are being posted at the boat ramp and nearby lakes describing the invasive plant problem and the need to keep boats, trailers, and fishing gear free of plant fragments. Regular weekend volunteers checking boats for noxious weeds at the boat ramp would reinforce this message. Boat washing stations have been used successfully at some lakes.

Increased education and outreach on landuse practices that may contribute to aquatic plant problems by adding nutrients: fertilizing, septic system integrity, creekside and shoreline burning and dumping of yard wastes, grading and development that does not have adequate control measures in place.

CONSIDERATIONS IN MANAGING PLANTS

This plan should prioritize the most valuable resources and lake uses in order to design and implement activities for restoring and maintaining Clear Lake in a healthy condition now and in the future. After reviewing the ecological status of Clear Lake, and upon considering the documented negative impacts that aquatic plants can have on lake ecosystems, it is clear that invasive aquatic plant infestations can cause problems for the overall health of the water body. These problems include consequences to biological diversity, important fish and wildlife resources, recreational activities, and economics in the region. Since certain non-native aquatic plants currently occupy such a large percentage of the system, it is not realistic to believe that all the problematic species can be eradicated from Clear Lake. However, it is possible that actions can be undertaken to greatly reduce the amount of non-native aquatic plants in the system, and keep invasive aquatic plants populations at a reasonably low level, while restoring and conserving the recognized benefits of a diverse native aquatic plant community.

In order to achieve such a goal, it is imperative that a lake management plan be developed to address the short-term problems associated with the *Hydrilla* infestation for the next several years, followed by addressing the long-term reduction and continued control of other invasive plants in Clear Lake over the next several decades.

Watershed management practices, including maintenance practices of shoreline property and sewage disposal issues should be reviewed and assessed to determine impacts of those processes on the implementation and success of aquatic plants control techniques applied to the lake.

Limnological Impacts of Aquatic Plants Control Techniques

A shallow warm water lake like Clear Lake generally supports a complex ecosystem. Everything in the system is interconnected and our actions on one part of the system can affect all other parts, although the actual method and quantity of interaction is usually unforeseeable. Inputs and nutrient loading can be caused by natural events (fire, geologic activity, drought, flooding) or anthropogenic impacts (mining, development, species introduction, wetland loss.) Long term impacts to the system are considered most unforeseeable.

The inputs to the system include the water that enters the lake through direct rainfall, stream flow, and ground water flow. A constituent of these inputs are the nutrients occurring naturally in the watershed. Of primary concern are nitrogen and phosphorous. The nutrient contribution to the system includes increased erosion caused by human activity in the watershed such as roads, as well as runoff of fertilizer, pesticides used in the watershed by agriculture and near-lake homeowners. Sewage inputs, while reduced in recent years, are still a source of excess nutrient flow to the lake from old or inadequate septic systems around the lake. Finally, one of the most significant inputs to the system is sunlight. While the average quantity of sunlight has been constant, the depth of penetration varies significantly depending on the water clarity that affects the dominance of plant growth or algae. Clear Lake is a eutrophic water body, meaning that it is nutrient rich and highly productive. Because of nutrient availability there will always be some level of algae or plants. Their abundance is directly related to the nutrient level. Land use changes without adequate and proper erosion and sediment control can increase sediment and nutrient loading into the lake, making algae and/or plant conditions a greater nuisance.

A myriad of plants and animals starting at the microscopic level in the muck at the bottom of the lake as well as suspended in the water consume some of the nutrients in the water and are in turn consumed by higher species in the food chain. Many of the plants and animals at all levels in the food chain die and decompose and again recycle through the food chain. The fish, invertebrates, and especially decomposing bacteria consume oxygen and if the levels are too low, die-off can occur. The plants utilize carbon dioxide and release oxygen during daylight, through sun driven photosynthesis. In addition, the plants, especially those near the shoreline provide shelter for spawning fish and habitat for the smaller plants and animals that the fish eat.

Because of the complexity of the system, whatever we do to one part may have an impact on many other parts of the system. For example: If we kill aquatic plants all at once in the summer without removing them from the lake, the decomposition process will consume oxygen from the water, which can cause fish kills. If we remove too many aquatic plants near the shoreline in the spring we may adversely affect fish spawning activities as well as reproduction of invertebrates necessary for the survival of young fish. Aquatic plant control could remove the hiding and feeding places the juvenile fish require to grow through their critical first few months of life.

Fish and Wildlife Impacts of Aquatic Plants Control Techniques

Physical problems of water bodies are usually relatively straightforward and solvable when compared with the issues related to plant and animal community ecology. Most aquatic organisms fall into three categories: 1) organisms that increase in abundance as aquatic vegetation increases, 2) organisms that decrease in abundance as aquatic vegetation increases, and 3) organisms that are unaffected by aquatic vegetation density. Although the nuisance aquatic plants should be curtailed for maintenance of safe conditions, recreational and economic reasons, there is still much concern and debate in the local fish and wildlife management community regarding the type and level of control for managing the plants in aquatic systems. Specific recommendations from the fish and wildlife management perspective include: limiting the use of harvesters which can exacerbate the spread of aquatic plants and limiting the use of the aquatic herbicides during sensitive times in reproductive lifecycle if necessary.

Although nuisance levels of aquatic plants are not desired, these plants help to maintain water quality, water clarity and provide fish and wildlife habitat.

For largemouth bass the first noticeable spawning activity is nest building by males, which starts when the water temperatures reach 14 to 16 degrees C, usually in April (Emig 1966). Spawning activity will often continue through June (Moyle 1976). Early use of herbicides during this spawning period is effective, yet there are concerns from California Department of Fish and Game about impacts to eggs in the nests, although has not been scientifically proven. Utilizing mechanical harvesters that do not completely remove aquatic plant habitat is an option, but would be disruptive to nesting fish. In addition, other biocontrol options such as fungus and pathogens could be explored. Moreover, fish and wildlife aquatic plant relations in Clear Lake should be examined in greater detail as insufficient data exists for a lake of this size. Fish population and reproductive success measurements need to be made in both vegetated and unvegetated areas of the lake. Many birds feed on aquatic vegetation and associated fauna and/or use the vegetation in nests. A commitment to long-term monitoring/research should be implemented in which aquatic plant managers and biologists need to coordinate their respective activities to collect accurate data to assist in the decision making process.

Water Quality Impacts of Aquatic Plants Control Techniques

It is often easier to work with visible (e.g., physical blockages of access to lakes with aquatic vegetation) than invisible (e.g., water quality, dissolved oxygen depletion) problems that appear with excessive aquatic plant growth. From an ecological standpoint, control of nuisance and/or exotic macrophytes can be considered a disturbance that often leads to temporary and/or permanent changes in the ecosystem structure and function. For instance, control of dense macrophyte stands can lead to an increase in available nutients, and subsequently may stimulate excessive algal growth. On the other hand, control of nuisance, canopy-forming macrophytes can lead to improvement in dissolved oxygen conditions, which can be beneficial to other biota. Thus, there are tradeoffs in water quality (both negative and positive) that must be considered when developing an aquatic macrophyte management plan. These water quality tradeoffs also need to be evaluated with respect to the overall feasibility of application of a particular control technique, or suite of techniques.

Described here are specific water quality impacts for a variety of macrophyte control techniques that are feasible for Clear Lake. Critical information regarding undesirable plant density, nutrient content (may be estimated from literature values), and aerial coverage, as well as changes in native macrophyte densities, will be needed in order to make better decisions regarding impacts of control on water quality.

Macrophyte Control without Removal of Biomass from the System

Both herbicide treatment and mechanical shredding control macrophytes without removal of biomass from the system. Herbicides generally promote death through cellular damage and inhibition of metabolic functions while mechanical shredding devices clip and cut up macrophytes, leaving the tissue in the water column. Both techniques can be useful in controlling areas infested with aquatic plants, the later only preferable where extensive growth has occurred and a regular maintenance program is in place to keep boat lanes open.

Negative impacts: Aquatic macrophyte tissue can constitute a large reservoir of important nutrients such as nitrogen and phosphorus that can be mobilized directly into the water column as a result of macrophyte control and

subsequent plant tissue decomposition (Nichols and Keeney 1973). This flux can potentially lead to stimulation of nuisance algal growth. In particular, decomposition of submersed macrophyte tissue can be rapid as a consequence of control, resulting in a pulse of nutrients to the water column. Since nitrogen- and phosphorus-rich sediments are the primary nutritional source for uptake and incorporation into tissue by rooted macrophytes (Barko and Smart 1986), leaving biomass in the system after control represents a recycling pathway whereby sediment nutrients are ultimately transported into the water column via plant uptake and decomposition.
Decomposition of macrophyte tissue in the system may also impart an oxygen demand due to microbiological respiratory activities during the decomposition process (Jewell 1971). In shallow wind-swept regions, dissolved oxygen demands will be offset by reaeration generated by surface water turbulence. However, in shallow embayments and other areas protected from wind-generated turbulence, dissolved oxygen demands created by macrophyte decomposition may lead to anoxia. In addition to stresses on biological components (i.e., fishes, invertebrates, etc), the development of anoxia in bottom waters can lead to enhanced nutrient flux from the sediment, further exacerbating the potential for stimulated algal growth. In addition, nitrification (i.e., metabolic conversion of ammonium-nitrogen to nitrate-nitrogen) ceases under anearobic conditions, resulting in the flux of ammonium-nitrogen from the sediment in the water column for uptake by algae. Eutrophication models, such as BATHTUB (Walker 1996), may be useful in predicting the potential impacts of decomposition and phosphorus mobilization resulting from macrophyte control, on changes in overall algal productivity in a lake.

Control of macrophytes can also lead to some indirect negative impacts on water quality. Non-selective destruction of all macrophyte cover can result in more frequent sediment resuspension and higher turbidity in the water column. Particularly in shallow lakes with large fetches, such as Clear Lake, water quality can be dominated by wind-induced sediment resuspension in the absence of submersed macrophyte coverage, promoting enhanced nutrient recycling, reduced water clarity, and higher concentrations of nuisance algae (Dillon et al. 1990: Maceina and Soballe 1990; Hellstrom 1991). In contrast, the occurrence of desirable native aquatic macrophytes in these shallow systems usually coincides with a clear water state and lower nuisance algal biomass (Hosper 1989; Dieter 1990; Scheffer 1990). Native macrophyte species provide refuge for zooplankton and fishes (Scheffer et al. 1993), and play an important role in stabilizing the sediment from resuspension by dampening wave activity and shear stress (James and Barko 2000).

Marsh Lake, a shallow impoundment located in western Minnesota, provides a good example of the role that native submersed macrophyte (sago pondweed, *Potamogeton pectinatus)* coverage can play in reducing sediment resuspension and improving water quality in shallow lakes. In the absence of macrophyte coverage, resuspension occurred frequently as wind speeds increase above 12 km/hr. During years when submersed macrophytes were present and covered the bottom of the lake, resuspension was minimal, even at very high wind velocities.

Positive impacts: Herbicide treatment and mechanical harvesting offer some positive impacts on water quality that need to be considered as well. For instance, opening up the canopy of a nuisance macrophyte stand via these techniques can lead to improved habitat for benthic invertebrate and fish communities via reaeration. For instance, dramatic changes in dissolved oxygen occurred in experimental plots after control of waterchestnut via mechanical shredding in Lake Champlain (James et al. 2000). This annual non-native macrophyte forms a dense surface canopy during the summer, which inhibits reaeration from the atmosphere and promotes the development of anoxia in the bottom waters. While it was hypothesized that mechanical shredding without harvesting the macrophyte material from the system would exacerbate dissolved oxygen conditions by increasing the oxygen demand in the water column, the opposite pattern occurred. Dissolved oxygen increased substantially in the water column due to removal of the surface canopy and improved reaeration. The authors suggested that improved reaeration neutralized any impacts that macrophyte decomposition might have had on dissolved oxygen stores in the shredded plots.

Water Clarity

Aquatic macrophytes have an inverse relationship with water clarity. As aquatic macrophyte abundance increases in a lake the abundance of suspended solids decreases.

The information on the inverse relationship between aquatic plants and water clarity needs to be discussed when planning any aquatic plant management because the control of abundant aquatic plants to alleviate a defined problem may cause another perceived problem. Most people consider clear water as a good attribute in lakes and when it decreases from 15 feet to 3 feet after controlling aquatic plants, people may decide that the aquatic plant problem was not as bad as the reduced water clarity.

Reaeration and increased mixing and water exchange can have an indirect positive effect on sediment-water interactions. Under oxidized conditions, the sediment microzone can act as a sink for phosphorus due to the formation of ferric hydroxides and associated adsorption of phosphorus, immobilizing it from flux to the water column. Nitrification will dominate nitrogen dynamics in the oxidized microzone as well, minimizing the buildup of ammonium-nitrogen near the bottom waters.

Conclusions: Non-selective control of macrophytes using methods that leave biomass in the system can lead to negative water quality impacts such as mobilization to the water column of nutrients stored in macrophyte tissue, stimulation of nuisance algal growth, dissolved oxygen demand and anoxia with associated enhancement of sediment nutrient flux, and both temporary (i.e., during the control process) and longer-term (i.e., as a result of non-selective destruction of macrophytes) problems with sediment resuspension and associated water quality impacts (i.e., high turbidity, nutrient recycling, stimulated algal growth). Positive impacts on water quality include opening up the canopy for reaeration and increase in dissolved oxygen levels.

If the biomass and tissue nutrient content of macrophytes to be controlled is known (this information can be obtained via a macrophyte survey), literature values on leaching and breakdown rates can be used to estimate nutrient (primarily phosphorus) flux and dissolved oxygen demand as a result of macrophyte decomposition. These overall fluxes can be incorporated into budgetary or steady-state models to estimate algal and dissolved oxygen response to macrophyte decomposition. The models must, however, be adapted to consider macrophyte (and lack thereof) influences on the light climate, as well as the nutrient budget. They must also consider attached algae uptake of nutrients and growth.

Finally, the timing and frequency of macrophyte control needs to be considered in the assessment of water quality impacts. *For instance, pre-emptive control, or control during the spring, when biomass and associated tissue nutrient mass is much lower, may lessen the severity of water quality perturbation versus control at peak biomass during mid to late summer.* Methods that require more frequent application throughout the growing season (i.e., mechanical shredding every month) may exacerbate nutrient recycling versus control that persists for the entire summer period.

Macrophyte Control with Removal of Biomass from the System

Mechanical harvesting is the primary means of both controlling macrophytes and removing biomass from the system. Generally, harvesters use conveyor belts to transport biomass to a truck that hauls it away for composting. Other harvesting techniques include hand pulling and diver-operated suction harvesting (Madsen 2000).

Negative impacts: There are two major impacts; one of the greatest impacts of mechanical harvesting on water quality is temporary resuspension of sediments during the procedure. As with contact herbicide applications (diquat and endothall) and mechanical shredding, mechanical harvesting is non-selective; thus, removal of all of the biomass can lead to more frequent periods of sediment resuspension over longer time scales (weeks), due to increased exposure to wind and wave activity. Resuspension of nutrient-rich sediment can lead to nutrient enrichment of the water column and the stimulation of algal growth. Finally, mechanical harvesting non-selectively removes and/or kills invertebrates and small fishes in the littoral zone (Madsen 2000). The second major impact is the potential spread of invasive species by fragmentation.

Positive impacts: *There are situations where removal of macrophyte biomass and associated nutrients via mechanical harvesting can be beneficial to water quality.* In these instances, the nuisance aquatic macrophyte to be controlled typically dies back in the summer (e.g. curlyleaf pondweed) as a part of their life cycle, releasing nutrients to the water column at the height of the growing season that can be utilized by algae for growth. Removing macrophyte tissue under these circumstances can reduce nutrient loading to the water column. For instance, James et al. (2000) suggested that greater harvesting of curlyleaf pondweed prior to its natural senescence could significantly reduce phosphorus flux to the water column of Half Moon Lake during the summer via decomposition. In contrast, for other macrophyte species such as Eurasian water milfoil, which slough bottom leaves throughout the summer and die back in the autumn (Smith and Barko 1990), mechanical harvesting during the summer will probably not be effective in reducing nutrient loads to the water column.

Like other non-selective macrophyte control techniques, mechanical harvesting may improve dissolved oxygen conditions by opening up the canopy, promoting reaeration, and reducing day-night oxygen swings (Madsen 2000). This change in dissolved oxygen dynamics can lead to shifts in oxygen concentration at the sediment-water interface which can negatively effect nutrient fluxes (i.e., reduce sediment phosphorus flux out of the sediment).

Niad sp.
Water Nymph

Conclusions: Mechanical harvesting can be associated with temporary sediment resuspension during operation. Non-selective removal of macrophyte biomass can also lead to more frequent resuspension and associated increased turbidity and enhance nutrient recycling over longer time scales. Under certain circumstances, mechanical harvesting can be beneficial in removing macrophyte tissue nutrients that would otherwise be recycled back into the water column during the height of the growing season. Opening up the surface canopy can stabilize dissolved oxygen dynamics and promote reaeration.

IMPLEMENTATION PLAN

Previous sections of this Plan have described both issues and methods related to Plant Management. This section describes the actual implementation plan proposed. For ease of discussion we have broken the implementation plan into two elements: *Working Framework* which is controlled by a permitting process and *Strategic Actions* which are also important and give additional substance to the Plan and complement the basic working framework. Both of these elements of the plan are described in more detail in the following sections

Working Framework and Permitting

The direct reduction of existing aquatic plants will be achieved through a mixture of the application of approved herbicides by licensed applicators as well as harvesting of existing plants. Both methods require the application for and receipt of a permit from the Lake County Department of Public Works prior to any action.

Although the plan commits us to an integrated approach of herbicides, and harvesting, the ongoing CDFA Hydrilla Eradication Program temporarily restricts our ability to harvest in many areas of the lake so for an extended period of time we will have to rely more on herbicides than many might prefer. As the hydrilla infestation is reduced and eliminated we may expect to see a shift in the balance between herbicides and harvesting as influenced by the ongoing data collection process and ongoing studies of the results of applications and harvesting in the lake.

Strategic Actions

There is a large range of critically important complementary actions also proposed as part of this plan. These include but are not limited to:

All of these topics will be described in much more detail in this Implementation Plan section.

- Data collection of the ongoing extent of aquatic plant growth, and the relative effectiveness of different treatments in the lake
- Integration with the CDFA Hydrilla Program
- Adaptive Management (using the data to modify the program)
- Reduction of nutrient loads into the lake
- Public Education Programs
- Prevention of the introduction and spread of Invasive Aquatic plants into the lake.
- Enforcement

WORKING FRAMEWORK AND PERMITS

Water Pennywort

Permitting

Modification of the aquatic habitat is being undertaken to enhance aesthetics, improve public safety, and insure unimpeded access to and from boating facilities to the deeper parts of the lake. During 2000, 2001, and 2002 the California Department of Fish and Game (CDFG) was cooperative in developing and permitting local management strategies to deal with nuisance aquatic species within Clear Lake. In 2003 the County implemented and emergency program to run the permitting program because of understaffing at CDFG.

The Permitting Plan, modeled after year 2002's coordinated single-point system, should insure continued protection of the natural resources, ongoing and improved data quality for analysis, while providing options for the control of nuisance vegetation.

All aquatic plant management activities, regardless of extent or method, must be approved in advance. Details of the Permitting Plan are as follows:

Permit Structure

The approval process is initiated by submission of an *"Aquatic Plant Management Program Application" (see appendix E)* to the County of Lake, Department in charge of the program. Valid applications must be accompanied by an Administrative Map of the Shore of Clear Lake, scale 1"=50' (hereafter referred to as a Lake Bed Map) of the treatment site and requisite fees, when necessary. One permit per parcel is required for all herbicide treatments. The complete application is processed and copies are sent to the CDFA Hydrilla Eradication field office and the Lake County Agricultural Commissioner's Office for approval or denial based on their jurisdictional authority and the current status of related activities. The applicant will be notified within 48 hours that the permit is ready for pickup and signature committing to compliance with all programmatic and specific conditions.

Herbicides

Administrative Controls. A greater degree of safety in the use of pesticides can be achieved by implementing rules that restrict who can recommend and use aquatic herbicides. These management practices include the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) regulations concerning product registration and labeling, state regulations governing applicator licensing, and permits:

A. All label directions FIFRA will be adhered to.

B. Herbicides will be applied by licensed and registered Qualified Applicators (holders of current and valid QAL or QAC license issued by the California Department of Pesticide Regulation) only.

C. The commercial applicator (the permit applicant) shall make a site visit to verify the need for treatment and the suitability of the site for treatment prior to receiving a permit. The information gathered (weed species, growth stage, area) will help the applicator determine the method of control and the appropriate herbicides to employ.

D. Immediately prior to treatment, the commercial applicator will examine a series of indicators and modify treatment plans accordingly. These indicators include (but are not limited to) heavy precipitation, recreational activity, boat traffic, water depth, water turbidity, and wind. If this examination indicates a potential for reduced control efficacy and/or increased water quality impacts, the treatment will be rescheduled. D.O and temperature reading will be collected at mid column above the bottom within the treatment area. D.O. levels below 5ppm and/or temperatures above 80 degree F could possibly act as thresholds, which prohibit herbicide applications.

E. Chemical applications shall be cumulatively restricted to an area of no more than 30% of any individual parcel or ownership as measured between extensions of the parcel's lot lines and lakeward from the shoreline for 300feet.

F. A 16-foot wide boat lane out to open water can also be maintained as part of the permitted activity.

Approved Herbicides. Certain practices can reduce the area and duration of impacts to water quality by substituting less toxic materials for more toxic products.

Only those registered herbicides, which have minimal spatial and temporal impact on beneficial uses, will be considered for use in Clear Lake. Those include copper-based herbicides, diquat, fluridone, endothall, triclopyr, 2,4-D, and glyphosate. As new herbicides are approved through California EPA, their environmental impact will be reviewed and balanced with benefits. A Special Local Needs Permit may also be obtained while awaiting approval of a California Label. The Restricted Use Herbicide acrolein will not be considered for use because of fish toxicity.

Notification. Even after all prudent and reasonable safety steps have been accomplished; some individuals feel at risk from herbicides. Making public notification of herbicide applications gives those individuals an opportunity to take the steps they feel are in their best interest. Prior to initial herbicide application, the individual applicators shall take steps to notify adjacent and/or potentially affected properties as per FIFRA label requirements.

The location of parcels with permits will be input into the county GIS database before any applications occur. This information can be accessed by the public through the county Internet GIS website.

The applicator will report conditions, apperarance, DO and temperature data with herbicide type/quantity and area treated per individual parcel/permit, in the Supplemental Pesticide Use Report, SPUR (see appendices). These reports will be sent to the Aquatic Weed Management Program Coordinator, County of Lake Department of Public Works, by the 15th of the following month.

Mechanical

Alternative Control Methods. This program shall employ integrated pest management (IPM) strategies that integrate the use of herbicides with other approaches and reduced the overall dependence on chemicals.

However, cutting of aquatic weeds by any method increases the risk of spreading *hydrilla* and other invasive species. For this reason, mechanical harvesting is prohibited within ¼ mile of sites where *hydrilla* is being actively managed. Mechanical control and retrieval of cut vegetation may be allowed in areas more than ¼ mile away from active *hydrilla* management areas. Coordination with the CDFA Hydrilla Eradication Program will be ongoing to assure compliance with program concerns.

Any control program that results in fragmentation must include a method for the collection of plant fragments and disposal of fragments landward of the high water mark. Fragments must be prevented from reentry into any waterbody until such time as fragments are unviable.

Permit Data Collection

The data collected are intended to support an adaptive management program. Analysis of data produced by such documentation will create a basis for comparison of how various program elements meet objectives.

A GIS database has been established to manage the APMP. A polygon and associated characteristics will be generated within 48 hours of permit application. This will allow an ongoing tabulation of the total area managed, according to: time period, area, method, herbicide type, and applicator. Upon submittal of Supplemental Pesticide Use Reports the GIS database will be updated to reflect actual treatment size, method and conditions.

Applicators will generate a record of the activities performed and the results of the treatment. The water temperature, concentration of dissolved oxygen, and approximate water depth shall be measured and recorded. The amount of herbicide applied and the area treated shall be measured and recorded. A follow-up evaluation and measurement of DO and temperature will be made at an interval when the greatest mass of dying vegetation might be expected, according to the herbicide employed in aquatic vegetation control.

Applicators will be required to carry valid permit(s), including the lakebed map with highlighted permit areas. Before leaving the site the map must be updated to reflect the actual treatment area. Agricultural biologists from the Commissioners office will monitor one application per week during the active treatment season which generally runs from April through September.

In compliance with NPDES permit requirements, sampling for active ingredients will take place during the same time period mid month at the inflow and outflow of the lake. A dissipation check will occur at 10 percent of applications during the season for each active ingredient shown.

The applicator will report DO and temperature data with herbicide quantity and area treated per parcel (APN), in the Supplemental Pesticide Use Report These reports will be sent to the Aquatic Weed Management Program Coordinator, County of Lake Department of Public Works, by the 15th of the following month.

Niads sp.

Maximum Allowable Acreage Managed

Guiding Principals

- This limit should be at or below the threshold that is established for less than significant impact.
- The Technical Advisory Group should play a key role in evaluating this number based on latest-best available data.
- Management by any method is limited to ten percent of total lake surface area showing elevated and high potential for vegetation establishment: currently this is 1043 acres based on the ReMetrix survey showing 10,428 acres, or approximately 26% of the lake with vegetation,.(ReMetrix 2002).
- The Department in charge of the program will stop issuing permits once this threshold has been reached.
- Agency programs to control or eradicate non-native invasive species will not be restricted by these principals (i.e. CDFA Hydrilla Eradication Program).

Much of the lakeshore is undeveloped (20.3% according to latest Lakebed Management database) and treatments for access are therefore unnecessary, (1523 wooden structures are recorded on 2641 parcels). In many areas the shoreline is not conducive for aquatic plant growth due to factors such as depth, substrate and current.

An addition, important natural and/or cultural areas will be identified where no treatments will be allowed except by lake-wide programs designed to protect the lake from specific invasive plants. An example is the CDFA Eradication Program to protect against hydrilla.

Permits allow for management of only 30 percent of individual property by herbicide methods, as measured by area enclosed by extensions of property lines 300 feet lakeward. This factor alone allows for a mosaic pattern of treated and untreated areas on a per parcel scale.

Other factors limiting the extent of management are purely economic. The cost of treatments includes permit fee, applicators time, and material costs may be as much as $6,000 per acre. During the 2002 season, 60.1 acres were treated by herbicides and 50.8 acres were treated by harvesting for a total of 110.9 managed acres.

Use of herbicides will be limited to approved aquatic herbicides determined by the United States Environmental Protection Agency and the California Department of Pesticide Regulation. The current list of aquatic herbicides is limited to glyphosate, copper, diquat, potassium salts of endothall, triclopyr, 2,4-D, and fluridone. As new products become available, that are designated and labeled for aquatic use, they too may be utilized in the program according to label specifications. Best Management Practices regarding the appropriate use of these materials will be adhered to by all applicators.

Alternative Methods

Although the plan commits us to an integrated approach of herbicides, and harvesting, the ongoing Hydrilla Eradication Program temporarily restricts our ability to harvest in many areas of the lake (harvesting causes plant fragmentation in hydrilla and could potentially spread the plants to new areas), so for an extended period of time we will have to rely more on herbicides than many might prefer. As the Hydrilla infestation is reduced and eliminated we would expect to see a shift in the balance between herbicides and harvesting as influenced by the recommended data collection process and ongoing studies of the results of applications and harvesting in the lake.

Other methods will be tested and encouraged to replace the use of herbicides or harvesting, if recommended by the Technical Advisory Group.

STRATEGIC PLANT MANAGEMENT ACTIONS

Use of underwater electronic devices

Document the Extent of Infestation(s)

The first step needed is to adequately address the problem. This first adequate assessment is occurring concurrently with the development of this document and will serve as a baseline for follow-up measurements.

Action

Vegetation Change Analysis

Monitor changes in area, location, and species composition over multiple seasons. Only by performing ongoing monitoring will we be able to evaluate effectiveness of the program and ascertain trouble areas. More than one methodology available, such as hydro-acoustic devices, physical weed hooking and remote sensing. A program could be designed to analyze species areal coverage using satellite multispectral analysis and/or aerial photography.

Potential Key Players: Consultant, DPW, CDFA, and USGS
Cost Estimates: Alternate Years: $20,000-$35,000,
Potential Funding Source: Transient Occupancy Tax (TOT) Funds, Grants, Boat Use fees, Boating Access permits
Time-Frame: Year: August-September
Benchmark: Follow-Up survey, Results/Maps/Report:
Issues: Water clarity insufficient for remote-sensing technologies, costly, degree of accuracy only records plants at or near surface. The density of sampling may be modified depending on data needs and budget.

Protect Access to Recreational Uses of Lake

The primary aquatic plant problem and conflict on Clear Lake is access to water sport activities, fishing, skiing and swimming. Local agencies need to keep the public access areas open for use. County maintains 5 double and 1 single boat ramps, 7 swimming areas; City of Lakeport maintains 4 double boat ramps, 1 swimming area; City of Clearlake maintains 3 double and 2 single boat ramps, 2 swimming areas; State Parks maintains 1 double boat ramp, 1 swimming areas. See Appendices and Map pages for public access points.

Action

Program at Public Access Areas

Every effort will be made to assure access to the lake for residents and visitors at the public facilities. The two cities with public access areas and the county maintained public access areas should be kept clear of aquatic weeds, as needed. Due to various substrates, depth and other local conditions, a one-size-fits-all maintenance plan to control nuisance aquatic weeds is not recommended. However, based on Best Management Practices (BMPs), a proactive program should be implemented and coordinated among the various agencies with jurisdiction and maintenance responsibilities.

Two basic options for treatment of submerged vegetation in these nearshore areas:

1. Herbicide application in boat launch embayments, public piers and swimming areas.

2. Mechanical harvesters could be used to provide boat lanes near boat launches, when approval from CDFA can be granted.

Potential Key Players: DPW, DBW, CDFA, CAC, Public Services, cities, CSD, RWQCB, CDFG, CSP & Rec.

Cost Estimates:

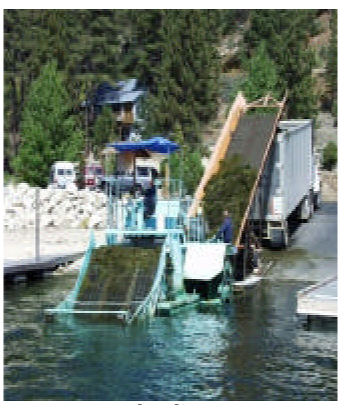
- Mechanical: $100,000-$200,000/Harvester, Trailer, Shore Conveyor, Maintenance, Transportation, Disposal Plants, Insurance , Operators, Training, Fragment Traps, Monitoring

- Chemical: $2,000 - $5,000 / Acre, depending on chemical choice, water depth and contractor, NPDES permitting, Monitoring/Reporting,

Potential Funding Source: TOT funds, general fund, Benefit Assessment, Grants, Boat Use fees
Time-Frame: 2003 season, ongoing investigation and dialog
Benchmark: Plan for Treatment. Operational harvester on the lake.
Issues:

- Mechanical: Funding, Compliance with Hydrilla Eradication Quarantine, Does the county purchase/lease equipment? Which department and staff will be assigned to operation and oversight? Contract with a private company for the service? Lack of suppliers on West Coast, What size and how many harvesters will be needed? Requirement of containment systems for fragment control, Effects on non-targets?

- Chemical: Funding, Appropriate use of herbicides, effects on non-target organisms, proximity to water intakes or irrigation and drinking, notification requirements, Native American use of riparian vegetation, monitoring and reporting,


Harvester Unloading

Action

Harvester for Boat Lanes and Removal of Large Floating Weed-Mats

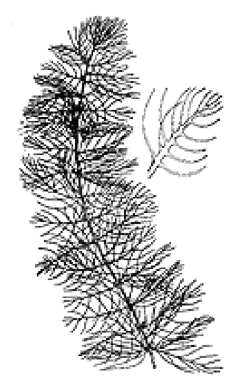
Use conventional harvesters in open water areas for collecting and removing free-floating plant fragments. Overall effectiveness of this type operation may be increased by testing increased production rates of the “larger-than-normal-sized” conventional harvesters for controlling actively growing aquatic plants beds and free-floating plant fragments.

Potential Key Players: DPW, CDFA, CAC, Private Contractors, CSD
Cost Estimates: $100,000-$200,000/harvester, Trailer, Shore Conveyor, Maintenance, Transportation, Disposal Plants, Insurance, Operators, Training, Fragment Traps, Monitoring
Potential Funding Source: TOT funds, general fund, Benefit Assessment, Grants
Time Frame: ongoing investigation and dialog
Benchmark: Operational harvester on the lake.
Issues: Compliance with Hydrilla Eradication Quarantine, Short-term control only, requires retreatment to keep actively growing plant removed. Biological Pollution accelerating spread of non-native invasive species. Does the county purchase/lease equipment, Which department and staff will be assigned to operation and oversight, Contract with a private company for the service, Lack of suppliers on West Coast, What size and how many harvesters will be needed, Requirement of containment systems for fragment control, Effects on non-targets.

Action

Streamlined Permitting Process for Private Shoreline Property Owners

Provide single point of contact for property owners and/or licensed herbicide applicators. Design a permit that is not overly burdensome. Design a single permit that is acceptable to all regulatory agencies. Design a permit that provides adequate information for evaluating program impacts. Design a system where there will be minimal processing time between agencies. A system was put in place for the 2002 season, however a yearly review and refinement is warranted. County of Lake will be the only permitting agency, after PLAN is CEQA reviewed.


Milfoil

Potential Key Players: DPW, CAC, CDFG, CDFA, RWQCB
Cost Estimates: Need for Program manager to provide oversight
Potential Funding Source: Fees for Processing, CDFG charged $280 per permit with TOT funds used to offset $180 for a net permit cost of $100 to defray costs incurred in program
Time Frame: After CEQA review
Benchmark: County Only Permit System in place
Issues: CEQA requirements, CDFG requirements, Enough data collected to meet legal requirements for oversight, Which department is responsible for

ongoing program, Non-compliance, Enforcement, Cost of monitoring, Who is responsible for monitoring.

Action

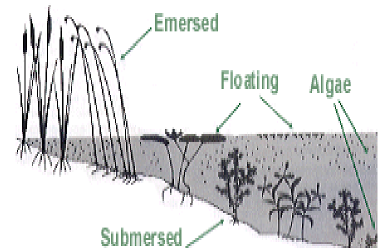
Cost-Share with Tourist Based Resort Owners

Help to assure the visiting public has access to the Clear Lake without interference of excessive nuisance vegetation. Assist the resort owners who responsibly maintain access to the lake with technical and monetary support.

Share the cost of treatments for creation and maintenance of boat lanes and swimming access on commercial resort properties. Provide a pool of monies that that can offset the cost of such treatment. Resort owners would be required to apply for assistance, which would require a short workshop on aquatic plant identification and management. Reimbursement would be limited to a maximum amount based on percentage of actual cost per resort owner. Funds would be available until funds are depleted.

Potential Key Players: PDW, CAC, CDFG, BOS, Contractors
Cost Estimates: dependent on availability
Potential Funding Source: TOT funds, grants
Time Frame: 2005 -
Benchmark: Cost-Share Program in place, Workshop designed
Issues: Actual percentage and maximum dollar amount of reimbursement, distribution of limited funds, excessive area treated, lottery may be required, management and structure of program, herbicide vs. mechanical options.

Prevent Introduction and Spread of Invasive Aquatic Plants



Based on an increasing body of knowledge on shallow lake ecology, it is becoming evident that native littoral vegetation is an important component of these systems from a water quality and habitat standpoint. They also provide habitat for invertebrates, young-of-the-year fish, and sport fishes and a food resource for waterfowl and mammals.

Many water bodies are rapidly filling with aquatic plants are dominated by invasive, non-indigenous plants. Biomass production by these species can be many times that of the native species that are reduced or eliminated from the sites because of competition. Non-native or exotic plant species are often deemed undesirable because of their growth potential and because they replace native species.

Invasions of exotic species such as aquatic plants can result in dramatic changes in macrophyte community structure, leading to changes in water quality and trophic structure. In particular, invasive non-native aquatic plants can result in suppression or displacement of native macrophyte species. The formation of dense surface canopies by species such as aquatic plants can lead to disruption of dissolved oxygen exchange, the development of low dissolved oxygen and/or anoxia below the canopy enhanced nutrient recycling, and strong vertical gradients in pH and temperature. These changes may lead to physiological stress to the invertebrate and fish community, unlike conditions in a mixed native submersed macrophyte community (Madsen 1997). Fish communities may be impacted by dense, monospecific stands of aquatic plants as forage species can evade predators, resulting in larger numbers of small fish at the expense of larger predatory fish (Lillie and Budd 1992).

Action

Program to Address Invasive Species on Lake Ecosystem Basis

Evaluation and management of the whole lake as a single system is necessary.

- Evaluate effect of invasive aquatic plants (i.e., creeping water primrose) on tule beds and other key aquatic habitat.

- Investigate patterns of invasive species infestations as a function of other measurable parameters, such as sediment type, depth, presence of other aquatic species, etc…

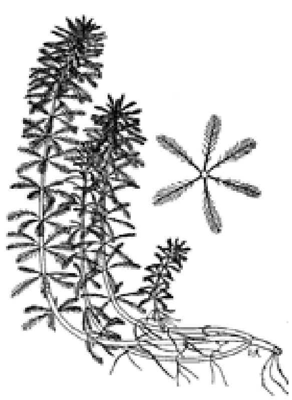
Potential Key Players: DPW, CAC, CDFA, CDFG, CDBW, UCD, NCRS
Cost Estimates: $20,000-$100,000
Potential Funding Source: California Boating and Waterways, California Department of Food and Agriculture, grants
Time Frame: ongoing
Benchmark: management program/ personnel in place
Issues: Funding, monies directed away from immediate public concerns, long-term commitment, control verses eradication, prevention of spread

Action

Prioritize Aquatic Plant Species of Local Concern

Not all species of aquatic plants are invasive. Some species are notorious for their invasive nature. Habitat value varies among aquatic plants species and growth habit. Various species have growth habits that create a greater nuisance to boaters and swimmers. Species listed as noxious by the California Department of Food and Agriculture (CDFA), United States Department of Agriculture (USDA) or California Department of Food and Agriculture (CDFA), California Exotic Pest Protection Council (Cal EPPC) should be a priority.

Potential Key Players: UCD, NRCS, CAC, DPW, LCWMA, USACE
Cost Estimates: minimal
Potential Funding Source: departmental budgets
Time Frame: ongoing
Benchmark: completion of list
Issues: methodology for identification, eradication verses control



Parrots Feather

Action

Permanent Staff Position: Limnologist, Lake Manager or Fisheries Biologist

Lake County's community recognizes that the local economy and culture is heavily dependent upon Clear Lake, yet there is no local or state biologist/lake manager devoted to understanding and proactively maintaining the lake's ecosystem health. Recommend the County of Lake hire a fresh water ecologist, limnologist, or warm water fishery biologist to work full-time on the multitude of lake and watershed issues to ensure the future health of the lake from a broad, lakewide perspective. See also 1996-1997 Fisheries Working Committee recommendations

Potential Key Players: DPW, City of Clearlake, City of Lakeport, CDFG, Tribes, USFWS, CDFG
Cost Estimates: $130,000 annually; Salary, Benefits, Overhead, Equipment
Potential Funding Source: partnerships
Time Frame: 2005-
Benchmark: Staff position created and funded, Initial costs greater than maintenance costs.
Issues: Coordination with agencies, priorities and responsibilities, equipment needs

Environmental Protection

Water for irrigation and drinking water is regularly pumped from the lake. Some aquatic plant control techniques pose higher risks of removing non-target organisms, particularly emergent vegetation along the shoreline.

Action

Clean Water Act (NPDES) Compliance

It was determined by a federal court ruling in late 2001 that the Non-Point Source section of the Clean Water Act should be applied to herbicide applications to waters of the Western United States. The County of Lake was counseled to apply for coverage under a general permit issued by the regional Water Quality Control Board (RWQCB). Regulatory compliance necessitated the development of a Monitoring and Reporting Plan (MRP) and associated Quality Assurance Program Plan (QAPP). Monitoring of active ingredients in herbicides approved for use to control aquatic plants is presently required and should continue at some level into the future.

Potential Key Players: DPW, CAC, CDFA, CDFG, and Licensed Applicators
Cost Estimates: 2002- $100,000, 2003- $45,000, 2004- $60,000 annually
Potential Funding Source: TOT funds, Benefit Assessment, Boating Fees, grants
Time Frame: present
Benchmark: Yearly NOI filed with RWQCB
Issues: Redirects limited resources from on-the-lake management of aquatic plant problem, stringent requirements constitute excessive burden, repetition of dissipation studies, inadequate training, burden on applicators, argued potentially unnecessary if herbicides used according to label instructions as mandated under USEPA and FIFRA regulations.

Action

Habitat Protection

Identify key areas where no, or restricted, control measures are allowed. Areas of the lake, such as, undeveloped and/or key nesting areas for fish and wildlife will be designated wildlife areas.

Potential Key Players: UCD, DPW, CAC, CDD, CDFG, Fish and Wildlife Committee, USFWS, Land Trust, Audubon
Cost Estimates: minimal
Potential Funding Source: staff budgets
Time Frame: present

Benchmark: Areas designated on maps
Issues: affect on fishing/boating access to some areas of lake with dense untreated aquatic vegetation, infestations of non-native invasives into identified sensitive areas may warrant intervention.

Action

Review Maximum Allowable Acreage for Treatment

Set an upper limit on cumulative acreage that will be treated with herbicide applications for control of aquatic vegetation. This limit should be at or below the threshold that is established for less than significant impact. The technical advisory group should play a key role in evaluating this number based on latest-best available data. Based on percentage of total lake surface area, miles of shoreline, vegetative potential or some part thereof. Request Technical Advisory Group develops maximum acreage to be actively managed.

Potential Key Players: DPW, CAC, CDD, CDFG, RWQCB, Advisory Groups
Cost Estimates: N/A
Potential Funding Source: N/A
Time Frame: 2004-
Benchmark: Method for tracking cumulative acreage
Issues: What is the threshold for non-significant impact, re-evaluation of cumulative area on yearly basis, public acceptance, permitted activity often significantly greater than actual application, will tracking application with GPS unit continue to be required. Some areas are more important as habitat to fish and wildlife. Prioritize natural areas.

Integration with Hydrilla Eradication Program

The California Department of Food and Agriculture is the designated agency to eradicate *Hydrilla* wherever it is found in the State of California. Clear Lake has been under quarantine since the initial find in 1994. Clear Lake is virtually

Hydrilla with tuber

the only body of water where fishing and boating has been allowed to continue while under quarantine, by the goodwill of CDFA. There are however restrictions that are imposed on the County program due to CDFA efforts.

- Primarily, *Hydrilla* can spread by fragmentation; therefore, the CDFA does not allow physical removal in areas where hydrilla has been found. This severely limits the use of physical methods from large-scale harvesting to small-scale handpulling as management tools. Presently, CDFA is prohibiting any use of harvesters or other mechanical weed control methods within ¼ mile from any spot that has had hydrilla in the past six years.


herbicide application from airboat

- Secondly, treatment with the systemic herbicide fluridone (Sonar) is a key tool in the eradication program. CDFA must follow the Department of Pesticide Regulations (DPR) label restrictions on cumulative fluridone that may be applied in any one area during the season and maximum daily applications. There is concern that multiple users of fluridone could cause that limit to be exceeded.

Action
Limit Physical Control Techniques

Physical control techniques (harvesting) are known to cause fragmentation of plants. For the purposes of this document harvesting can be simply hand pulling, non-mechanized cutting or large-scale commercial harvesting boats. Most of our serious problem aquatic plants reproduce by fragmentation. There are no effective feasible means for 100% control of fragmentation, by any control method. Establish Red Zones where no harvesting is permitted determined on yearly basis with Technical Advisory Group (TAG). Zone will be based on ¼ mile buffer from active hydrilla control areas. Establish Yellow Zone where mechanical control limited to hand methods. Zone determined on yearly basis with assistance of TAG. Based on areas with historical hydrilla infestations but not under active treatment regime.

Potential Key Players: DPW, CAC, CDFA, CDFG,
Cost Estimates: N/A
Potential Funding Source: N/A

Time Frame: ongoing
Benchmark: alternative methods available
Issues: limiting options, hand methods can be a low cost method for small scale control (especially if done by the property owner), compliance with hydrilla eradication program, spread of Eurasian water milfoil and other invasive species.

Action

Limit Use of Fluridone (Sonar)

Continued cooperation with CDFA Hydrilla Eradication Program. Because of extensive use in CDFA Hydrilla Eradication Program, partial-lake utilization of fluridone is problematic because of questions as to the maximum allowable concentration in the water that would provide selective control of invasive aquatic plants. Coordinate with CDFA to determine where and when fluridone may be used.

Potential Key Players: DPW, CAC, CDFA, CDFG, RWQCB
Cost Estimates: N/A
Potential Funding Source: N/A
Time Frame: present
Benchmark: agreement with CDFA
Issues: lack of substitute herbicide similar effectiveness and environmental sensitivity. Ability to monitor applications through permit process. Maximum allowable rates according to label.

Manage Nuisance Aquatics Using Current and New Technologies

New techniques, herbicides and equipment are constantly being developed. It is imperative to utilize the best of these new products and techniques in a timely and efficient manner. It may require facilitation with local regulatory agencies to permit. A consideration of alternative control methods including less toxic and non-toxic methods will be made prior to selecting the control method in a specific situation.

Action

Utilize Latest Herbicides Technology

Renovate, (triclopyr) from SePRO Corp., is a newly registered by Claifornia EPA spring 2004. The product is weed selective and is extremely effective on Eurasian water milfoil, creeping primrose, and broadleafs, but does not affect coontail, hydrilla, tules or pondweeds, many of which are native. Acts very quickly, no restrictions on drinking water or swimming, only restriction on distance from irrigation intakes, short waiting period. Conduct test plots using the aquatic herbicide *Renovate* to attempt to control non-native invasives, concentrate use on Creeping Water Primrose. Funding should be obtained to closely monitor changes in plant communities. As other products become approved by Federal EPA, apply for a Special Local Needs permit or Research Authorization Permit to Department of Pesticide Regulation (DPR)

Potential Key Players: CDPR, DPW, CAC, CDPR, CDFA, CDFG, RWQCB, and Pesticide Manufacturer
Cost Estimates: Application fee and yearly renewal
Potential Funding Source: Partnership with manufacturer
Time Frame: present
Benchmark: agreement with CDFA
Issues: Obtaining special use permit, Lack of substitute herbicide similar effectiveness and environmental sensitivity. Yearly fee for Special Use permits. CDPR is real interested in seeing some work with Renovate.

Strategy

Utilize Biological Controls

Make determination whether to intensively stock Eurasian Watermilfoil Weevils or similar species. Funding should be obtained to monitor weevil populations and damage to the target plant. Appropriate pathogens and fungus controls should be explored.

Hyacinth Weevil

Potential Key Players: DPW, CAC, CDFA, CDFG, RWQCB
Cost Estimates: TBD

Potential Funding Source: CDFA Integrated Pest Management
Time Frame: present
Benchmark: agreement with CDFA
Issues: lack of substitute herbicide similar effectiveness and environmental sensitivity. Lack of funding for state bioresearch program

Action

Evaluate Harvesting with Containment Systems

Conduct trials in an appropriate area. A combination of closing off an area with containment buoys barriers and harvesting while area is closed off. Determine fragmentation effects; identify which species are floating or sinking, how well can fragments be contained. Ability to treat area with herbicide if fragmentation not being adequately contained.

Potential Key Players: DPW, CAC, CDFA, CDFG, and UCD
Cost Estimates: $80, 000
Potential Funding Source: grants, CBW
Time-Frame: 2005-
Benchmark: Study plan and funding
Issues: CDFG favors harvesting over herbicide use. CDFA Hydrilla Eradication Program policy currently prevents harvesting within ¼ mile of any area where hydrilla has been found within 6 years. No current technology available to collect 100% of fragments caused by harvesting.

Action

Study the Feasibility of New Products and Techniques in Clear Lake

Equipment such as weed rollers have not been utilized in Clear Lake. Controlled trials of certain models in appropriate areas could be attempted. Simple small-scale bottom barriers made of common materials have been used in other lakes and may be an option for small areas around docks.

Potential Key Players: DPW, CAC, CDFA, CDFG, RWQCB
Cost Estimates: TBD

Potential Funding Source: grants
Time Frame: present
Benchmark: agreement with CDFA
Issues: Trials done in other lakes may be adequate to make determination of potential effectiveness in Clear Lake. Limited options available. Mercury and nutrients in bottom sediments that can be methylated or suspended are a concern. Methods that cause fragmentation of plants are limited in application due to invasive non-native species present.

Study Ecology of Nuisance Aquatic Species

While there is abundant information in the scientific literature, very little information related to aquatic plant management specifically in Clear Lake's unique ecosystem exists. Further study could prove helpful.

Action

Impact of Water Primrose on Tules

Primrose growing over and among tules in Dorn Bay, below state park campgrounds, 2002

It appears creeping water primrose (*Ludwigia peploides*) is spreading rapidly along the shoreline. Although native to the western United States it's presence in Clear Lake was not noticed until the last few years. It has now become the dominant shoreline vegetation in many areas. However, protection by the county Shoreline Ordinance does not prevent the apparent decline of tules in areas where primrose is present. There is a need for further documentation on this competitive relationship.

Potential Key Players: UCD, DPW, CAC, CDFA, CDFG, and WMA
Cost Estimates: $20,000+
Potential Funding Source: grants, NRCS, USFWS
Time Frame: 2005
Benchmark: Study developed and initiated
Issues: Rodeo/Round-Up kills both tules and primrose, Primrose is prime habitat for mosquitoes that carry West Nile Virus. Tules provide waterfowl habitat, Fisheries values need to be determined. Weedar 64 herbicide might work but is restricted use herbicide.

Action

Colonization of Non-Natives into Managed Areas

Document species reestablish dominance in treated areas. Determine effect of; substrate type, treatment type, maturity of infestation, depth, etc. Seek to answer the following questions: Can species composition be manipulated to favor natives or species considered less of a nuisance? Need and effectiveness of revegetation? Do undesirable invasives colonize treatment areas?

There is, however, little hope of totally eradicating these exotic plants so a better title for them may be "naturalized flora." (Moxley and Langford 1982).

Potential Key Players: DPW, CAC, CDFA, CDFG, and UCD
Cost Estimates: $50,000
Potential Funding Source: grants
Time Frame: 2005-
Benchmark: Study(s) developed and funded
Issues: Multi-year project, short-term benefit elusive, resources directed away from visible control measures.

Action

Dispersion of Early Infestation of Non-Native Invasives

The lake is vulnerable to new species introductions, via boats, fisherman, aquarium and water-garden enthusiasts. Studying dispersion may be helpful in future control/eradication efforts. Develop an early detection and treatment program to prevent establishment and spread of new invasive species into surrounding waterbodies (i.e. Pillsbury, Hidden Valley, Indian Valley, Mendocino, Berryessa, etc).

Potential Key Players: DPW, CAC, CDFA, CDFG, UCD
Cost Estimates: TBD, significant of cost associated with yearly surveys and dedicated staff time
Potential Funding Source: CBW, CDFA, surrounding lake management authorities
Time Frame: present
Benchmark: agreement with CDFA
Issues: Surveys and educational program. Prevention/control plan needed for follow-up

Action

Response to Treatment Timing

Timing especially of herbicide treatments is directly related to efficacy. Postulated that early treatment late winter to early spring may be extremely effective on some species. Determine species /chemical /timing efficacy for optimum control on Clear Lake.

Potential Key Players: DPW, CAC, UCD, CDFA, CDFG, RWQCB, Herbicide manufactures
Cost Estimates: $40,000
Potential Funding Source: Herbicide manufactures
Time Frame: 2003-
Benchmark: protocol on treatment timing vs. efficacy
Issues: impact on fish spawning, agreement with CDFG, more herbicide required for earlier application at high lake levels, extensive monitoring required to determine effectiveness, lake levels fluctuate on average 7 feet over the season. CDFG has threshold of Dissolved Oxygen levels (DO 5ppm) below which no treatment is allowed.

Action

Investigate Vegetation-Fish Population Dynamics

Electofishing in small baot to determine fish population dynamics

Evaluate the relationship between fisheries and aquatic plant management activities. Electrofish before and after treatments. Monitor recruitment through evaluation of seining records. Coordinate data collection efforts with CDFG to evaluate plant management effects, if any, on fisheries.

Potential Key Players: DPW, CAC, CDFA, CDFG, LCVCD, UCD
Cost Estimates: $TBD
Potential Funding Source: partnership with Vector Control and CDFG, grants, fee for fishing tournaments
Time Frame: 2006-
Benchmark: Report on available data/study
Issues: Need for local fisheries biologist, need for local equipment, some historical electrofishing data available from CDFG, beach seining data available from LCVCD

Education Program

The public is generally not aware of the economic and environmental impacts of noxious weeds, aquatic or otherwise. There is a need to improve awareness and provide educational information to the public. Start an aggressive public education campaign supported through the Clear Lake Advisory Subcommittee (CLAS) group to encourage lake front homeowners to manage their private lake access using the approved BMPs and permitting requirements. Pamphlets, bulletins and brochures are useful at meetings, for follow-up consultations, and educational purposes with all age groups. Education, awareness and assistance in weed identification fosters cooperation and partnerships with the private sector.

Action

Develop Workshops and Training for Commerical Applicators

Before embarking on a season of herbicide applications, the commercial applicator will evaluate the types of weed infested sites in Clear Lake and consider alternative control measures. The County Agricultural Commissioner and the Lake County Department of Public Works Aquatic Weed Management Program Coordinator will apprise the registered applicators in the county of educational opportunities including continuing education credits towards renewal of their licenses, specifically with respect to the aquatic weed management. The range of educational opportunities include, but are not limited to, the University of California Extension, the Pesticide Applicators Professional Association, and the Weed Science Society of America.

Potential Key Players: UCD, DPW, CAC, CDFA, CDFG
Cost Estimates: $2,000
Potential Funding Source: grants, NRCS, USFWS
Time Frame: 2005-
Benchmark: Program developed and initiated
Issues: Adequate staff and time to complete staff

Action

Develop Workshops for Hand Pulling and Cost-Share Program

Provide a mandatory workshop for participants in experimental programs (Cost Share, Hand-Pulling). Many Lake front property owners are unaware of the complicated nature of aquatic plant management in a large multiple-use public waterbody such as Clear Lake. The proper application of appropriate methods is essential to assure the success of the overall management effort. Plant identification, especially invasive exotics of highest concern, is an important skill to impart to shoreline property owners.

Potential Key Players: UCD, DPW, CAC, CDFA, CDFG
Cost Estimates: $5,000
Potential Funding Source: grants, NRCS, USFWS
Time Frame: 2005-
Benchmark: Program developed and initiated
Issues: resistance by property owners to mandated attendance, resistance by CDFA to allow controlled handpulling in non-active management areas. Funds available for cost-share program.

Action

Develop Educational Materials: Brochures, Pamphlets, Mailings, and Press Releases

Targeted mailing in fall and spring to lakeshore property owners to go out with billing, and flood protection information. Specific and general brochures available in print and on the website for local residents and educators. Regular press releases highlighting various aspects of program and aquatic species found in Clear Lake. Develop a monthly "Shorelines" newsletter for public dissemination.

Potential Key Players: UCD, DPW, CAC, CDFA, CDFG
Cost Estimates: $20,000+
Potential Funding Source: grants, NRCS, USFWS
Time Frame: present

Benchmark: Copies available to public
Issues: adequate staff time available, space provided in local newspapers, providing copies on line and at various public places will significantly reduce mailing costs but limit distribution.

Action

Provide Adequate Signage at Lake Access Points

As a supplement to the hydrilla programs signs throughout the county at public boat ramps provide signs on other aquatic weeds of local concern. Informational pamphlets in weatherproof boxes near public access areas.

Potential Key Players: UCD, DPW, CAC, CDFA, CDFG
Cost Estimates: $3,000+
Potential Funding Source: grants, NRCS, USFWS
Time Frame: 2005
Benchmark: Signs designed. Pamphlets printed. Boxes in places
Issues: Largest expense in first year. Coordination with CDFA and California Boating and Waterways may prove useful.

Action

Provide Presentations to Local Groups and Classrooms

Develop curriculum and outreach materials for K-12 students in local schools. Continue to make staff available to community groups and local educators as guest speakers.

Department of Public Works staff giving a presentation to students in watershed setting.

Potential Key Players: UCD, DPW, CAC, CDFA, CDFG
Cost Estimates: $3,000+
Potential Funding Source: grants, NRCS, USFWS
Time Frame: present
Benchmark: Presentations scheduled. PowerPoint presentation created.
Issues: adequate staff time available, Creation of materials not prepackaged. The Aquatic Plant Management Society has developed a 5-6 grade APM lesson plan.

Action

Provide Information on WebPages and Links to Other Sites

Aquatic weeds of local concern.

Potential Key Players: UCD, DPW
Cost Estimates: $1,500+
Potential Funding Source: grants, NRCS, USFWS
Time Frame: present
Benchmark: Site updated to reflect latest and best information on Aquatic Plant Program
Issues: adequate staff time available,

Enforcement

While the goal would be 100 percent voluntary compliance with the program, especially permitting requirements, past experience shows this is not always the case. Applicators will be required to carry valid permit(s), including the lakebed map with highlighted permit areas. Before leaving the site the map must be updated to reflect the actual treatment area. Failure to comply could result in fines and the revoking of all outstanding permits. Agricultural Biologists from the Commissioners office will monitor random applications during the active treatment season of June through August.

In compliance with NPDES permit requirements, sampling for active ingredients will take place during the same time period at the inflow and outflow of the lake. A dissipation check will occur at 10% of the sites during the season for each active ingredient shown. The agriculture biologist will be monitoring DO and Temperature weekly in anticipated treatment sites to determine when thresholds are approaching.

Secondly, education and outreach efforts need to be in place so that ignorance is not an excuse for non-compliance. Currently restricted herbicides can be ordered over the Internet and delivered directly to your door. Individual property owners are responsible with following label requirements. Past practices of pulling bedsprings, chains etc, behind boats or jet skis can severely spread invasive aquatic weeds by fragmentation. Such activity needs to be curtailed.

Action

Enforcement of Non-Permitted Aquatic Plant Management Activities.

The Agriculture Commissioner Office has been responding to complaints and issuing a non-punitive Notice of Violation (NOV). Local and State agency staff on the lake need to report suspected violations. A penalty system needs to be developed.

Potential Key Players: UCD, DPW, CAC, CDFA, CDFG
Cost Estimates: TBD,
Potential Funding Source: fines
Time Frame: 2003-
Benchmark: Policy developed
Issues: Available staff and boat available for follow-up necessary for enforcement, adoption of ordinance by County of Lake, need for outreach to educate public on policy,

Action

Ban Sale of Aquatic Invasives in County

Agriculture Commissioner can apply for additional quarantine restrictions, as a special local need, to prevent the sale of exotic invasive species in the ornamental horticulture and aquarium businesses within the County of Lake specific invasive aquatic species, such as Water Hyacinth, Parrot Feather and Brazilian Elodea, etc. Voluntary compliance will be sought in the interim.

Potential Key Players: DPW, CAC, CDFA, and CDFG
Cost Estimates: $2,000+
Potential Funding Source: grants, NRCS, USFWS,
Time Frame: present
Benchmark: Ban of specific exotic species established in county

Issues: Lack of state program for invasive (currently in development). Resistance to additional government regulation.

Action

Adopt Aquatic Plant Ordinance

An ordinance giving permit authority to the county to control methods, monitor impacts and provide for local control of program should be developed and refined.

Potential Key Players: UCD, DPW, CAC, CDFA, CDFG
Cost Estimates: minimal to develop, enforcement costs TBD
Potential Funding Source: department staff time
Time Frame: ongoing
Benchmark: Ordinance reviewed by Clear Lake Advisory Committee (CLAS) and submitted to Board of Supervisors with recommendation to adopt. *(Urgency Ordinance No. 2625, Chapter 26 of County Code was signed by Board of Supervisors on March 18th 2003).*
Issues: Resistance to additional government regulation, A policy one-step short of an ordinance could be adopted to provide guidance but difficult to enforce. Frequent updates to ordinance may be required.

Adaptive Management

Trawl off Lucerne 2002, by Vector Control staff and summer interns, note extensive aquatic vegetaion in net

Choose the combination of control efforts that best meets the needs of lake users with the least impacts to the environment is a task that need regular reappraisal, and possible adaptation. Evaluate each control option described elsewhere in the document using an integrated vegetation management approach. This approach involves examining the alternatives with regard to such factors as:

* The extent of problem plant(s) infestation
* Scale, intensity, and timing of treatment
* Effectiveness against target plant(s),
* Duration of control (short-term vs. long-term)

* Human health concerns
* Environmental impacts and mitigation, if needed
* Program costs
* Permit requirements (Federal, state, local).

Review control alternatives in light of these and other site-specific factors. No management program, however, is without some impacts. Decide a course of action to achieve a balance between expected management goals at a reasonable cost and acceptable environmental disruption.

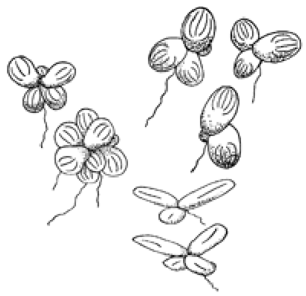
Action

Establish Technical Advisory Group (TAG)

Establish a scientific peer-review process by creating a committee composed of technical staff from local, state and federal agencies and universities. Participants should include the University of California Cooperative Extension Farm Advisor, the County Agricultural Commissioner, private local Pest Control Advisors and Qualified Applicator, registrants of aquatic herbicides, CDFA Hydrilla Eradication Program, DPR, USDA Aquatic Weed Program and the California Dept. of Fish and Game.This group would provide a discussion of technical issues, including pros and cons, relevant to the issues and courses of action identified by the Citizens Advisory Committee (CAC). Information can be presented to the community for discussion and approval through the public process. Experts can debate the technical issues and avoid making policy.

Specific tasks may include: Yearly scientific evaluation of the program. Prior to start of each season set Red Zones (where no harvesting is allowed) and Yellow Zones (where only hand harvesting is allowed). Re-evaluate Green Zones (Natural Wildlife Areas). Suggest and develop experimental projects. Establish monitoring requirements.

Potential Key Players: UCD, DPW, CAC, CDFA, CDFG, USFWS
Cost Estimates: Negligible
Potential Funding Source: departmental budgets
Time Frame: ASAP
Benchmark: Committee selected and meeting
Issues: make-up of group, frequency of meeting, committeemen by agencies, reimbursement for travel



Duckweed
Lemna minor
Small free floating can form large colonies

Action

Establish Citizens Advisory Committee

Through the CLAS (MAP), establish a citizens advisory committee to assist in recommending and coordinating aquatic plant management activities on the lake. This board should be comprised of citizens that represent different interest groups on the lake (i.e. power boating/skiing, sailing, fishing/hunting, aesthetics, environmental, resorts, shoreline homeowners). This separate yet complementary forum from the TAG allows for democratic public participation. The CAC reviews relevant issues and directs the technical discussion of TAG according to identified local needs. The TAG provides the citizens with technical information necessary to make informed choices without being forced to become scientists. After obtaining group consensus on a management scenario, the CAC sets short-term and long-term program priorities and policy. Tasks may also include directing the public outreach efforts.

Potential Key Players: UCD, DPW, CAC, CDFA, CDFG, Rimlanders Assoc., Restaurants and Resort Owners Assoc., City Representatives, Public Stakeholders
Cost Estimates: Negligible
Potential Funding Source: departmental budgets
Time Frame: 2003-
Benchmark: Committee selected and meeting
Issues: make-up of committee, frequency of meeting, subcommittee of CLAS, reestablish MAP Taskforce

Identify Lake Zones

Better understand the aquatic ecosystem of Clear Lake in order to protect the lake's vitality in terms of recreation, domestic consumption, agricultural use, aesthetic values, fish and wildlife habitat, and commercial uses. Current land use maps should be developed.

In terms of human enjoyment, Clear Lake is a popular place for swimming, boating, and fishing. It offers a variety of economic benefits such as tourism. Its capacity to provide aesthetic enjoyment is immeasurable. Clear Lake provides water for drinking and irrigation both locally and to our down stream neighbors. Equally important, Clear Lake provides habitat and food for all kinds of aquatic life, including fish, waterfowl and other animals.

Desired uses of a water body must be compatible with its capacity to sustain those uses, both human and natural. Under the Water Quality Standards, protected beneficial uses include fish rearing; spawning and harvesting; swimming; boating; navigation; irrigation; wildlife habitat; and domestic, industrial, and agricultural water supply. Clear Lake supports many different desirable uses, which sometimes conflict with each other. The management challenge involves identifying and agreeing on uses that complement each other, and realistically managing for these uses.

Action

Identify present water body use areas.

Prioritization of the most valuable resources and critical uses of the lake are needed to design and implement activities for maintaining Clear Lake in a healthy condition. Identify the areas of Clear Lake presently employed for beneficial uses. Document most common types of usage. This process should forecast resources and uses over the next five, ten, and 25 years. Use available information in the zoning, wetland, or resource inventory maps. Include:

- Conservancy areas, including habitats that are integral to the lake ecosystem, such as nesting sites, fish rearing or spawning areas, or locations of rare plant communities.
- Boating and boat access areas (launches, ramps)
- Water skiing zones
- Beaches and swimming areas (public, private)
- Fishing areas
- Areas for special aquatic events (e.g., sailing, rowing, poker runs, hydroplane fly-in)
- Parks, picnic areas, nature trails, scenic overlooks

- Irrigation/water supply intakes
- Other shoreline uses (e.g., residential, commercial).

Potential Key Players: CDD, DPW, CAC, CDFA, and CDFG
Cost Estimates: negligible
Potential Funding Source: departmental budgets
Time Frame: present
Benchmark: Information collected in spreadsheet/table
Issues: Staff time, insufficient GIS layers, agreement on uses. Often, the process of identifying and defining zones for each beneficial use on a map of the lake opens the potential for conflict.

Action

Develop a water body usage map:

Overlay the current water body use areas on a map of the lake. This water body usage map shows primary human uses, as well as habitat areas for fish, waterfowl, and other wildlife utilizing the water body. Native American cultural uses of wetland vegetation for basketry.

Potential Key Players: UCD, DPW, CAC, CDFA, CDFG, GIS Subcommittee
Cost Estimates: negligible
Potential Funding Source: Departmental Budgets
Time Frame: in process
Benchmark: Map Completed
Issues: Staff time, insufficient GIS layers, agreement on uses

Action

Develop Control Strategies by Area

Overlay treatment options per areas on a map of the lake. Utilizing water body usage maps habitat areas for fish, and other wildlife, bathymetric and substrate information and hydrilla management areas to develop zones for approved treatment methodologies.

Using the Control Intensity Map, match each control zone (no control, low control, and high control) with an appropriate control method.

Address following concerns: Will the control option restrict use of the water body after treatment by banning water contact or ingestion (swimming, fishing, drinking or irrigation use)? Does the operation of large machinery or equipment occur at a peak time of recreational use? Does this control option represent a severe safety hazard or interfere significantly with normal use? Site-specific constraints that might affect use of control method: Does the site have a lot of submerged logs or bottom debris or water intake pipes that would hamper bottom treatments like rotovation or bottom barrier application? Are there many surface obstacles such as docks or buoyed areas that could interfere with surface operations of mechanical cutting or harvesting?

Establish:

1. *Green Zones*: No control. Except management activities limited to programmatic control of exotic invasive species (i.e. Hydrilla, Eurasian Water Milfoil, Water Hyacinth) as necessary to protect native habitat.
2. *Red Zones*: Based on CDFA Hydrilla Eradication Program Status, identify areas where no mechanical control, in any form will be allowed.
3. *Yellow Zones*: Areas where limited non-mechanized hand-harvesting will be allowed. Under specified circumstances.
4. *Blue Zones:* Areas within set limit of known municipal potable water intakes where herbicide applications will not be permitted.
5. *Clear Zones*: Areas were all approved and permitted means of aquatic vegetation control are allowable.

Potential Key Players: UCD, DPW, CAC, CDFA, CDFG, GIS Subcommittee
Cost Estimates: negligible
Potential Funding Source: Departmental Budgets
Time Frame: in process
Benchmark: Map Completed
Issues: Need to update during the growing season, as new data becomes available. Limited staff, insufficient GIS layers, agreement on controls, CDFA quarantine limitations. Water intakes no longer public information due to national security concerns. Issues with limited reporting of individual water intake systems around the lake.

Watershed Controls

Produced by Lane Council of Governments

Watershed influences on lake water quality and macrophyte growth need to be considered within the context of macrophyte control.

As lake and upland development increases the possibility of increased sediment and nutrient inputs to the lake increase as well, which may exacerbate aquatic plant presence. Increased sedimentation and storage of watershed-derived nutrients in the sediment can promote non-native aquatic plants growth such as eurasian watermilfoil and persistence at the expense of native species. Many non-native species can be characterized as opportunistic invaders flourishing in nutrient-rich, fine-textured sediment and quickly forming a canopy, shading out native species. Dense stands of macrophytes like eurasian watermilfoil can, in turn, further promote gradual build-up of incoming sediment loads, providing a mechanism for increasing sediment surface area that can be colonized by macrophytes in a lake (Carpenter 1981; James and Barko 1990). Thus, reducing sediment loading, or its accretion, should be a secondary goal of aquatic plant management.

Another watershed consideration in aquatic macrophyte management is the role that accelerated eutrophication may play in exacerbating the growth of nuisance algae. Increased watershed nutrient loading (primarily phosphorus) in conjunction with development in riparian areas may promote the occurrence of blue-green algae blooms in association with changes in macrophyte community architecture (i.e., reduction in canopy-forming biomass). Surface algal blooms can also have an impact on light penetration, thereby reducing the growth of native macrophyte species, in favor of low light tolerant rapidly growing non-natives. Thus, one problem is being replaced by another due to accelerated eutrophication in conjunction with nuisance macrophyte control. It is recommended that a water quality monitoring program be implemented in conjunction with an aquatic macrophyte control plan.

Action

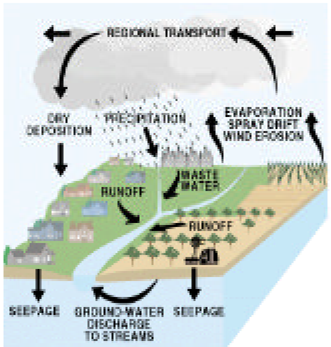
Reduce Nutrient Loading

According to the Clean Lakes Study, 1995: "Accelerated erosion caused by destabilization of creek channels by gravel mining, road construction, lakeside dredge and fill operations, the shoreline deposition of mine overburden and tailings and similar disturbances is the most important factor causing a doubling of sediment inflow into Clear Lake."

Clear Lake is considered an impaired water body according to the 303d list generated by the State Water Quality Control Board. The county is currently developing a Stormwater plan for NPDES Phase II, Non-Point Pollution Program compliance. A grading ordinance has been in place and is currently being reviewed by a taskforce for possible revision. Continue with the Middlecreek Ecosytem Restoration Project, thereby filtering water inflow from that major watershed.

Watershed management practices, including maintenance practices of shoreline property and sewage disposal issues, should be reviewed and assessed to determine impacts of those processes on aquatic growth.

Potential Key Players: DPW, Resource Agencies
Cost Estimates: Covered by other programs
Potential Funding Source: staff and volunteers, grants
Time Frame: present
Benchmark: Stormwater Plan and Grading Ordinance adopted
Issues: Nutrient TMDL due for development



Action

Coordinate Watershed Planning Efforts.

Complete Clear Lake Basin Management Plan (CLMP) and continue implementation of recommendations. Coordinate with Clear Lake component of General Plan update. Continue work with volunteer watershed groups (CRMP's) to improve water quality from their sub-watersheds.

Potential Key Players: DPW, Resource Agencies
Cost Estimates: Covered by other programs
Potential Funding Source: staff and volunteers, grants
Time Frame: present

Benchmark: Clear Lake Basin Management Plan, completed
Issues: limited resources


Tour of Rodman Slough with Department of Public Works Staff

Action

Coordinate Watershed Monitoring Efforts.

Continue coordination within existing agency programs. Seek funding for additional monitoring as needed. The goal of the water quality monitoring program should be to document, over long time scales, changes (if any) in water quality that might be symptomatic of accelerated eutrophication. The program should consider budgetary (i.e., how much is going into the lake, how much is leaving the lake, how much is being stored in the lake) analysis of hydrology, sediments, and nutrients (primarily nitrogen and phosphorus). Major tributary inflows and the discharge should be monitored for flow and water quality to determine loading, discharge, and retention of sediment and nutrients in the lake over an annual cycle. In-lake stations should be monitored at monthly intervals for variables such as temperature, dissolved oxygen, pH, secchi disk transparency, chlorophyll, and total nitrogen and phosphorus.

Continue work with volunteer watershed groups (CRMPS) to develop water quality monitoring in basin streams and Clear Lake.

Data can be compiled in the form of an annual data summary so that year-to-year variations and long-term trends can be evaluated. Sound decisions regarding watershed rehabilitation to improve water quality and promote native macrophyte community persistence can then be made.

Potential Key Players: Vector Control, DPW, Resource Agencies
Cost Estimates: Covered by other programs
Potential Funding Source: staff and volunteers, grants
Time Frame: present
Benchmark: GIS Database complete
Issues: Sharing of confidential information, monies for staff, equipment and analysis, quality of data collected by volunteers

APPENDICES

Appendix A

Bibliography

Bibliography

Barko, J. W., and Smart, R. M. (1986). "Sediment-related mechanisms of growth limitation in submersed macrophytes," *Ecology* 67, 1328-1340.

Booms, T. L. (1999). "Vertebrates removed by mechanical weed harvesting in Lake Keesus, Wisconsin," *J. Aquat. Plant Manage.* 37, 34-36.

Buckingham, G. R. (1994). "Biological control of aquatic weeds." In: D. Rosen, F. D. Bennett, and J. L. Capinera (ed). *Pest management in the subtropics: biological control - a Florida perspective*. Intercept Ltd., Andover, UK, 413-480.

___________. (1998). "Surveys for insects that feed on aquatic plants, *Myriophyllum spicatum*, and hydrilla, *Hydrilla verticillata*, in the People's Republic of China, Japan, and Korea," Technical Report A-98-5, US Army Engineer Waterways Experiment Station, Vicksburg, MS.

Carpenter, S. (1981). "Submersed vegetation, An internal factor in lake ecosystem succession," *Amer. Nat*. 118, 372-383.

Creed, Jr., R. P. (1998). "A biogeographical perspective on aquatic plants declines: additional evidence for the role of herbivorous weevils in promoting declines?" *J. Aquat. Plant Manage.* 36, 16-22.

___________. (2000). "The weevil-aquatic plants interaction at different spatial scales: what we know and what we need to know," *J. Aquat. Plant Manage.* 38, 78-81.

Crowell, W., Troelstrup, N., Queen, J., and Perry, J. (1994). "Effects of harvesting on plant communities dominated by aquatic plants on Lake Minnetonka, MN," *J. Aquat. Plant Manage.* 32, 56-60.

Dillon, P. J., Evans, R. D., and Molot, L.A. (1990). "Retention and resuspension of phosphorus, nitrogen, and iron in a central Ontario lake," *Can. J. Fish. Aquat. Sci.* 47, 1269-1274..

Getsinger, K. D., Davis, G. J., and Brinson, M. M. (1982). "Changes in a *Myriophyllum spicatum* L. community following a 2,4-D treatment," *J. Aquat. Plant Manage.* 20, 4-8.

Getsinger, K. D., and Netherland, M. D. (1997). "Herbicide concentration/exposure time requirements for controlling submersed aquatic plants: Summary of research accomplishments," Miscellaneous Report A-97-2, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

Green, W. R., and Westerdahl, H. E. (1990). "Response of aquatic plants to 2,4-D concentrations and exposure times. *J. Aquat. Plant Manage.* 28, 27-32.

Hellstr`m, T. (1991). “The effect of resuspension on algal production in a shallow lake,” *Hydrobiologia* 213, 183-190.

Hofstra, D.E., Clayton, J. S., and Getsinger, K. D. (2000) “Evaluation of selected herbicides for the control of exotic submerged weeds in New Zealand: II. The effects of turbidity on diquat and endothall efficacy,” *J. Aquat. Plant Manage.* 39, in press.

James, W. F., and Barko, J. W. (1990). “Macrophyte influences on the zonation of sediment accretion and composition in a north-temperate reservoir,” *Arch. Hydrobiol.* 120, 129-142.

James, W. F., Barko, J. W., and Eakin, H. L. (2000). “Macrophyte management via mechanical shredding: Effects on water quality in Lake Champlain (Vermont-New York),” ERDC TN-APCRP-MI-05, U.S. Army Engineer Research and Development Center, Vicksburg, MS.

Jewell, W. J. (1971). “Aquatic weed decay: Dissolved oxygen utilization and nitrogen and phosphorus regeneration,” *J. Wat. Pollut. Cont. Fed*. 43, 1457-1467.

Kimbel, J. C. (1982). “Factors influencing potential intralake colonization by *Myriophyllum spicatum* L.,” *Aquat. Bot.* 14, 295-307.

Lillie, R. A., and Budd, J. (1992). “Habitat architecture of *Myriophyllum spicatum* as an index to habitat quality for fish and macroinvertebrates,” *J. Freshwat. Ecol.* 7, 113-125.

Maceina, M. J., and Soballe, D. M. (1990). “Wind-related limnological variation in Lake Okeechobee, FL,” *Lake and Reserv. Manage.* 6, 93-100.

Madsen, J. D. (1997). “Methods for management of nonindigenous aquatic plants.” In: J.O. Lukin and J.W. Thieret, (ed.) *Assessment and management of plant invasions.* Spring, New York, 316.

___________. (2000). “Advantages and Disadvantages of Aquatic Plant Management Techniques,” ERDC/EL MP-00-1, U.S. Army Engineer Research and Development Center, Vicksburg, MS.

Madsen, J. D., Crosson, H. A., Hamel, K. S., Hilovsky, M. A., and Welling, C. H. (2000). “Panel discussion - management of aquatic plants in the United States using native insects: State regulatory and management issues,” *J. Aquat. Plant Manage.* 38, 121-124.

Mikol, G. F. (1985). “Effects of harvesting on aquatic vegetation and juvenile fish populations at Saratoga Lake, New York," *J. Aquat. Plant Manage.* 23, 59-63.

Moyle, Peter

Netherland, M. D., and Getsinger, K. D. (1995a). "Laboratory evaluation of threshold fluridone concentrations under static conditions for controlling hydrilla and aquatic plants," *J. Aquat. Plant Manage.* 33, 33-36.

____________. (1995b). "Potential control of hydrilla and aquatic plants under various half-life scenarios," *J. Aquat. Plant Manage.* 33, 36-42.

Netherland, M. D., Getsinger, K. D., and Skogerboe, J.G. (1997). "Mesocosm evaluation of the species-selective potential of fluridone," *J. Aquat. Plant Manage.* 35, 41-50.

Netherland, M. D., Getsinger, K. D., and Turner, E. G. (1993). "Fluridone concentration and exposure time requirements for control of aquatic plants and hydrilla," *J. Aquat. Plant Manage.* 31, 189-194.

Netherland, M. D., Green, W. R., and Getsinger, K. D. (1991) "Endothall concentration and exposure time relationships for the control of aquatic plants and hydrilla," *J. Aquat. Plant Manage.* 29, 61-67.

Newman, R. M., and Maher, L. M. (1995). "New records and distribution of aquatic insect herbivores of aquatic plantss (Haloragaceae: *Myriophyllum* spp.) in Minnesota," *Entomol. News* 106, 6-12.

____________. (2001a). "Factors influencing the control of aquatic plants with native or naturalized insects," Fourth Status Report for 1999-2001 to the Minnesota Department of Natural Resources, Ecological Services, St. Paul, MN.

Nichols, S. A. (1991). "The interaction between biology and the management of aquatic macrophytes," *Aquat. Bot.* 41, 225-252.

Nichols, D. S., and Keeney, D. R. (1973). "Nitrogen and phosphorus release from decaying aquatic plants," *Hydrobiologia* 42, 509-525.

Parsons, J. K., Hamel, K. S., Madsen, J. D., and Getsinger, K. D. (2001). "The use of 2,4-D to selectively control an early infestation of aquatic plants in Loon Lake, Washington," *J. Aquat. Plant Manage.* 39, in press.

Pine, R. T., and Anderson, L. W. J. (1991). "Plant preferences of triploid grass carp," *J. of*

Aquat. Plant Manage. 29, 80-82.

Poovey, A. G., and Getsinger, K. D. (2002). "The effects of inorganic turbidity on diquat efficacy against *Egeria densa*," *J. Aquat. Plant Manage.* 40, in press.

Sabol, B. M. (1983). "Simulated mechanical control of aquatic plants in Buffalo Lake, Wisconsin," Miscellaneous Paper A-83-8, US Army Engineer Waterways Experiment Station, Vicksburg, MS.

Sabol, B. M., and Hutto, T. D. (1984). "Simulating mechanical control operations," Information Exchange Bulletin A-84-1, US Army Engineer Waterways Experiment Station, Vicksburg, MS, 1-4.

Shearer, J. F. (1996). "Potential of a pathogen, *Mycoleptodiscus terrestris*, as a biocontrol agent for the management of *Myriophyllum spicatum* in Lake Guntersville Reservoir," Technical Report A-96-4, US Army Engineer Waterways Experiment Station, Vicksburg, MS.

Sheldon, S. P. and Creed, Jr, R P. (1995). "Use of a native insect as a biological control for an introduced weed," *Ecol. Applic.* 5, 1122-1132.

Sheldon, S. P., and O'Bryan, L. M. (1996a). "Life history of the weevil *Euhrychiopsis lecontei*, a potential biological control agent of aquatic plants," *Entomol. News* 107, 16-22.

Skogerboe, J. G., and Getsinger, K. D. (2002) "Endothall species selectivity evaluation: Northern species community. *J. Aquat. Plant Manage.* 40, in press.

Solarz, S. L., and Newman, R. M. (1996). "Oviposition specificity and behavior of the aquatic plants specialist *Euhrychiopsis lecontei*," *Oecologia* 106, 337-344.

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

Ustipak, R. D. (1995). "An analysis of wild rice at Clear Lake, California," California Department of Natural Resources, Lansing, MI.

Walker, W. W. (1996). Simplified procedures for eutrophication assessment and prediction: User Manual. Instruction Report W-96-2. U.S. Army Engineer, Waterways Experiment Station, Vicksburg, MS.

Appendix B

Glossary of Terms and Acronyms

GLOSSARY OF TERMS AND ACRONYMNS*

- Algae — Small aquatic plants containing chlorophyll and without roots that occur as single cells or multi-celled colonies. Algae form the base of the food chain in aquatic environments.

- Algal bloom — Heavy growth of algae in and on a body of water as a result of high nutrient concentrations.

- Alkalinity — The acid combining capacity of a (carbonate) solution, also describes its buffering capacity.

- Aquatic plant survey — a systematic mapping of types and location of aquatic plants in a water body, usually conducted by means of a boat. Survey information is presented on an aquatic plant map.

- BMP's (Best Management Practices) — practices or methods used to prevent or reduce amounts of nutrients, sediments, chemicals or other pollutants from entering water bodies from human activities. BMP's have been developed for agricultural, silvacultural, construction, and urban activities.

- Bathymetric map — a map showing depth contours in a water body. Bottom contours are usually presented as lines of equal depth, in meters or feet.

- Benthic — Bottom area of the lake (Gr. benthos depth).

- Biocontrol — management using biological organisms, such as fish, insects or microorganisms like fungus.

- Biomass — The total organic matter present (Gr. bios life).

- Bottom barriers — synthetic or natural fiber sheets of material used to cover and kill plants growing on the bottom of a water body; also called sediment covers.

- C(DPR) -- California Department of Pesticide Regulation

- C(DFG) -- California Department of Fish and Game

- C(DFA) -- California Department of Food and Agriculture

- C(DWR) – California Department of Water Resources

- Chlorophyll — The green pigments of plants (Gr. chloros green, phyllon leaf).

- Consumers — Organisms that nourish themselves on particulate organic matter (Lat. consumere to take wholly).

- Contact herbicide -— A herbicide that causes localized injury or death to plant tissues with which it contacts. Contact herbicides do not typically kill the entire plant.

- Control intensity map -— A map of a water body showing areas requiring no, low or high levels of aquatic plant control.

- Decomposers — Organisms, mostly bacteria or fungi, that break down complex organic material into its inorganic constituents.

- Detritus —Material suspended in the water that settles to bottom: organic detritus, from the decomposition of the broken down remains of organisms; inorganic detritus.

- Dissolved oxygen — A measure of the amount of oxygen gas dissolved in water and available for use by microorganisms and fish.

- Drainage basin — The area drained by, or contributing to, a stream, lake, or other water body (see watershed).

- Drawdown — Decreasing the level of standing water in a water body to expose bottom sediments and rooted plants. Water level Drawdown can be accomplished by physically releasing a volume of water through a controlled outlet structure or by preventing recharge of a system from a primary external source.

- Dredging — Physical methods of digging into the bottom of a water body to remove sediment, plants or other material. Dredging can be performed using mechanical or hydraulic equipment.

- Ecology — Scientific study of relationships between organisms and their surroundings (environment).

- Ecosystems — Any complex of living organisms together with all the other biotic and abiotic (non-living) factors which affect them.

- Emergent plants — Aquatic plants that are rooted or anchored in the sediment around shorelines, but have stems and leaves extending well above the water surface. Cattails and bulrushes are examples of emergent plants.

- Endothall — The active chemical ingredient of the aquatic contact herbicide Aquathol®.

- Epilimnion — The uppermost, warm well-mixed layer of a lake (Gr. epi on, limne lake).

- Eradication — Complete removal of a specific organism from a specified location, usually refers to a noxious, invasive species. Under most circumstances, eradication of a population is very difficult to achieve.

- Euphotic zone — That part of a water body where light penetration is sufficient to maintain photosynthesis.
- Eutrophic — Waters with a good supply of nutrients and hence a rich organic production (Gr. eu well, trophein to nourish).
- Exotic — Refers to species of plants or animals that are not native to a particular region into which they have moved or invaded. Eurasian watermilfoil is an exotic plant invader.
- Floating-leafed plant — Plants with oval or circular leaves floating on the water surface, but are rooted or attached to sediments by long, flexible stems. Water Primrose is an example of rooted floating-leafed plants.
- Fluridone — The active chemical ingredient of the systemic aquatic herbicide SONAR®.
- Flushing rate — Term describing rate of water volume replacement of a water body, usually expressed, as basin volume per unit time needed to replace the water body volume with inflowing water. The inverse of the flushing rate is the (hydraulic) detention time. A lake with a flushing rate of 1 lake volume per year has a detention time of 1 year.
- Fragmentation – Pieces of aquatic plants broken during mechanical physical control measures.
- Freely-floating plants — Plants that float on or under the water surface, unattached by roots to the bottom. Some have small root systems that simply hang beneath the plant. Water hyacinth and tiny duckweed are examples of freely-floating plants.
- Glyphosate — The active chemical ingredient of the systemic herbicide RODEO®.
- Grass carp — Also known as white amur, grass carp is a large, vegetation-eating member of the minnow family (Ctenopharyngodon idella). Originally from Russia and China, these plant grazers are sometimes used as biological agents to control growth of certain aquatic plants. Regulated use of sterile (non-reproducing) grass carp is not permitted in Clear Lake for aquatic plant control.
- Herbicide — A chemical used to suppress the growth of or kill plants.
- Habitat — The physical place where an organism lives.
- Hydraulic detention time — The period of detention of water in a basin. The inverse of detention time is flushing rate. A lake with a detention time of one year has a flushing rate of 1 lake volume per year.
- Hypolimnion — The cold, deepest layer of a lake that is removed from surface influences (Gr. hypo under, Limne Lake).

- Integrated aquatic plant management — Management using the best combination of plant control methods that maximizes beneficial uses, minimizes environmental impacts and optimizes overall costs.

- Limiting nutrient — Essential nutrient needed for growth of plant organism, which is the scarcest in the environment. Oftentimes, in freshwater systems, either phosphorus or nitrogen may be the limiting nutrient for plant growth.

- Limnology — The study of inland waters (Gr. limne lake).

- Littoral — The region of a body of water extending from shoreline outward to the greatest depth occupied by rooted aquatic plants.

- Macro-algae — Large, easily seen (macroscopic) algae. The macro-algae Nitella sp. sometimes forms dense plant beds and can be a conspicuous member of the aquatic plant community.

- Macrophyte — Large, rooted or floating aquatic plants that may bear flowers and seeds. Some plants, like duckweed and Coontail, are free-floating and are not attached to the bottom. Occasionally, filamentous algae like Nitella sp. can form large, extensive populations and be an important member of the aquatic macrophyte community.

- Mitigation — Actions taken to replace or restore animals or plants that may have been damaged or removed by certain prior activities.

- Morphology — Study of shape, configuration or form (Gr. morphe form, logos discourse).

- Niche — The position or role of an organism within its community and ecosystem.

- Nitrogen — A chemical constituent (nutrient) essential for life. Nitrogen is a primary nutrient necessary for plant growth.

- Non point (pollutant) source — A diffuse source of water pollution that does not discharge through a pipe or other readily identifiable structure. Non-point pollution typically originates from activities on land and the water. Examples of non-point sources are agricultural, forest, and construction sites, marinas, urban streets and properties.

- Non-target species — A species not intentionally targeted for control by a pesticide or herbicide.

- Noxious weed — Non-native plant species that, because of aggressive growth habits, can threaten native plant communities, wetlands or agricultural lands. The California Department of Food and Agriculture has the authority to designate certain plants as "noxious" in the state.

- NPDES—National Discharge Elimination System, a regulatory program part of the 1972 Clean Water Act, recently being applied to aquatic pesticide use.

- Nutrient — Any chemical element, ion, or compound required by an organism for the continuation of growth, reproduction, and other life processes.

- Oligotrophic — Waters that are nutrient poor and have little organic production (Gr. oligos small, trophein to nourish).

- Oxidation — A chemical process that can occur in the uptake of oxygen.

- pH — The negative logarithm of the hydrogen ion activity. pH values range from 1-10 (low pH values are acidic and high pH levels are alkaline).

- Phosphorus — A chemical constituent (nutrient) essential for life. Phosphorus is a primary nutrient necessary for plant growth.

- Photosynthesis — Production of organic matter (carbohydrate) from inorganic carbon and water in the presence of light (Gr. phos, photos light, synthesis placing together).

- Phytoplankton — Free floating microscopic plants (algae) (Gr. phyton plant).

- Point (pollutant) source — A source of pollutants or contaminants that discharges through a pipe or culvert. Point sources, such as an industrial or sewage outfall, are usually readily identified.

- Pollutant — A contaminant, a substance that is not naturally present in water or occurs in unnatural amounts that can degrade the physical, chemical, or biological properties of the water. Pollutants can be chemicals, disease-producing organisms, silt, toxic metals, and oxygen-demanding materials, to name a few.

- Primary production — The rate of formation of organic matter or sugars in plant cells from light, water and carbon dioxide (Lat. primus first, producere to bring forward). Algae are primary producers.

- Problem statement — A written description of important uses of a water body that are being affected by the presence of problem aquatic plants.

- Producers — Organisms that are able to build up their body substance from inorganic materials (Lat. producere to bring forward).

- Public Awareness/Outreach — Programs designed to share technical information and data on a particular topic, usually associated with activities (such as management) on or around a water body.

- RWQCB – Regional Water Quality Control Board, The State is divided in several regions with each region administering the Clean Water Act for the state of California. Clear Lake is in Region 5, The Central Valley Regional Water Quality Control Board

- Residence time — The average length of time that water or a chemical constituent remains in a lake.

- Rotovation — A mechanical control method of tilling lake or river sediments to physically dislodge rooted plants. Also known as bottom tillage or derooting.

- Rumsey -- The scale for measuring water depth in Clear Lake. Zero = 1318.26 feet above sea level.

- Secchi disc — A 20-cm (8-inch) diameter disc painted white and black in alternating quadrants. It is used to measure light transparency in lakes.

- Sediment — Solid material deposited in the bottom of a basin.

- Sensitive areas — Critical areas in the landscape, such as wetlands, aquifer recharge areas, and fish and wildlife habitat conservation areas, that are protected by state law.

- Standing crop — The biomass present in a body of water at a particular time.

- Steering committee — A small group of people organized to represent the larger community of individuals, businesses and organizations who have an interest in management of a particular water body. The steering committee is responsible for following the planning steps outlined in this manual.

- Stratification — Horizontal layering of water in a lake caused by temperature-related differences in density. A thermally stratified lake is generally divided into the epilimnion (uppermost, warm, mixed layer), metalimnion (middle layer of rapid change in temperature and density) and hypolimnion (lowest, cool, least mixed layer).

- Submersed plants — An aquatic plant that grows with all or most of its stems and leaves below the water surface. Submersed plants usually grow rooted in the bottom and have thin, flexible stems supported by the water. Common submersed plants are milfoil and pondweeds.

- Susceptibility — The sensitivity or level of injury demonstrated by a plant to effects of a herbicide.
- Systemic herbicide — A herbicide in which the active chemicals are absorbed and translocated within the entire plant system, including roots. Depending on the active ingredient, systemic herbicides affect certain biochemical reactions in the plant that can cause plant death. SONAR® and RODEO® are systemic herbicides.
- TMDL – Total Maximum Daily Load a maximum level of a specific pollutant that can be discharged into a water body without negatively effecting beneficial uses
- Thermal stratification — Horizontal layering of water in a lake caused by temperature-related differences in density. A thermally stratified lake is generally divided into the epilimnion (uppermost, warm, mixed layer), metalimnion (middle layer of rapid change in temperature and density) and hypolimnion (lowest, cool, least mixed layer).
- Thermocline — (Gr. therme heat, klinein to slope.) Zone (horizontal layer) in water body in which there is a rapid rate of temperature decrease with depth. Also called metalimnion, it lies below the epilimnion.
- Topographic map — A map showing elevation of the landscape in contours of equal height (elevation) above sea level. This can be used to identify boundaries of a watershed.
- Transect lines — Straight lines extending across an area to be surveyed.
- Tributaries — Rivers, streams or other channels that flow into a water body.
- Triclopyr — The active ingredient of the systemic herbicide Renovate, Garlon3.
- Triploid — A genetic term referring to non-reproducing (sterile) forms of grass carp induced by manipulating reproductive genes. Reproducing grass carp have two pairs of chromosomes and are termed diploid. Triploid fish have three sets of chromosomes.
- Trophic state — Term used to describe the productivity of the lake ecosystem and classify it as oligotrophic (low productivity, "good" water quality), mesotrophic (moderate productivity), or eutrophic (high productivity; "poor" water quality).
- Vascular plant— A vascular plant possesses specialized cells that conduct fluids and nutrients throughout the plant. The xylem conducts water and the phloem transports food.
- Water body usage map — A map of a water body showing important human use areas or zones (such as swimming, boating, fishing) and habitat areas for fish, wildlife and waterfowl.

- Watershed — The entire surface landscape that contributes water to a lake or river. See drainage area.

- Watershed snapshot — A simple drawing of a water body and its watershed showing important identifying features such as watershed boundary lines, inlet and outlet streams, wetlands, landuse zones and other site-specific characteristics. This is a simple way of condensing background data and information on a project area and displaying selected features in a picture.

- Watershed management — The management of the natural resources of a drainage basin for the production and protection of water supplies and water-based resources.

- Wetland — A generalized term for a broad group of wet habitats. Wetlands are areas of vegetation that are transitional between land and water bodies and range from being permanently wet to intermittently water covered.

- Zooplankton — Microscopic animal plankton in water (Gr. zoion animal). Daphnia sp. or water fleas are freshwater zooplankton.

**Adapted from Washington State Department of Ecology*

- *A Citizen's Manual for Developing Integrated Aquatic Vegetation Management Plans*

Appendix C

Guide to Clear Lake Aquatic Plants

Guide to Clear Lake Aquatic Plants

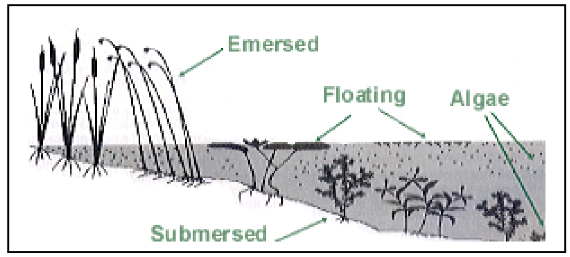
These plants can generally be categorized as emergent, submersed, or free-floating:

- Emergent aquatic plants are flowering plants with roots, stems, and leaves. They are rooted in the lake sediments and their stems; flowers and leaves extend above shallow waters less than about two feet deep. Water Primrose and Cattails are two examples of emergent weeds found in Clear Lake

- Submersed aquatic plants may be rooted or not, but their stems and leaves do not extend above the surface of the water. Flowers may extend just slightly above the surface. Examples of submersed plants in Clear Lake include Sago Pondweed, Curlyleaf Pondweed, American Pondweed, Coontail (not bottom rooted), Hydrilla, and Elodea.

- Floating aquatic plants usually bear roots, but they attach to nothing, deriving nutrients from the water column. Duckweed and Azolla (mosquito fern or water velvet) are examples of floating aquatic macrophytes found in Clear Lake.

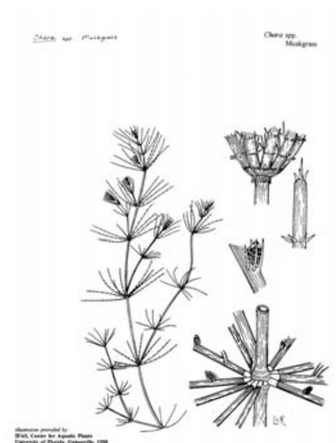
- Algae - Cellular, lower weed form. No distinguishable stem or leaf. Commonly called moss or scum.



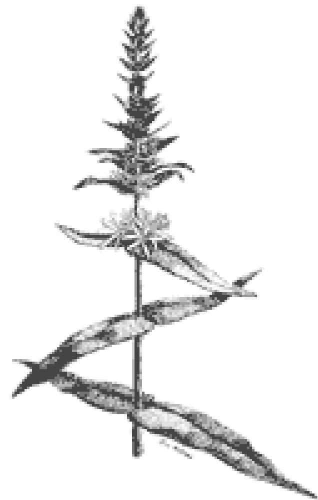
Algae

Cellular, lower weed form. No distinguishable stem or leaf. Scum and Chara are common.

- CHARA (Chara vulgaris): Leaf-like structures whorled around hollow stem. Dense growth attached, but not rooted to bottom. May carpet large areas of a lake or pond bottom. Strong musky odor when crushed. May have a gritty texture due to mineral deposits on the surface. Do not confuse with higher weeds.

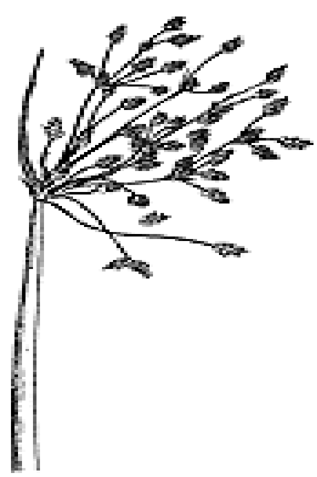


- ♦ PURPLE LOOSESTRIFE (Lythrum salicaria): Leaves slightly heart-shaped at base coming to a point at leaf tip. Leaves small and more numerous near tip. Stems rigid four-sided and have fine hairs on them. Leaves oppositely arranged on stem usually in pairs. Flowers bright purplish on a spike closely attached to stem.

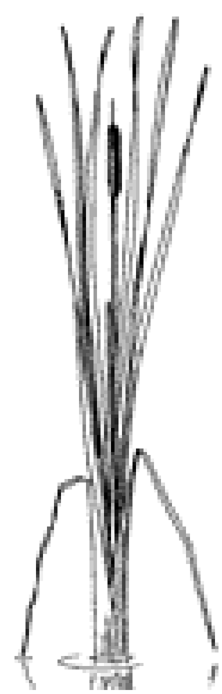


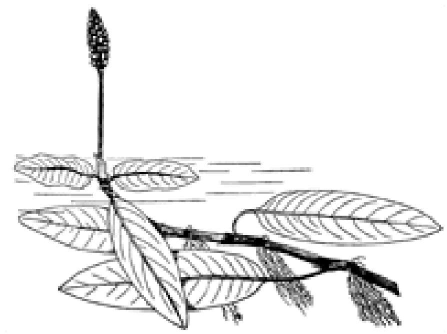
FILAMENTOUS ALGAE:
Individual filaments. A series of cells joined end to end that give a thread-like appearance. Often referred to as pond scum. Forms surface mats. Growth begins at the bottom and rises to the surface as a bubble-filled mass. May also form fur-like growths on logs and rocks at the bottom.

CATTAIL (Typha latifolia): Leaves are tall and flat. Stems are tall, round and unbranched. Flower is the distinctive cigar-shaped cattail which is green in early summer and turns brown and fuzzy in fall. This weed has an extensive root system. Difficult to control when well established.



BULRUSH (Scirpus spp.): Leaves may or may not be present. If present, they appear as a continuation of the stem. Stems are tall and smooth and either round or triangular in shape loose cluster of brownish flowers and seeds is located near the tip of the stem.





♦ SMARTWEED (Polygonum hydropiperoides): Leaves are oblong and smooth on the edges. Stems are distinctly jointed with leaves alternately arranged. The lower portion of the stem is rooted at the joints. Flowers are small and tightly clustered and are white or pink in color. Weed may be emersed in shallow water or completely submersed with only flowers visible above surface in deep water.

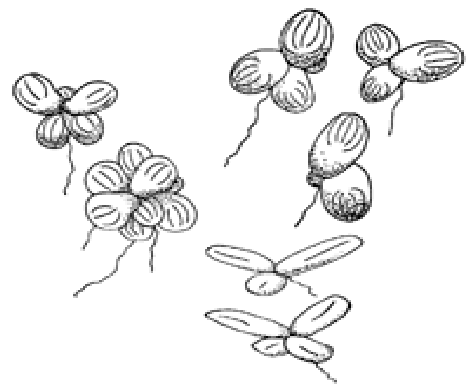
♦ WATER PRIMROSE (Ludwigia spp.): Leaves are lance shaped with smooth edges. Veins in leaves are evident. Stems and leaves are hairy. Leaves are numerous and alternately attached. Flowers are bright yellow and develop at the top of the weed.

Floating

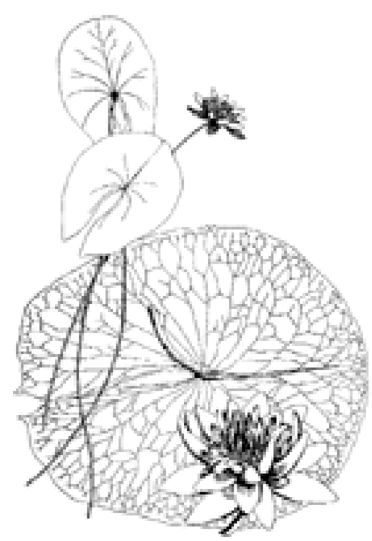
Growing unattached or rooted with floating leaves .

. . . .

♦ DUCKWEED (Lemna minor): Leaves the size of a pencil eraser. May be observed individually or in clusters upon close observation. Small root hairs may be seen hanging down from the underside of the leaf. No stem is distinguishable. Heavy growth will blanket the surface with many inches of growth. Duckweed is not interconnected as is Filamentous Algae. Do not confuse with Algae.



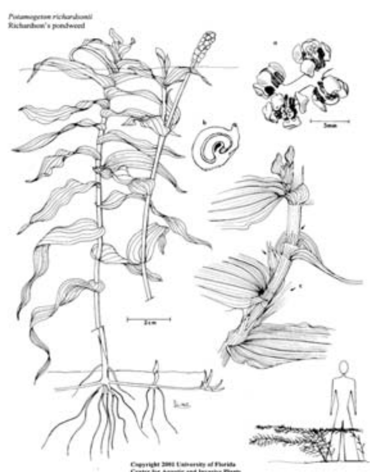
♦ WATER LILIES



Submersed

Growing in deeper water entirely below the surface.

- Slender Water Niad (Najas gracillima): Leaves are narrow with tiny spines along the edges. Slightly enlarged at the base. Stems slender with frequent branching. Leaves oppositely attached, or in groups of two or more at a node. Leaves are densely concentrated at the tips. May be confused with sago Pondweed or Chara. Chara has a strong odor when crushed, Bushy Pondweed does not.

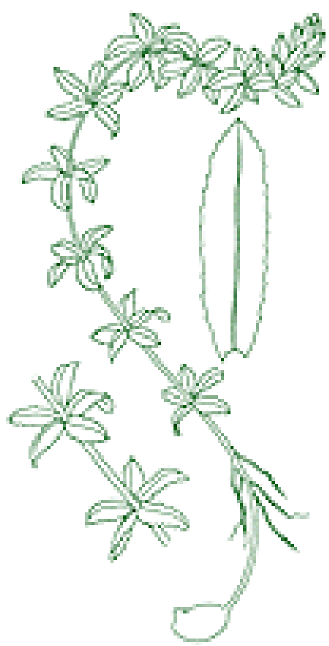


- CLASPING-LEAF PONDWEED (Potamogeton richardsonii): Leaves wide and wavy with smooth edges. Broad base clasps the stem. Upper stem commonly branched and leafy. Leaves are alternately arranged on stem. Solid tightly packed spike of nutlets at tip of weed rises above water surface.

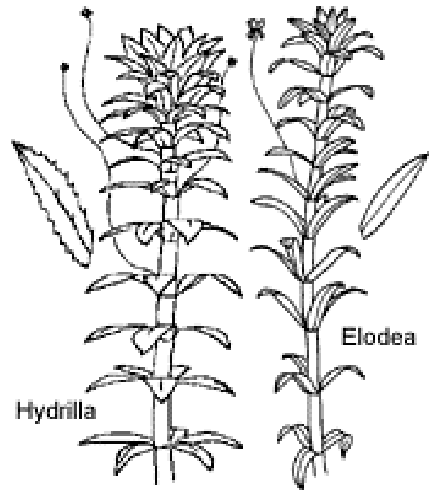
- COONTAIL (Ceratophyllum demersum): Leaves whorled around the stem and have a serrated appearance (see leaf detail). Spacing between leaf whorls is variable. Consequently, weeds may be long and sparse or bushy. Near the end of the stem leaves and whorls are crowded. Branches are forked repeatedly. Do not confuse with Chara.

- CURLY-LEAF PONDWEED (Potamogeton crispus): Leaves thin with wavy and finely serrated edges. Stems branched. Upper leaves are often crispy and appear waxy. Leaves alternately on stem. Flowers born on spikes rise above the water surface.

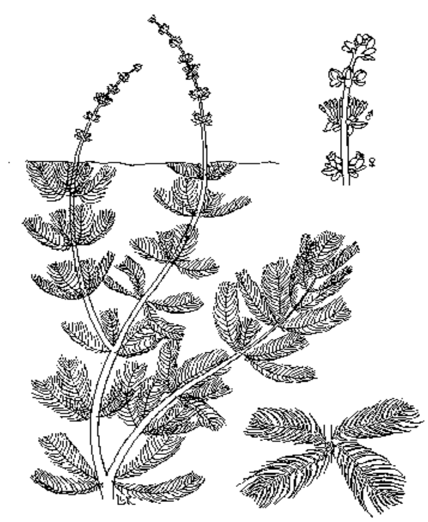
- FLOATING-LEAF PONDWEED (Potamogeton natans): Leaves both floating and submersed. Submersed leaves are long and narrow. Floating leaves are oblong and slightly heart-shaped at base. Parallel leaf veins are evident. Stems occasionally branched. Leaves are alternately arranged on stem. Solid tightly packed spike of nutlets at tip of weed rises above water surface.



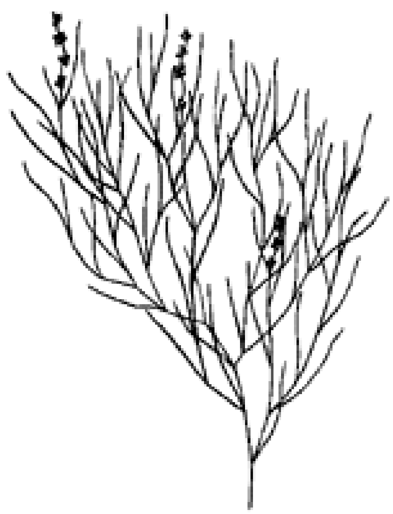
- HYDRILLA AND ELODEA (Hydrilla verticillata/Elodea canadensis): These two weeds are very similar. Both have leaves whorled in groups. Hydrilla leaves have a serrated edge. (See leaf detail for each.) Whorls of leaves are compact near the growing tips. Spacing between whorls increases further down the stem.



- MILFOIL (Myriophyllum): Northern (Native) Invasive (Non-Native) Eurasian. Leaves whorled in groups of four. Each leaf is divided into many thread-like leaflets extending from a central rib (see leaf detail). Forms tangled mats at the surface. Seed heads develop in mid to late season and may extend above the water surface.



- Illinois Pondweed (Also a type of Milfoil. Leaves whorled in groups of four to six. Each leaf is divided into eighteen pairs of threadlike segments resembling a feather (see leaf detail). This species differs from other Milfoils by having its foliage partially out of the water. Emersed foliage is bright green



- SAGO PONDWEED (Potamogeton pectinatus): Leaves are stiff, narrow and threadlike. Stems branched with leaves alternately attached. Spreading leaves resemble a fan with an overall bushy appearance. Nutlets appear like beads on a string. Tiny green flower appears on a spike along with nutlets above the water surface.

Appendix D

Evaluation of Control Methods

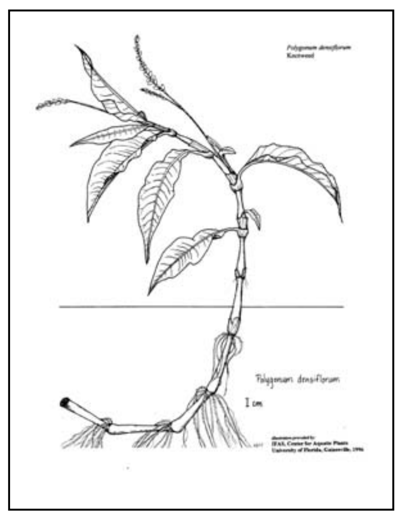
Evaluation of Control Alternatives for the Management of Aquatic Vegetation in Clear Lake

The management options described in this report represent techniques that can be implemented on an operational scale, with approval from appropriate state regulatory agencies. Treatment methods for the control of noxious aquatic plants are various (physical, mechanical, biological, chemical) and may be initiated for the short term or long term. What works in one situation may not work in another. Or perhaps a combination of treatments might be best. The Pilot Program examined several available options in terms of suitability for Clear Lake in the late 1990's; many of their findings are incorporated below. Environmental effects, costs, user friendliness, effectiveness, and permitting were points for evaluation. Both the advantages and disadvantages of each control method were considered. Usefulness in management of Clear Lake specifically, with its variety of uses (wildlife habitat, excellent fishery, domestic water source, and recreation) has been taken into account.

PHYSICAL CONTROLS

BOTTOM BARRIER

Description: Barrier material (liners, geotextile mats, and bottom barriers) is applied over the lake bottom to prevent plants from growing. Bottom covering materials such as sand-gravel, polyethylene, polypropylene, synthetic rubber, burlap, fiberglass screens, woven polyester, and nylon film have all been used with varying degrees of success. Typically, synthetic (geo-textile) fabrics or burlap are used. Bottom barriers can be used at any depth, with divers often utilized for deeper water treatments. Usually, bottom conditions (presence of rocks or debris) do not impede barrier applications, although pre-treatment clearing of the site is often useful. Sediment sealing Fabrics laid over sediment block sunlight penetration and prevents plant growth. They are usually anchored with stakes or weighted by sand or gravel.



Smart Weed
Polygonum sp.

A dominant shoreline vegetation. Is found in transition to upland areas, also found in shallows. Pink Flower.

Cost estimate: $3660 per ¼ acre (1999), material cost alone. Solutions to overcome disadvantages: Best Available Technologies and Best Conventional Technologies (BAT and BCT) are not able to mitigate the disadvantages

Effectiveness and Duration: Bottom barriers create an immediate open water area. Duration of control is dependent on a variety of factors, including type of material used, application techniques, and sediment composition. Synthetic materials like Aquascreen and Texel have eliminated nuisance plant conditions for at least the season of application. If short-term control is desired for the least expense, burlap is a good choice of materials. It has been known to provide up to two to three years of relief from problematic growth before eventually decomposing (Truelson 1989). The intensity of control is high. In some situations, after satisfactory control has been achieved (usually several months), bottom barriers may be relocated to other areas to increase benefits.

Advantages: Not directly detertmental to the environment. Non selective control blocks all rooted plant growth. Bottom barriers can generally be easily applied to small, confined areas such as around docks, boat launches, or swimming beaches. They can be installed by homeowners. Bottom barriers are hidden from view and do not interfere with shoreline use. They are site specific and can be installed around obstructions. Bottom barriers do not result in significant production of plant fragments (advantageous for hydrilla treatment). Barriers are most appropriately used for localized, small-scale control where exclusion of all plants is desirable.

Disadvantages: Requires that plants somehow be removed before installation. Cumbersome to install requiring diver assistance. Depending on the material, major drawbacks to the application of bottom barriers include some or all of the following: control not species specific, high material cost if used on a large scale, labor-intensive installation, limited material durability, possible suspension due to water movement or gas accumulation beneath material, eventual regrowth of plants from above material, requires area free of large obstructions. Periodic maintenance (yearly) of bottom barrier materials is beneficial to remove accumulations of silt and any rooting fragments. In some situations, removal and relocation of barriers may not be possible (natural fiber burlap decomposes over time). If used over a large area, sediment covers can produce potential environmental impacts such as a decrease in the populations of bottom-dwelling organisms like aquatic benthic invertebrates. Cumbersome and expensive to remove, and they create a nuisance waste which is costly to dispose of. Material cost is high, installation is expensive, and removal and disposal incur additional costs. Mats tested in Clear Lake were ineffective because of damage in high traffic areas. Mats, which dislodge due to fishing snags or gas accumulation underneath, become a hazard to boats and swimmers. Sediment accumulation on top of the mats supports rooted plant growth. Creation of an anaerobic zone underneath may lead to elevated production of methyl-mercury.

Costs: Bottom barrier material costs vary depending on the type of material used. Rolls of synthetic material for aquatic barrier use can be purchased in 300-foot lengths and either 12 or 15-foot widths for $300 to $350. Rolled burlap material (available in fabric stores or outlets) averages from $0.15 to $0.25 / sq. ft. Costs for professional installation are an additional $0.25-$0.50 / sq. ft. Some property owners have installed a bottom barrier using a 20 X 20 ft plastic tarp. These are relatively inexpensive to purchase at a local hardware store. Current costs are about $8.50 for an 8 x 10 ft tarp and $25 for a 16 x 20 ft tarp (~$3400/acre).

Permits: CDFG 1600 permit required.

Appropriateness for Clear Lake: Bottom barriers would be appropriate around docks at Clear Lake where there are no large obstructions and also along short stretches of shoreline. Cost and maintenance of bottom barriers confine them to very small-scale use

WATER LEVEL DRAWDOWN

Description: Drawdown involves exposing plants and root systems to prolonged freezing and desiccation. It is generally performed in winter months. The use of Drawdown as an aquatic plant management tool is more common for use in reservoirs and ponds than in natural lakes. A water control structure for drainage or high capacity pumps are needed to draw the water down. Water level could be allowed to drop below zero Rumsey (the scale for measuring water depth) in Clear Lake) for an extended period in the summer, causing shallow sediments to dry, oxidize, and consolidate, killing susceptible aquatic plant species.

Effectiveness and Duration: Although freezing can have a dramatic impact on some plants, Brazilian elodea is known to have over-wintering buds. Also, temperatures in the Clear Lake area rarely reach the sub-zero temperatures that would be necessary for a large-scale kill.

Advantages: Consolidation of sediments increases water clarity. Low cost when considered in isolation from negative impacts. Controls many aquatic macrophytes such as *Potamogeton amplifolius, P. foliosus, P. richardsonii, Nymphaea tuberosa, and Polygonum natans*.

Disadvantages: Abrogates water rights obligations to the Yolo County Irrigation District. May violate water rights. May interrupt municipal water districts ability to serve their constituents. Ability to quickly reestablish high water level depends on unpredictable weather patterns. Exposure of extensive lakebed sediments would be unsightly and produce objectionable odors for an extended period. Receding shoreline would deny lake access to many users at both public and private facilities, causing a massive negative impact to the local economy. Wildlife may be forced out of long established near-shore habitat. Weeds may invade deeper areas of the lake as low water produces transient shallow zones. Certain species of mosquitoes may increase. Hydrilla and creeping primrose are tolerant of low water, and will be at an advantage over more desirable, native species. Best Available Technologies and Best Conventional Technologies (BAT and BCT) are not able to mitigate the disadvantages.

Appropriateness for Clear Lake: Drawdown is not feasible at Clear Lake.

NON-TOXIC DYES

Description: Chemicals, which prevent penetration of necessary light energy to developing plants, can reduce aquatic macrophyte growth.

Advantages: Non-toxic dyes do not affect aquatic organisms, which do not depend on light. Does not interfere with irrigation or recreational water uses. Effective against a broad spectrum of submerged weeds and algae.

Disadvantages: May not be used in drinking water sources. Dyes become quickly diluted in large or flowing water bodies. Dyes can be quite expensive. Must be applied early when growth is still 2 to 4 feet below the surface. Not effective in shallow water (less than about 3 feet). Best Available Technologies and Best Conventional Technologies (BAT and BCT) are not able to mitigate the disadvantages.

Appropriateness for Clear Lake: Dilution related to size and water movement make the use of Non Toxic Dyes not feasible in Clear Lake.

NUTRIENT LIMITATION

Description: Plant growth is inhibited if an essential nutrient critical for growth is in short supply.

Advantages: Improved water clarity occurs as plankton and suspended sediment is removed.

Disadvantages: A lake essentially can become as unproductive. No good examples exist where nutrient limitation has sufficiently reduced nuisance aquatic plants in large water bodies. Best Available Technologies and Best Conventional Technologies (BAT and BCT) are not able to mitigate the disadvantages.

Appropriateness for Clear Lake: Limiting nutrient input into the lake has been attempted on a watershed basis for more than a decade. Water clarity has increased and the algal blooms have decreased. Due to the lakes thick bottom sediment and warm euthrophic nature, nutrient limitation is not feasible as the sole control method for aquatic plants, but should be continued for over-all health of the lake.

FERTILIZATION

Description: Critical plant nutrients in short supply may be added to cause an algal bloom, which shades out rooted plant growth.

Advantages: Fertilizers are relatively inexpensive and readily available.

Disadvantages: Increased turbidity due to algae growth is perceived as a decrease in water quality by most people. More algae growth will return Clear Lake to a situation of nuisance blooms, unsightly vegetative flotsam, and obnoxious smells. Best Available Technologies and Best Conventional Technologies (BAT and BCT) are not able to mitigate the disadvantages.

Appropriateness for Clear Lake: Fertilization is not feasible at Clear Lake, due to listing as a nutrient impaired water body.

MECHANICAL CONTROLS

Mechanical control techniques have been in use for centuries to battle nuisance growth of both terrestrial and aquatic plants. For purposes of this document, mechanical control techniques were classified based on how they eliminate the plant problems: (i) by inflicting physical damage to the problem plants or (ii) by physically removing all or portions of the problem plants from the affected area.

Harvester's come in a variety of sizes.

Techniques that inflict physical damage to plants range from hand-operated implements to very specialized mechanized equipment. For example, in areas with sufficient water exchange, simply cutting rooted plants below the water surface, by either hand-operated or mechanized cutters, may result in transport of the problem plants from the affected area. Even in areas with insufficient water exchange to provide elimination of cut plant material, cutting in itself may lead to death and eventual decomposition for some species. However, for many typically problematic species (e.g. Eurasian Water Milfoil, Egeria, and Hydrilla), cut shoot material may continue to thrive if it is not removed by some secondary process.

HAND-PULLING

Description: Hand-digging and removal of rooted, submerged plants is a labor intensive control method. This method involves digging out the entire plant with roots. Plants are then deposited in a dry disposal area away from the shoreline. No specialized gear is required in waters less than three feet. In deeper waters, hand pulling is most efficient with divers using snorkeling equipment or SCUBA gear. Divers carry mesh bags for collection of plants. Plants then need to be disposed of on shore.

Effectiveness and Duration: Sediment type, visibility, and thoroughness in removal of the entire plant, particularly the roots, all affect the speed at which plants are removed. A high degree of control, lasting more than one season, is possible when complete removal has been achieved.

Advantages: This method results in immediate clearing of the water column of nuisance plants. The technique is very selective in that individual plants are removed. It is most useful in sensitive areas where disruption must be kept to a minimum and also works well in hard to get places. It is a highly labor intensive control and, therefore, most appropriate for small areas. Environmental impacts, including turbidity increases and bottom disruption, are short-term.

Disadvantages: This method is time-consuming and can be very costly if contract divers are employed. Diver visibility may become obscured by the digging process, making it difficult to see and remove roots. Hand pulling is labor intensive for large areas.

Costs: Costs will vary depending on whether contract divers and laborers or volunteers are used. Expenses can run between $500 to $2400 per day.

Permits: A 1600 Stream and Lakebed Alteration Agreement would be required by CDFG, as covered in County Aquatic Weed Management Permit.

Appropriateness for Clear Lake: This method would be useful for small-area, short-term control of non-invasives around private docks and along short shoreline segments. Some type of boom or boat could be used to help collect fragments. Due to the hydrilla infestation in Clear Lake, and the ongoing eradication efforts by CDFA, hand-pulling is only permitted in areas 1/4 mile or greater away from hydrilla management sites. Currently, there are extremely few locations that qualify.

Hand-pulling or digging is also suggested as a control method for the removal of creeping primrose and yellow flag iris, although residents who have tried this report that it is very labor intensive. As the lake levels drops in summer removal of aquatic vegetation other than tules/bulrushes and woody species above the water line is permitted (i.e. creeping primrose).

HAND-CUTTING

Description: This is also a manual method but does not involve hand-pulling the roots. The plants are cut or torn using tools that can be pulled through the weed beds by boat or manually. This work can be done using hand held cutting tools, some of which may be powered. Items such as rakes, chains, logs, railroad ties, or even old bedsprings may be dragged across the bottom to collect plants. Collected plants should be disposed of at a dry land location. Because roots are not removed, this is a less intensive removal technique. Mechanized weed cutters are also available that can be operated from the surface for small-scale control (similar to an underwater lawnmower)

Effectiveness and Duration: With hand-cutting, root systems and lower stems are left intact. As a result, effectiveness is usually short-term, as rapid regrowth is possible from the remaining root masses. Duration of control is limited to the time it takes the plant to grow to the surface (probably less than one season).

Advantages: Hand-cutting and mechanized weed cutters result in immediate removal of the nuisance plant and quickly create open water for swimming or fishing. Hand-cutting is similar to hand-pulling but costs can be minimal. Hand-cutting is site specific and can be species specific, if care is used, which minimizes environmental disruption. Mechanized rollers and cutters are site specific and offer low-cost operation after the initial purchase.

Disadvantages: The hand-cutting method is time-consuming and labor intensive. Visibility may become obscured by turbidity generated during cutting activities. This technique does not result in long-term reductions in growth because roots are left intact. Duration of control would be minimal, probably less than one season. Cut plants must be removed from the water. Fragments are numerous, making clean up messy and laborious. This method is not practical for large areas.

Costs: Assuming volunteers are used, costs are limited to the purchase of cutting implements. This can vary from under \$100 for the Aqua Weed Cutter (Sunrise Corp.) to approximately \$1500 for the mechanized underwater lawnmower Swordfish (Redwing Products). A WaterWeed Cutter (Aquacide Company) was purchased for \$135 and found to be a very effective tool.

Permits: The permitting process is the same as for hand-pulling.

Appropriateness: for Clear Lake Hand cutting of aquatic plants would be most applicable for short-term and small-scale control around private docks and in light areas of infestation along the shoreline. It was used to clear a heavily infested area around a dock and was found quite easy to use. The actual weed cutting may go very quickly. The time consuming element is the collection of the weed fragments. One should note that though the tool is easy to use it is quite sharp and could be dangerous if safety is not kept in mind. In order to keep a dock weed-free with this cutter; one would probably need to use it several times a growing season. Due to the hydrilla infestation in Clear Lake, and the ongoing eradication efforts by CDFA. Currently, there are extremely few locations that qualify at this time for this method of control.

HARVESTING / CUTTING

Description: Mechanical harvesters are large floating machines that cut plants below the water surface. Harvesters have U-shaped underwater cutter bars that cut plant shoots to depths up to 8 ft below the water surface. Submersible conveyors attached to the cutter bars bring the cut plant material onboard the harvester for temporary storage. However, due to the limited onboard storage capacity of harvesters, plant material must eventually be transported over water to an onshore conveyor, where it is offloaded onto an awaiting truck for upland disposal. Harvesting is considered a short-term technique that temporarily removes nuisance plants. To achieve maximum removal of plant material, harvesting is usually performed during summer when submersed and floating-leafed plants have grown to the water's surface. Conventional single-staged harvesters combine cutting, collecting, storing, and transporting vegetation into one piece of machinery. Cutting machines are also available which perform only the cutting function. Maximum cutting depths for harvesters and cutting machines range from 5 to 8 feet with a swath width of 6.5 to 12 feet.

Effectiveness and Duration: The immediate effectiveness of harvesting is creating open water. The duration of control is variable. Factors such as frequency and timing of harvest, water depth, and depth of cut may influence the duration of control. Harvesting has not proven to be an effective means of sustaining long-term reductions in the growth of milfoil. Regrowth of Eurasian milfoil to pre-harvest levels typically occurs within 30-60 days (Perkins and Sytsma 1987) depending on water depth and the depth of cut.

Advantages: In areas where excessive plant growth has led to degraded habitat and water quality, harvesting often provides temporary improvement to conditions. A specific location can be targeted leaving an area open for fish and wildlife. There is usually little interference with recreational use of the water body during harvesting operations. By cutting only the top 5-ft of the plant, some habitat remains. Harvesting dense stands of Aquatic plants may promote good fish growth and allow predator fish to forage more effectively. Harvesting has the added benefit that removal of in-lake plant biomass also eliminates a source of nutrients, often released during fall die back and decay. Furthermore, harvesting can reduce sediment accumulation by removing organic matter that normally decays and adds to the bottom sediments. *However, contrary to widely held opinion, harvesting submersed plant species normally does not result in significant reductions in whole lake nutrient levels (Madsen 2000).* Depending on species content, harvested vegetation can be easily composted and used as a soil enhancement. Conventional harvesting operations implemented for control of actively growing weed beds have the potential for integration with both chemical control and biological control techniques. Temporal integration of mechanical control techniques can be used to open boat lanes through dense weed beds while awaiting onset of large-scale impacts from systemic herbicide treatments or weevil releases. Spatial integration of mechanical control techniques with chemical control techniques can occur by using mechanical harvesting for spot treatments in high water exchange areas, where contact herbicides would not be effective.

Disadvantages: Conventional aquatic plant harvester systems can not be utilized to control the plant fragment masses in the shallow water and near shore areas. Conventional harvester systems generally have a minimum operating draft of more than 3 ft, and therefore, would not be able to collect fragment masses in these extensive shallow water areas. Smaller fish, turtles, and macroinvertebrates are themselves subject to becoming harvested, especially in dense plant stands that hinders their escape (Booms 1999). Nichols (1991) suggests that harvesting nontarget native species that reproduce by seed, regenerate poorly from fragments, or regrow slowly are at a competitive disadvantage to plants with growth characteristics similar to Eurasian Water Milfoil. Fragment production by harvesting has often been mentioned as a detrimental consequence of this technique, since generated fragments can serve as a source for dispersal to new areas. However, several researchers (Kimbel 1982, Nichols 1991, Madsen 2000) suggest that fragments generated by harvesting and other "artificial means" are not as viable as naturally occurring auto-fragments, and therefore probably do not contribute significantly to inlake dispersal and expansion of invasive plant species such as Eurasian Water Milfoil. Cut plant material requires collection and removal from the water with off-loading sites needed for plant disposal. Collecting machines fill up very quickly due to the limited onboard storage capacity of harvesters. Plant material must eventually be transported over water to an onshore conveyor, where it is offloaded onto an awaiting truck for upland disposal. If dedicated transporters are included in the operation, the harvested load may be transferred to it for over water transport to the shoreline-offloading site. In this type operation, the harvester can continue with harvesting operations after the transfer is accomplished. If dedicated transporters are not included and the harvester must itself transport the collected plant material to the onshore conveyor, the harvester's production rate will be greatly reduced. Harvesting creates numerous plant fragments, which would contribute to the spread of Eurasian milfoil and Brazilian elodea. It is not species specific and can be detrimental to juvenile fish, which are removed indiscriminately by the process. Harvesting can enhance the growth of opportunistic plant species that invade treated areas. Capital costs for the machine purchase are high ($35,000-$150,000) and equipment requires considerable maintenance. Harvesters are not very efficient and repeated treatments are necessary--rather like mowing a lawn. Harvesting is most suitable for large lakes and open areas with few surface obstructions. Harvesting operations result in the immediate, <u>non-selective</u> removal of the upper shoot portions of targeted plant stands. Due to the hydrilla infestation in Clear Lake, and the ongoing eradication efforts by CDFA, mechanical harvesting is only permitted in areas 1/4 mile or greater away from hydrilla management sites. Currently, there are extremely few locations that qualify for this method.

Costs: Harvesting costs depend on a variety of factors such as program scale, composition and density of vegetation, equipment used, skill of personnel, and site-specific constraints. Detailed costs are not uniformly reported, so comparing project costs of one program to another can be difficult. Currently, contract aquatic plant harvesting operations cost about $750.00 per acre on non-prevailing wage rate projects and $1000.00 per hour if prevailing wage is required (McNabb pers. comm. 1998). Using a recent estimate of control at one acre per day, contracting would be very costly. The current purchase price for a new harvesting system is approximately $110,000 plus an ongoing operations and maintenance expense each year.

Permits: The permit process is the same as for hand-pulling.

Appropriateness for Clear Lake: Conventional mechanical control techniques could theoretically be used to control all actively growing aquatic plants beds in Clear Lake. Due to the acreage involved, the low areal production rates of these systems, and the fact that harvested aquatic plants regrow in four to six weeks (Mikol 1985; Crowell et al. 1994), treatment by this technique will probably be limited to small high use areas (e.g., boat lanes, marinas, boat launches, etc.). The cost of the equipment could be prohibitive, particularly in the light of the short-term control offered by harvesting. Harvesting results in the production of numerous plant fragments, which would contribute to a larger scale infestation of invasives in the lake. Due to the hydrilla infestation in Clear Lake, and the ongoing eradication efforts by CDFA, mechanical harvesting is only permitted in areas 1/4 mile or greater away from active hydrilla management sites. Currently, there are extremely few locations that qualify for his method.

Actively growing Coontail and Eurasian Water Milfoil beds generate extensive free-floating fragment rafts in open water areas of Clear Lake. These free-floating fragment rafts are transient and ultimately are propelled by prevailing winds to shoreline areas where they are extremely detrimental. However, even before their arrival to near shore areas, these extensive free-floating rafts create widespread negative impacts, including disruption of navigation, shading and physical injury to native plant beds, disruption of fisheries habitat, and denied access to foraging substrates by waterfowl. Conventional mechanical harvesters may best be used for control of free-floating fragment rafts in Clear Lake.

ROTOVATION

Description: Rotovation is basically underwater cultivation or rototilling using a barge-mounted rototiller or amphibious tractor towing a cultivator. Plants and root crowns are uprooted as bottom sediments are tilled to a depth of up to 12 inches. Bottom tillage is usually performed in the cold months of winter and spring to reduce plant regrowth potential. This technique is most suitable for use in larger lakes due to the size of the equipment and the high cost.

Effectiveness and Duration: Depending on plant density, control offered by rotovation may last up to two or three years. Further, removal of the upper shoot material by the harvester prior to rototilling will reduce shoot entanglement of the rototiller and improve production rates of the rototilling operation.

Advantages: Destruction of root crowns by the rototiller should provide a significantly longer control time than would be provided by the harvest operation alone. A high percentage of entire plants, including the roots, can be removed during tillage. Plant density is generally reduced. By removing the canopy, tilling stimulates the growth of native plants, which is of potential benefit to fish.

Disadvantages: Bottom obstructions can interfere the use of rotovation. Tillage should not occur where water intakes are located. Short term turbidity increases in the area of operation, and short-term impacts on water quality and the benthic invertebrate community can occur (Gibbons et al. 1987*).* More long-term water quality impacts may follow from resuspension of sediment-bound plant nutrients, and perhaps even more significantly from resuspension of other immobilized sediment contaminants. *Rotovation is not advised where bottom sediments have excessive nutrients and/or metals because of their potential release into the water column.* Rotovation is not species selective. Plant fragments are produced and the machine does not collect plants. Due to the hydrilla infestation in Clear Lake, and the ongoing eradication efforts by CDFA, rotovation is only permitted in areas 1/4 mile or greater away from hydrilla management sites. Currently, there are extremely few locations that qualify. The process is very labor intensive and expensive.

Costs: Bottom tillage costs vary according to treatment scale, density of plants, machinery used and other site constraints. Production rates for mechanical harvesting operations are typically in the range of 1 to 2 acres per day per harvester. Actual rates depend on performance characteristics of the harvesting equipment, water conditions and dimensions of the harvest site, over water transport distance from the harvest site to the shoreline offloading site, and the harvestable plant standing crop in the treatment area (i.e. cutter bar width and storage capacity) (Sabol 1983; Sabol and Hutto 1984; Madsen 2000). Costs for harvesting operations are extremely variable and depend on these same factors. Per acre costs may range from as little as $1200 per ac to over $6100 per ac (HLP).

Permits: An individual 1600 CDFG permit is required for all rotovation projects. Also, the use of bottom tillage requires a temporary modification of water quality standards from Regional Water Quality Control Board.

Appropriateness for Clear Lake: Rotovation is generally used for milfoil control. This procedure is cost prohibitive and also would contribute to the spread, by fragmentation, of other invasives. Also, due to the 303d listing of Clear Lake as an impaired water body for nutrients and mercury this method is inappropriate. No such equipment is currently in the area but could be brought in.

WEED ROLLER

Description: The mechanized weed roller may be used around private docks. Mechanized weed rollers, which flatten and wear down weeds by frequent agitation, are useful around docks. Most have wings running lengthwise which cut or press plants into the bottom sediment. They prevent reestablishment of new plants by disturbing the sediment.

Advantages: With a weed roller, control is achieved on a continuous basis. Neighbors can share weed rollers.

Disadvantages: The area needs to be free of obstructions. Mechanized weed rollers and cutters are expensive to purchase and require maintenance and are not species specific. They are cumbersome to install. Unknown environmental impacts related to fragmentation, turbidity and effect on benthos. Weed rollers are generally not permitted for removal of invasive aquatic weeds because they create fragments and might help spread the plant to new locations.

Appropriateness for Clear Lake: A relatively new product and currently none are in use on the lake. Dr Lars Anderson, who has seen videos of weed roller in use, says in would be worse than dredging in spreading fragments. CDFG may have issues and would need to review feasibility.

DIVER-OPERATED SUCTION DREDGING

Description: With this technique, divers operate portable dredges with suction heads that remove plants and roots from the sediment--essentially vacuuming the bottom of the lake. The suction hoses draw the plant/sediment slurry up to a small barge or boat carrying the dredge. On the barge, plant parts are separated from the sediment slurry and retained for later off-site disposal. The sediment slurry can be returned to the water column, if permitted.

Effectiveness and Duration: Diver dredging can be highly effective under appropriate conditions. Removal efficiency depends on sediment condition, density of aquatic plants, and underwater visibility (Cooke et al. 1993). This technique works well to control early low-level infestations of Eurasian milfoil or Brazilian elodea. It can also be used as a *species selective* maintenance tool following herbicide treatments.

Advantages: This method of control is site and species specific. Disruption of sediments is minimized compared to the use of rotovation. Plant parts are collected for later disposal, and the spread of fragments is minimized which is important in the control of Brazilian elodea or milfoil. Diver dredging can cover a much larger area than is practical for hand pulling and it can be effective in soft sediments. Also, it can be easily operated around obstacles and in tight places.

Disadvantages: Diver dredging is labor intensive and very costly. Two divers and a tender are needed. Turbidity and release of nutrients and other contaminants from disturbed sediments are some environmental concerns. The turbidity caused by the machine creates poor visibility, which slows the process. Some sediment and non- target vegetation may inadvertently be removed during the process. Some fragment loss may be expected if dredged slurry is directly returned to the lake. It would be even more costly if slurry were disposed of upland.

Costs: The costs can vary depending on density of plants, type of equipment used, and disposal requirements. State regulations on contract divers for dredging work are stringent and prevailing wage rates are high. Two divers and a tender are needed. Costs can range from a minimum of \$1100 / day to upwards of \$2000 / day with actual removal rates varying from approximately ¼ to one acre per day.

Permits: Four different permits are needed, one of which takes up to two years. CDFG requires a 1600 Permit and the Corps of Engineers may also require a permit. A lakebed management permit is required from the Lake County Department of Public Works. A temporary modification of water quality standards due to increased turbidity may be required from the Regional Water Quality Control Board.

Appropriateness for Clear Lake: This method is very costly, very labor intensive and slow going, so it isn't very practical for widespread infestations such as in Clear Lake. It may work well at Clear Lake (with soft sediments) if volunteer equipment and labor were used, but, as mentioned above, the permitting process is long and can take up to two years. Some community members have discussed the possibility of building the equipment on a very low budget. If so, diver dredging could come up at a later date as a control of interest in selected areas. Issue of visibility, once dredging is initiated localized turbidity will increase drastically.

BIOLOGICAL CONTROLS

Biological control is "the use of parasitoid, predator, pathogen, antagonist, or competitor populations to suppress a pest population, making it less abundant and thus less damaging than it would otherwise be" (Van Driesche and Bellows 1996). The desire to find a more "natural" means for long-term control, to reduce use of expensive equipment, and to eliminate the use of chemicals has created an interest in biological control agents to reduce the quantity of non-native aquatic weeds. Non-native plants become invasive when they encounter a suitable environment, free of their natural controls. Introduction of herbivorous or pathogenic organisms free of their respective natural controls can result in acceptable control. Control organisms may be insects (or other arthropods), pathogens, or vertebrate herbivores. The biological methods of control are limited at this time. Theoretically, once classical biological control is established, it is and highly and economically effective and supposedly maintenance free. Biological control should be highly selective of the target plant species. Involves no environmental toxin. Control potentially becomes area-wide though not complete.

Introduction of non-native organisms is highly regulated by governmental agencies, and research requirements are substantial and expensive. Compared to controlling pest insects, bio-control of exotic invasive plants has produced far fewer successful examples in terrestrial ecosystems, let alone aquatic. The use of pathogens (primarily fungi) to control milfoil is under investigation (e.g., Shearer 1996), but effective operational formulations have not yet been developed. Grass carp (*Ctenopharyngodon idella*) are effective generalist herbivores and will often eliminate preferred native plants before controlling the non-native invasive plants (Madsen 2000). Moreover, introduction of grass carp is illegal in 100 year floodplains within California.

INSECTS / PATHOGENS

Description: Although surveys for classical biological control agents (agents that control the exotic plant in its native range) have been conducted on Clear Lake no classical agents have been released from quarantine (Lars Anderson, pers. comm.) and it is unlikely that classical agents will be available in the near future. Most attention has been given to indigenous (native) and naturalized insects. Three species have been considered as potential Eurasian Milfoil control agents: the moth *Acentria ephemerella*, a naturalized Pyralidae, the indigenous midge *Cricotopus myriophylli* Oliver and the indigenous weevil *Euhrychiopsis lecontei* (Dietz) (= *Eubrychiopsis lecontei*) (Creed and Sheldon 1995; Sheldon 1997a; Johnson et al. 2000). All three taxa are present in the Midwest (Newman and Maher 1995; Scholtens and Balogh 1996; Creed 1998). Although all three taxa have potential to control aquatic plants (e.g., Johnson et al. 1998; 2000, Kangasneimi et al. 1993), prior research (Creed 1998; Newman and Biesboer 2000) suggests that *E. lecontei* is the most promising control agent. The Eurasian Water Milfoil weevil is indigenous to North America and is broadly distributed across the northern states and southern Canadian provinces (Creed 1998; Tamayo et al. 1999). The native host plants of eurasian watermilfoil weevil are northern watermilfoil (*Myriophyllum sibiricum*) and likely other native milfoils such as *M. verticillatum* (Newman and Maher 1995; Solarz and Newman 2001). The weevil is fully aquatic and spends the summer submersed on aquatic plants; in the fall adults move to shore where they overwinter in dry leaf litter along the shore (Newman et al. 2001b).

Advantages: Given sufficiently high and persistent weevil populations, declines of eurasian watermilfoil are likely.

Disadvantage: Currently, the size and abundance of the population is unknown. Given sufficiently high and persistent weevil populations, declines are likely. However, many, if not the majority of sites investigated, have failed to sustain sufficient weevil density to effect control. We currently cannot predict when and where weevil populations will reach sufficient densities nor when or where declines and suppression will occur (Creed 2000; Newman and Biesboer 2000). Integration with mechanical harvesting, which removes the top portion of the plant where all life stages of the weevil occur, is not advised.

Control Effectiveness and Duration Effectiveness: The Eurasian water milfoil weevil has caused suppression of plant height and biomass in several field enclosure experiments (Creed and Sheldon 1995; Sheldon and Creed, 1995). Moreover, the eurasian watermilfoil weevil has been associated with numerous eurasian watermilfoil plant declines (Creed 1998). Although many of these declines are poorly documented and cannot be directly related to weevil damage. Stem mining reduces buoyancy causing the plants to drop out of the water column and perhaps below the photic zone (Creed et al. 1992). This, in conjunction with damage to the vascular system that reduces the plant's ability to translocate nutrients and carbohydrates, may be important in reducing eurasian watermilfoil's competitive advantage and its ability to regrow the next spring (Newman et al. 1996, Creed 2000). In addition, the wounding of the plant and deposition of insect excrement may make the plant more susceptible to pathogen attack (Creed 2000).

Costs: Biological control can be quite cost effective *if* agents establish and develop self-sustaining populations. If there are already weevils in Clear Lake, costs may be limited to monitoring weevil populations and insuring proper integration with other techniques (e.g., preventing harvesting or chemical control in designated areas). Simple monitoring of weevil populations throughout the summer could be done for several thousand dollars if students or volunteers were used. A more intensive investigation could cost $25,000 to $50,000 per year. Introduction of weevils may not be necessary as weevils already occur in the lake and any factors that are limiting current populations would likely limit introduced or augmented populations. If there were areas where weevil densities were low or eliminated, EnviroScience provides weevils and pre- and post-stocking assessments for $1000 per 1000 weevils (Madsen et al. 2000). EnviroScience recommends stocking 1200 weevils per acre for control within two seasons. Ten 2.5-acre plots could be stocked and assessed for $30,000 ($528,000,000 for 44,000 acres of Clear Lake). Clearly one needs to know if some major limiting factor, such as sunfish predation, exists in the lake before using this approach. Cost estimates for more intensive conservation strategies to enhance existing or augmented populations are not readily available. In addition to protecting existing weevil habitat (regulation and enforcement costs), manipulations such as improving shoreline overwinter habitat or removing bluegills would be experimental and probably cost prohibitive. These approaches could be integrated with other strategies to improve overall lake health, such as a program to enhance shoreline habitat or to improve the fishery, but biocontrol would be best considered an additional benefit, not the main focus of the activity.

Permits: Although several historical and recent surveys for classical biological control agents (agents that control the exotic plant in its native range) have been conducted (Buckingham 1998), no classical agents have been released from quarantine (Buckingham 1994, 1998) and it is unlikely that classical agents will be available in the near future.

Appropriateness for Clear Lake: Successful biological control results in a suppression of the pest plant, not its elimination. Because of the potentially cyclical nature of control and the lower predictability of control temporally, biological control is most useful for long term control in lower priority sites and over large areas where other management actions would be less feasible or cost effective. High priority areas, where effective and rapid control is needed (e.g., boat channels, swimming beaches, docks), should be managed with other approaches. Because some of these intensive management approaches may conflict with biological control (see integration), sites chosen for biological control should be areas with less disturbance and less need for immediate relief. An acceptance of partial control and a healthy native plant community in areas targeted for biological control is needed. In Clear Lake, backwater areas or unused bays would be suitable for biological control. The Eurasian water milfoil weevil requires Eurasian water milfoil, or its close relatives such as northern water milfoil, to exist. Northern water milfoil has not been documented in Clear Lake.

TRIPLOID GRASS CARP

Description: Grass carp were brought into the United States from Malaysia in the 1960's and have been used to control aquatic weeds extensively in the South. Grass carp or white amur (*Ctenopharyngodon idella*) are plant consuming fish native to the large rivers of China and Siberia.

Advantages: They have definite feeding preferences, though there is a wide range of plants that they will eat. Under the right circumstances, these fish are known to control certain submersed nuisance aquatic plants, notably hydrilla in Imperial Irrigation District canals. They are most suitable for use as a system-wide, low intensity control over the long term. Triploid carp, which are sterile individuals, to eliminate breeding and thereby limit population to stocked fish. Depending on the problem plant species and other site constraints, proper use of grass carp can achieve long-term reductions in nuisance growth of vegetation without much management. In some cases, introduction of grass carp may result in improved water quality conditions, where water quality deterioration is equated with dense aquatic plant growth (Thomas et al. 1990).

Disadvantages: Calculating the optimum stocking rate to achieve the desired control of the target plant is not easily achieved. Variable factors such as the amount of plant material available (both target species and other plants), water temperature, climate, and predators, along with past experiences from other lakes, are considered in determining the stocking rate. In order to introduce the carp, a permit is required from California Department of Fish and Game and specific state regulations must be adhered to. Only certified sterile fish can be planted. Inlets and outlets must be screened to keep the carp out of other water bodies. These regulations are in place to prevent problems that have occurred in other lakes where grass carp were introduced. Long term operation and maintenance costs are relatively inexpensive. The target plant, such as eurasian watermilfoil, may not be high on the grass carp's preference list. The fish may avoid areas of the water body experiencing heavy recreational use, resulting in less plant removal in these locations. Plant reductions may not become evident for several years. Full ecological impacts of grass carp introductions in non-agricultural waters are still being determined, and there may be a problem which is presently unrecognized. Overstocking of grass carp could result in eradication of beneficial plants and have serious impacts on the overall ecology of the water body. Overstocked carp are very difficult to remove, and these fish can live 14 years. Also, costs for screening inlets and outlets can be substantial. Because of the unpredictability of grass carp control, it is recommended that they not be introduced where total plant eradication and increased turbidity cannot be tolerated. Total eradication has caused turbidity problems in other lakes where all submersed plants were eaten and carp began rooting on the bottom. Other consequences of total submersed plant eradication include: loss of habitat which provides protection for young fish and other aquatic organisms, loss of a waterfowl food source, and the possible establishment of another invasive species in the newly created niche. With the removal of a large biomass of aquatic macrophytes, there is a potential for increased alga production. Cost very high in California. Only one supplier of certified triploids in the state. Difficult to remove once established. Screens on inlets and outlets can add considerably to costs.

Control Effectiveness and Duration Effectiveness: Dependent on several factors: feeding preferences, metabolism, temperature, and stocking rate. Grass carp eat in a hierarchy with distinct preferences. For example, newly introduced carp in Devil's Lake, Oregon initially preferred thinleaf pondweeds (Potamogeton spp.). However, as the fish grew larger (12-14 inches), Brazilian elodea became the favored food. This change in food preference took approximately one year. According to biologist Scott Bonar (Houghton Lake), it generally takes about two to three years to see noticeable results from stocking when the density of carp is adequate. Restocking may be necessary in five to ten years.

Costs: Compared to other plant control techniques, costs for grass carp are relatively low in states not requiring the monitoring and reporting necessary in California. Screens on inlets and outlets can add considerably to costs. The costs for grass carp control include those for the fish and any needed screens for inlets and outlets, permit fees, monitoring and replacement. Rotating drum screens require electricity to run them. At a stocking rate of 10 to 25 fish per vegetated acre at an average cost of $155 per certified triploid fish for 10 years ($15/fish, $15/fish annual renewal fee, 10-15 year life-span and $5 delivery fee = $155), (44,000 acre lake x 15 fish/acre x $155/fish =

$102,300,000). The estimated a cost to install a drum screen at the Cache Creek dam would be excessive. An additional screen on the major inlet may also be required. Actual cost $500-$3000/acre.

Permits: CDFG requires a game fish planting permit prior to grass carp introduction to a water body, California Code of Regulations Title 14 section 5.37 and 238.6., also CDFG Code Sections 6440-6460. In addition, if outlet screening is necessary, hydraulic approval is required from the several agencies. CDFG must be contacted for assessment of threatened or endangered plant species.

Appropriateness for Clear Lake: Because Clear Lake has an excellent fishery and supports a great deal of waterfowl and wildlife, the possibility of total destruction of lake ecosystem is a big concern. For numerous reasons grass carp are not appropriate for Clear Lake.

BIOACTIVE

Description: Some bioactive products are designed to consume hazardous waste such as pesticides (including herbicides) and petroleum products but use is not limited to that type of operation. The microorganisms in such products consume anything comprised of an organic nature, however will not work on living matter.

Advantages: Is not considered a pesticide. Can be purchased without restriction. Consumes the detritus (bottom muck or sediments) on the lakebed taking away nutrients essential for weed growth.

Disadvantages: Does not directly kill living aquatic vegetation. Expensive. Unknown if the bacteria would increase the level of the toxic methyl mercury, the potential is a concern. Microorganisms need oxygen to survive, ideally requiring an aeration system for success. Minimal effectiveness in an open waterbody.

Cost: One pail (45 pounds) of Aquaclear will treat about 1/2 of an acre and costs about $135.00 to $150.00.

Control Effectiveness and Duration Effectiveness: Bioactive products typically require water temperatures between 50 degrees F and 95 degrees F, proper pH (between 6.5 and 8), dissolved oxygen in sufficient quantities for aerobic bacteria, and a food source. Bacteria can be separated into aerobic (those requiring oxygen to survive) and anaerobic (can live without oxygen), facultative types can survive in either environment. Bacteria grow and reproduce as long as there is a food source. Enzymes aid in digestion, breaking down molecules so that they are available for bacterial consumption. Enzymes are not living organisms, they cannot reproduce. Enzymes are specific and will only work on one type of molecule i.e. lipase breaks down fats/greases, protease breaks down proteins, cellulase breaks down cellulose, and amylase breaks down carbohydrates and starches. Bioactive products can consume herbicides and should not be used in coincidence, mainly because it would be a waste of the herbicide to do so. A lack of vitamins or minerals can influence how well bacteria are able to grow and reproduce. Some products may add essential vitamins and minerals to the digestant product.

Appropriateness for Clear Lake: The Clear Lake Pilot Project considered the use of products such as Aquaclear and Superbugs that utilize bacteria and enzymes that digest or consume organic waste. The products may not be worth the cost considering the level of benefit (Pilot Project 1999)

CHEMICAL CONTROLS

Aquatic plants have been successfully managed using various formulations of systemic and contact herbicides for several decades. While several formulations of both systemic and contact herbicides are registered by the U.S. Environmental Protection Agency for controlling aquatic plants not all of those products are currently registered in the state of California and would be potentially available for use on Clear Lake. Species selective control is important, especially when treating large areas of the lake. The population of the invasive aquatic plants can be significantly reduced while limiting negative impacts on the desirable native plant community. When treating submersed plants, herbicide effectiveness depends upon dose and contact time (also known as concentration and exposure time relationships or CETs), which is in turn dependent upon the water exchange characteristics of the treatment zone (Getsinger and Netherland 1997). Therefore, to insure an efficacious application of any herbicide, water exchange characteristics of the treated zone, such as seasonal retention time of the lake and/or water movement in application plots, should be investigated prior to any herbicide applications. Using this information, one can precisely predict control of the target species and impacts on desirable native vegetation, as well as provide estimates of off-target movement of herbicide residues.

REGISTERED NON-RESTRICTED HERBICIDES

- Copper (various complexes)
- Diquat

- Endothal
- Triclopyr (USEPA only 4/2003)
- Fluridone
- Glyphosate

ADVANTAGES

- Easy and convenient to apply
- Effective control
- Economical and cost-effective
- Applicable to a variety of situations

DISADVANTAGES

- Toxicity to humans and the environment
- Special training and qualifications are required
- Measurement and timing are critical to safety and efficacy
- Pesticide resistance may occur, (although some plants do not reproduce sexually)
- Non-target, unintended consequences

COST ESTIMATES

- Fluridone: $1000 per acre, material only (1999).
- Komeen: $260 per acre single treatment, material only (1999). Up to 3 treatments may be necessary for season long control.
- Rodeo: $65 to $130 per acre, material only (1999). Not applicable to submersed aquatic weeds.
- Diquat: $1250 to $1400 per infested acre
- Triclopyr: unknown at this time
- Endothal: $1750 per infested acre

CONTACT HERBICIDES

Contact herbicides are products that have a broad spectrum of activity and can be used to control most submersed plant species. However, knowledge of CET relationships with respect to contact herbicides can be used to provide some degree of species selectivity. Also, the active ingredients in these products do <u>not</u> translocate throughout the plant, and therefore only affect the tissue that is contacted by the herbicide. With the exception of annual plants and very young perennial plants (with poorly developed rootstock or rootcrown tissue), contact herbicides rarely kill the entire plant. When used to control submersed vegetation, they perform well in removing or "burning-down" the shoots, but do not control the rootstock or rootcrown tissue, which is at or below the surface of the sediment. Because of this, robust perennial species, such as Eurasian Water Milfoil that are treated with contact herbicides usually have the ability to recover from the herbicide exposure and re-grow. Two contact herbicides are registered for use in California that would be appropriate for controlling aquatic plants, diquat [6,7-dihydro-dipyrido (1,2-a: 2', 1'-c) pyrazinediium dibromide] and endothall [7-oxabicyclo (2.2.1) heptane-2, 3-dicarboxylic acid].

Diquat. Diquat is available as a liquid product (trade name, Reward®) that can provide a rapid kill of submersed plant shoots, followed by a quick decomposition of the affected tissue (within 4 to 7 days post-treatment). The herbicide is usually applied from a boat directly to the stand of target vegetation by injection beneath the surface, or broadcast sprayed over the surface of the water. The application window for optimum plant control is in late spring when plants are actively growing and water temperature is above 54 degrees F. Extensive treatment experience in California lakes has shown that one application of diquat at recommended rates can provide greater than 80% knockdown of Eurasian milfoil plants, with regrowth occurring in six to eight weeks post-treatment. Since it is a non-selective product, shoots of non-target native plants that occur within the treated zone will also be controlled. Because diquat is readily bound to mineral clays and organic matter, this herbicide is most effective when used in clear water. Use of diquat in turbid water conditions will inactivate the product and result in poor or no control of treated vegetation (Hofstra et al. 2001; Poovey and Getsinger 2002). Rapid plant uptake, short CET requirements, and limited off-site movement of diquat makes this herbicide ideal for treating small stands of plants, or for use as a follow-up (spot-treatment) application to remove patches of plants that might have survived a large-scale herbicide treatment. Furthermore, the activity and dissipation properties described above also make it a good choice for conducting fairly precise treatments in and around marinas, docks, boat launches, and swimming areas. It can also be used to open-up small, well-defined areas in dense stands of vegetation for boat access and/or fishing lanes. For complete use restrictions, refer to the current product label and contact CDPR. When used at rates effective for controlling Eurasian Water Milfoil, diquat will also control other native plants in the treated zone. *However, the most appropriate use of diquat in Clear Lake would be for relatively small-scale, partial lake applications, where broad-spectrum removal of submersed aquatic plants in those settings would only represent a small proportion of the total plant community. Application of diquat in this manner would permit for the integration with non-chemical techniques, such as mechanical harvesting or biocontrol insects.* It was generally agreed that the cost of diquat applications would range from $1250 to $1400 per infested acre treated. These costs include the current price of the herbicide and the estimated cost of application.

Endothall. There are two endothall formulations recommended for controlling aquatic plants, the liquid Aquathol® K, and the granular material Aquathol® Super K Granule. Recommended treatment rates range from 2 to 4 mg ai /L. When used in this manner, there is a rapid kill of plant shoots that results in >80% knockdown within year of treatment. However, because of the contact nature of this herbicide, regrowth can occur in six to eight weeks. Herbicide applications should be made in spring when water temperatures are above 54 degrees F and plants are actively growing. The herbicide is applied by boat, and is either injected underneath the water surface into a stand of vegetation or sprayed above the surface with hand-held equipment in a broadcast application. Research of endothall CET relationships conducted at the ERDC have indicated that Eurasian water milfoil injury was directly proportional to the length of time plants were in contact with a given endothall concentration (Netherland et al. 1991). Endothall rates that are effective for aquatic plants control should have at least 18- to 24-hour exposure times for best results (Netherland et al. 1991). Given these exposure times, water in treatment areas should be quiescent, with minimal flow. Endothal is not affected by turbidity in the water column and can provide aquatic plant control in areas protected from high water exchange processes, such as coves, swimming areas, and boat docks. Endothal is generally considered a non-selective herbicide and recommended application rates (2 to 4 mg ai /L) may impact some native submersed vegetation. However, small-scale studies have shown that lower rates of endothall (0.5 to 1.0 mg ai /L) provide excellent control of aquatic plants and significant regrowth of non-target plants was observed just eight weeks post-treatment (Skogerboe and Getsinger, 2001). These results have yet to be verified in the field. Endothal applications in Clear Lake would provide an opportunity to confirm these selectivity results, where low doses of endothall could be used in partial lake treatments of 25 to 125-acre blocks. In addition, application of endothal in partial lake treatment techniques would allow for the integration with non-chemical techniques, such as mechanical harvesting or biocontrol insects. The State of California has specific restrictions on application of the granular formulation of endothall near shore well locations; applications must be____ away from wells. Other water use restrictions include: no swimming in treated area for 24 hours after application; 3-day restriction on taking fish from treated areas for consumption; and ___day restriction on using treated water for irrigation, agricultural sprays, or domestic purposes. For complete use restrictions, refer to the current product label and contact CDPR. The cost for application of endothall is estimated at $1750 per infested acre, which includes the cost of the herbicide.

SYSTEMIC HERBICIDES

Systemic herbicides, unlike contact herbicides, translocate throughout the plant and under ideal conditions can provide complete control of the target weed. These herbicides are primarily absorbed by the leaf and stem tissues and move to the actively growing apical regions of roots and shoots, killing the entire plant. Two systemic herbicides approved for aquatic use in California for control of submersed aquatic plants are the low-volatile butoxyethyl ester (BEE) of 2,4-D (2,4-dichlorophenoxyacetic acid) and fluridone (1-methyl-3-phenyl-5-[3-(trifluoromethyl) phenyl] -4(1*H*)-pyridinone). Selectivity has been reported in laboratory and field CET evaluations for both these products, in which target plants were selectively controlled and non-target species were unaffected or regrew after herbicide application (Getsinger et al. 1982; Green and Westerdahl 1990; Netherland et al. 1993; Netherland and Getsinger 1995a, 1995b; Netherland et al. 1997; Sprecher et al. 1998; Parsons et al. 2000; Getsinger et al. 2001).

2,4-D A granular (clay) product (trade name Navigate®) that acts as an auxin-like plant hormone. Once absorbed into plant tissues, there is a moderately slow kill of shoots (7 to 14 days) and decomposition of plants (14 to 28 days), with >85% knockdown of mature shoots within the year of treatment. Young, actively growing aquatic plants are more susceptible to 2,4-D than are mature, slowly growing plants. In cases where aquatic plants is not completely killed, regrowth can occur in eight to twelve weeks following the initial application. Control of aquatic plants is selective at all rates, with minimal injury to non-target plants. However, young plants can usually be controlled with lower application rates of this herbicide. 2,4-D has been routinely used to selectively control aquatic plants in Midwestern water bodies for over 50 years. *The State of California: imposes a 24-hour swimming restriction on the use of 2,4-D and has specific restrictions on application of 2,4-D near shore well locations; applications must be ___ away from wells. For complete use restrictions, refer to the product label and contact County Agriculture Commissioner (CAC).* Partial lake treatments using 2,4-D would include moderately sized blocks or all hectares infested with Eurasian Watermilfoil (10,000 acres). In either case, use of 2,4-D would allow for integration with other non-chemical management techniques. Cost of 2,4-D application is approximately $1900 per infested acre, which includes the cost of the herbicide. Restricted Use Herbicides not recommended for use in Clear Lake.

Fluridone. Fluridone (Sonar® AS, Avast®) is a liquid product that is applied in the form of an aqueous suspension. Once the plant leaves and stems absorb the herbicide, fluridone interrupts the carotenoid biosynthetic pathway; carotenoid pigments are necessary for plants to photosynthesize. Susceptible plants die and decompose slowly, with >90% knockdown in year of treatment. If the treatment is effective, target plant regrowth usually does not occur for over 12 months. Low rates are selective for Eurasian water milfoil and hydrilla, with minimal injury to non-target species. Fluridone efficacy is best provided with whole lake treatments, or very large treatment blocks. Whole lake treatments have been successful in water bodies ranging from 32 acres to 60,000 acres (Getsinger et al. 2001).

Whole lake treatments are not compatible with other control techniques in year of treatment, but can be a prelude to integrated control methods in the years following fluridone application to keep Aquatic plants at low levels. Large block treatments of fluridone, approximately 125 to 500 acres, are an alternative to a whole lake treatment. In order to determine the rate of fluridone used in partial-lake block treatments, characterization of water exchange and dilution processes would have to be determined. Cost of fluridone applications would be in the neighborhood of $1235 per infested acre, which includes the cost of the herbicide. The scientific advisory committee, convened in 1994, for the CDFA Hydrilla Program recommended the use of fluridone in Clear Lake

Triclopyr.
Received its federal registration in December of 2002 and was immediately submitted to California EPA for state approval. Rennovate® 3 has been specifically developed for use in all wetland remediation projects and all aquatic habitat restoration initiatives. Rennovate®3A can be used to treat emerged, submerged or floating aquatic plants in aquatic sites such as, ponds, lakes, reserviors, no-irrigation canals and ditches that have little or no continuous flow. This includes applications to

broad leaf weeds and woody vegetation on banks, shore and terrestrial sites within or adjacent to aquatic sites. It is particularly effective on eurasian watermilfoil and can provide selective control of this problem plant. Active ingredient triclopyr. Triclopyr effects the plants growth cycle, prematurely aging of leaves and fall colors is a noticeable result. Similar to Garlon®3 for forestry applications.

ECOLOGICAL IMPACTS

In many instances, using herbicides to remove or reduce nuisance levels of invasive aquatic vegetation can have many positive impacts on lake ecosystems. However, using aquatic herbicides can result in some types of indirect ecological impacts on lakes, but any negative impacts are usually short term (i.e. DO sags). When aquatic herbicides are used for controlling aquatic plants in a broad-spectrum manner, desirable native submersed plants growing in the treated area can also be removed or injured. If all submersed plants are quickly removed from an area, indirect ecological effects can occur -- release of nutrients into the water column from quickly decaying vegetation (nutrients that would become available for phytoplankton and filamentous algae), removal of structure and food sources for aquatic organisms and wildlife, and potential to roil and disrupt the sediment.

Of the herbicides available and suitable for eurasian watermilfoil control on Clear Lake, diquat is the only product that would be used in a broad-spectrum fashion. However, diquat would typically be used to remove submersed vegetation and open small blocks of the lake, such as swimming areas, around docks, cutting boat access trails, and selected shoreline areas. When used in this way, large areas of undisturbed vegetation would surround the treated areas that would help prevent any sediment resuspension, act as a sink for any nutrients released into the water column, and provide adequate habitat to mitigate any reductions of such occurring in the treated areas. Since diquat is a contact herbicide, control of vegetation achieved in treated areas is temporary, as “burned-down” plants recover and resprout from unaffected rhizomes and rootcrowns.

The other products available for aquatic plant control would not be used in a broad-spectrum manner on Clear Lake. As noted above, 2,4-D is inherently selective for rapidly growing dicots (broad-leaved plants) and would not injure the native submersed plants, which are primarily monocots (tules and grasses), growing in treated areas. 2,4-D is a restricted use herbicide and could functionally be replaced with triclopyr with is a non-restricted material. If applied at high rates both endothal and fluridone can be used as broad spectrum herbicides; however, the application rates of these products used on Clear Lake could be low enough to provide selective control of aquatic plants, with little to no injury of associated native submersed plants and emergent tules.

CULTURAL CONTROL METHODS

MANIPULATING PLANT COMMUNITIES

The aesthetics, fish and wildlife habitat values of lakes and reservoirs can sometimes be greatly enhanced by establishing and managing certain desirable aquatic plants. Many lakes have little vegetation, undesirable species, or plants growing in the wrong places. Manipulating habitat (e.g., substrate type, lake slope), selectively removing undesirable plants or plants that occur in undesired locations and planting desired plants in desirable locations are all ways of managing aquatic plants to improve the quality of a lake or reservoir.

Where it is legal, excavation can deepen aquatic environments to exclude plants from areas where they are not desired and the substrate can be used to form shallows for planting desired aquatic plants. When manipulating habitat like this it extremely important to determine the low, average and high water line of the lake. While some wetland plants will tolerate dry and wet seasons, there are many that will die if they are kept too wet or too dry. Individual plant species also require different water depth to be successful. Thus, when creating habitat for aquatic plants it is important to create habitat of the proper depth for the desired plant species.

Some aquatic management techniques that control plants can also promote desirable species and improve habitat. The physical removal of problem aquatic plants like mechanical harvesting of water milfoil can sometimes stimulate wild celery by removing the shading canopy of watermilfoil. The herbicide 2,4-D can sometimes shift plant community composition from watermilfoil and Coontail to beneficial pondweeds and wild celery (Nichols 1986). Screens and harvesters can channelize plant beds to produce island habitats, increase edge, and form cruising lanes for boaters and gamefish. Aluminum sulfate (alum) can reduce algae and thus improve water clarity for larger plants to grow. These are only a few of the many methods available to promote desirable aquatic plant growth in lakes and reservoirs. This is also a concept that should be part of any aquatic plant management plan.

Before attempting to revegetate it is best to list the types and species of aquatic plants that can grow in a particular lake.

SELECTED USE AREAS

Control of people rather than plants may be an effective method to reduce the area actively managed for nuisance aquatic vegetation. The primary action would be to set aside areas where no treatment method will take place. This could have at last two favorable results. Identifies natural areas will be less disturbed by human visitation due to limited access caused by potentially dense aquatic vegetation. Secondly, cumulative impacts from management activities in other areas will be minimized. Infestations of these natural areas by invasive exotic species may require some intervention to limit habitat destruction.

NO-ACTION ALTERNATIVE

Along with control alternatives to be investigated, the "no action" alternative should also be considered. There are several situations in which taking no action is appropriate. Consensus on control strategy may be unattainable or simply taking no action may be more favorable than using control options. No action might be the choice while waiting for new, more effective or environmentally friendly strategies to be developed.

If taking no action is considered, it is important to think about the eventual consequences to the target water body and perhaps surrounding water bodies, particularly in the case of a non-native invasive weed such as Brazilian elodea and Eurasian milfoil. The effects of dense weeds on water quality, fish and wildlife habitat, aquatic organisms, and recreation and tourism are all concerns to be addressed when considering the no action alternative. In order to maintain a perspective, the consequences of taking no action should be weighed against the costs and benefits of various plant control options.

The residents of Lake County and visitors to the area are very unhappy about the excessive aquatic plants and its impacts to recreation in the lake, and, currently, they are looking for an effective control.

Considering the fact that there are no large-scale control options without associated risks, the no-action alternative has appeal. Though the negative impacts of native and exotic plant encroachments throughout the littoral zone of Clear Lake are substantial, some of these impacts, such as swimming safety, can be addressed better through chemical control.

Because of the complexities involving the tourism, the local economy and safety in Clear Lake Creek, taking no-action on the aquatic weeds is not felt to be appropriate.

PREVENTATIVE TECHNIQUES

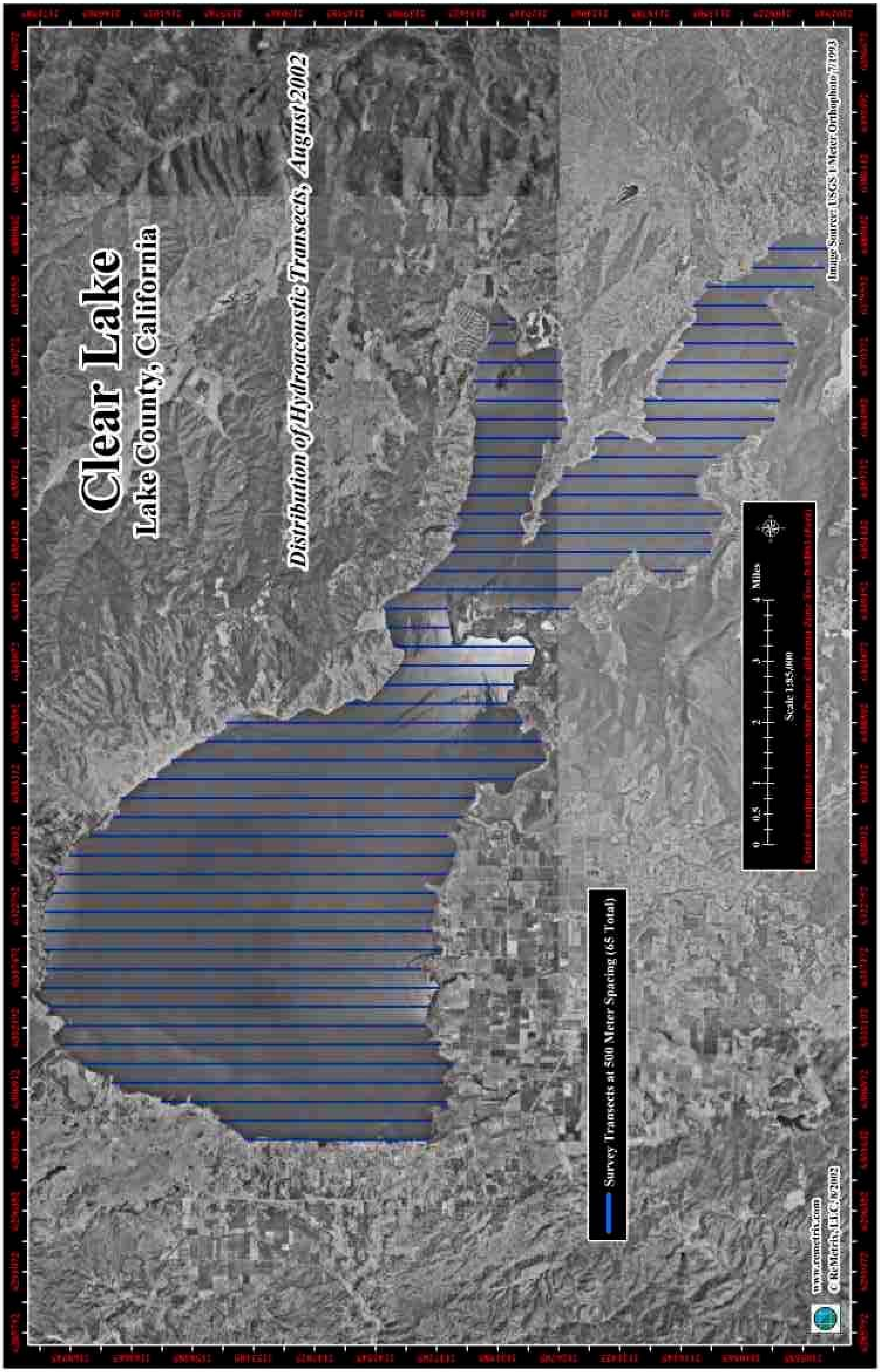
A prevention program that educates the public about noxious aquatic weeds is a valuable and important part of aquatic management planning and is highly recommended for the Clear Lake Plan. Weed control is not weed prevention. Education is a great prevention tool. This can be accomplished in the form of continued newsletters, flyers, and newspaper articles. More neighborhood workshops for training in the recognition of troublesome aquatic plants can help citizens with the early detection of different noxious weeds. Monitoring the areas that have used specific control methods such as hand-pulling and bottom barriers will add knowledge for future planning.

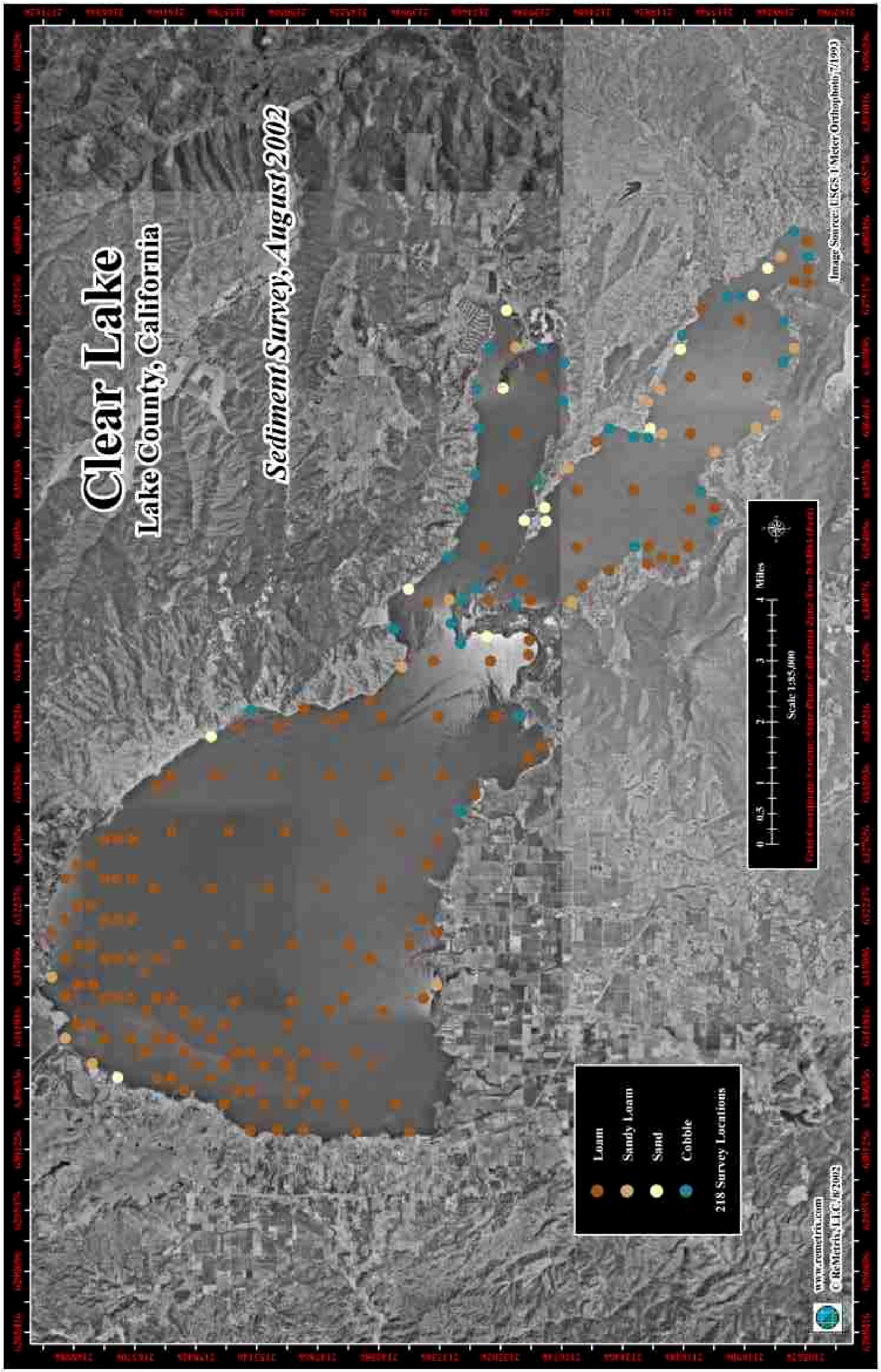
Public awareness of the problem can make a difference in the spread of exotic plants. Signs are being posted at the boat ramp and nearby lakes describing the invasive plant problem and the need to keep boats, trailers, and fishing gear free of plant fragments. Occasional weekend volunteers checking boat motors and trailers for noxious weeds at the boat ramp would reinforce this message. Boat washing stations have been used successfully at some lakes.

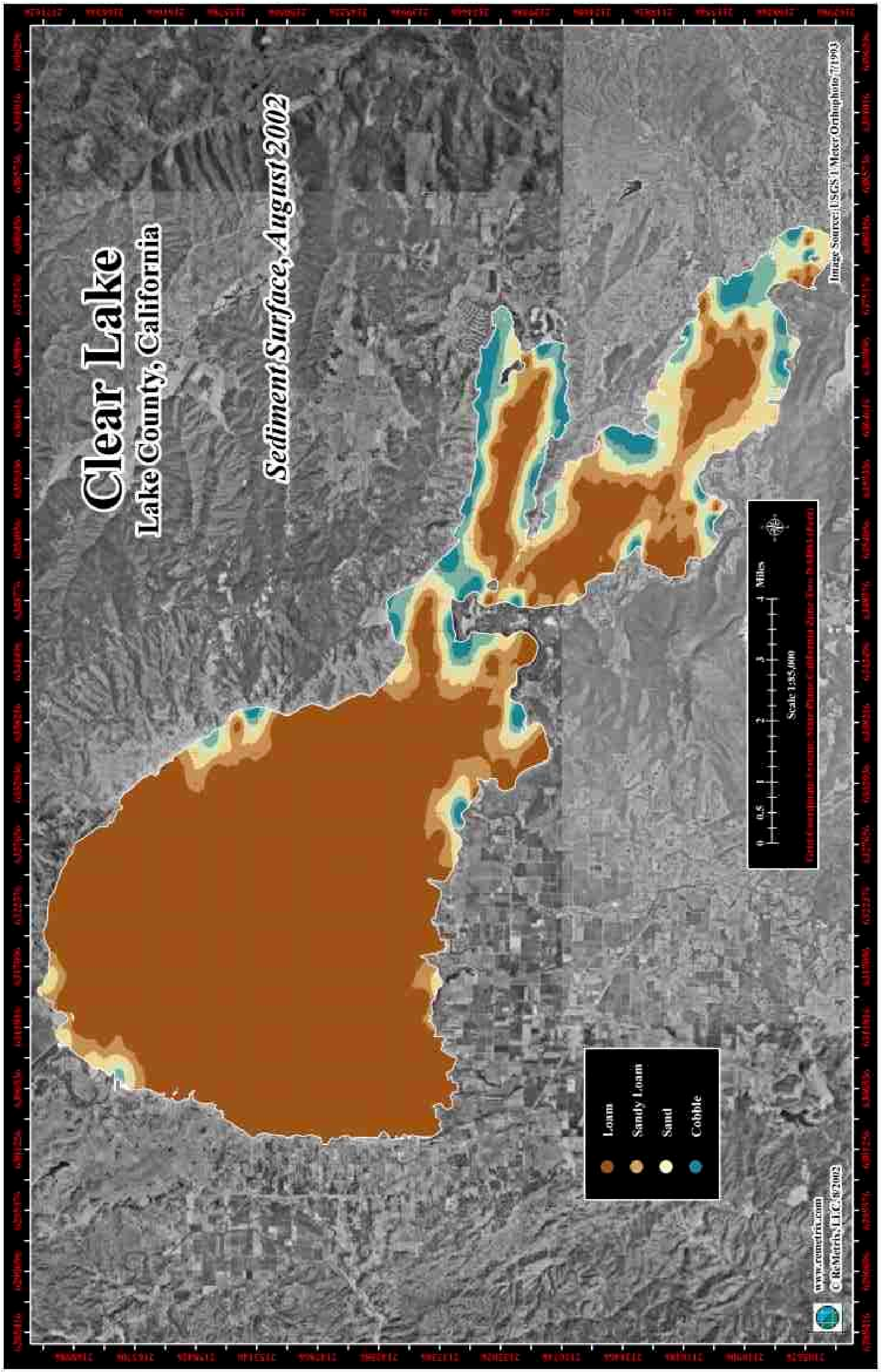
Appendix E

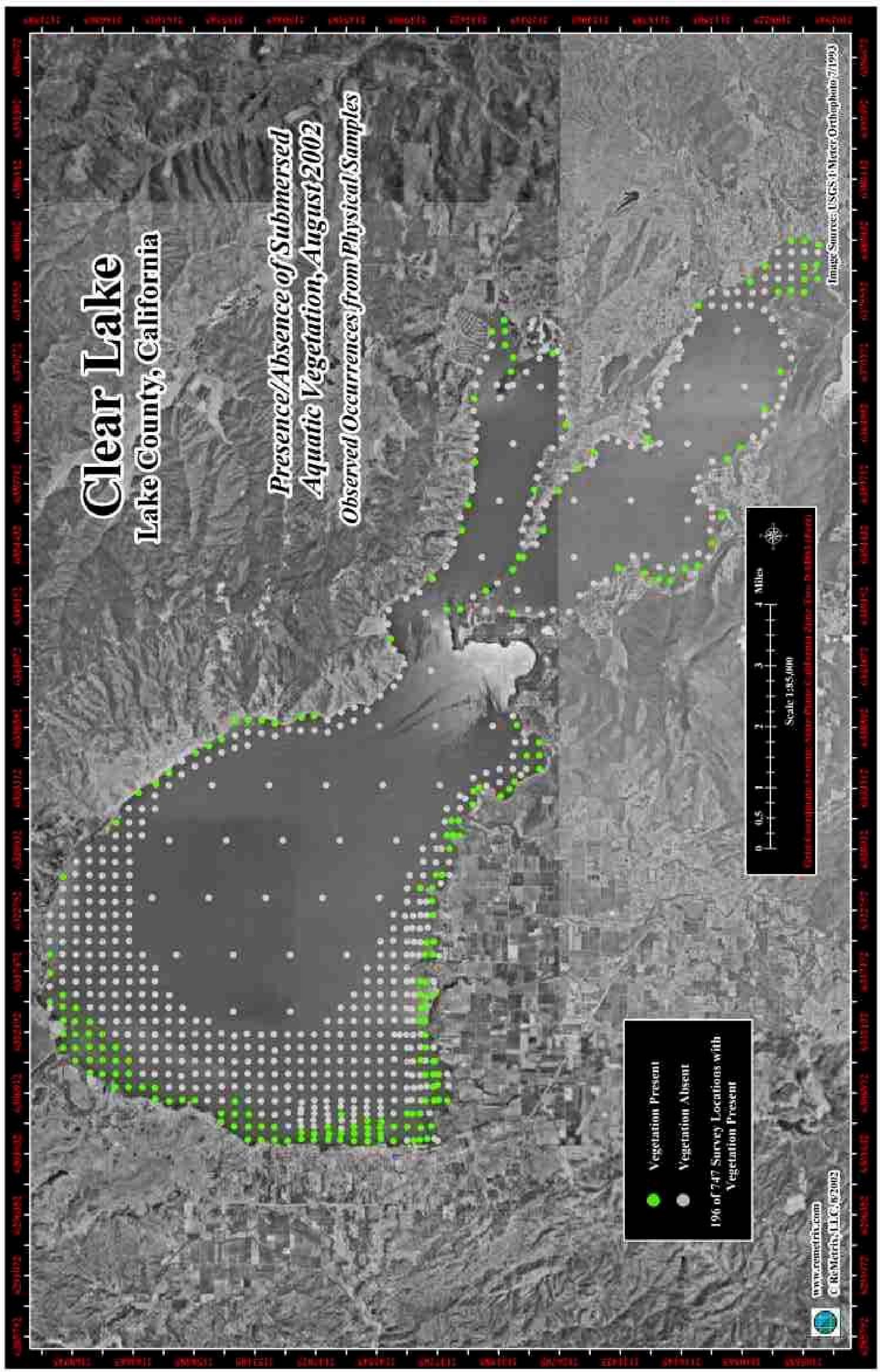
Maps

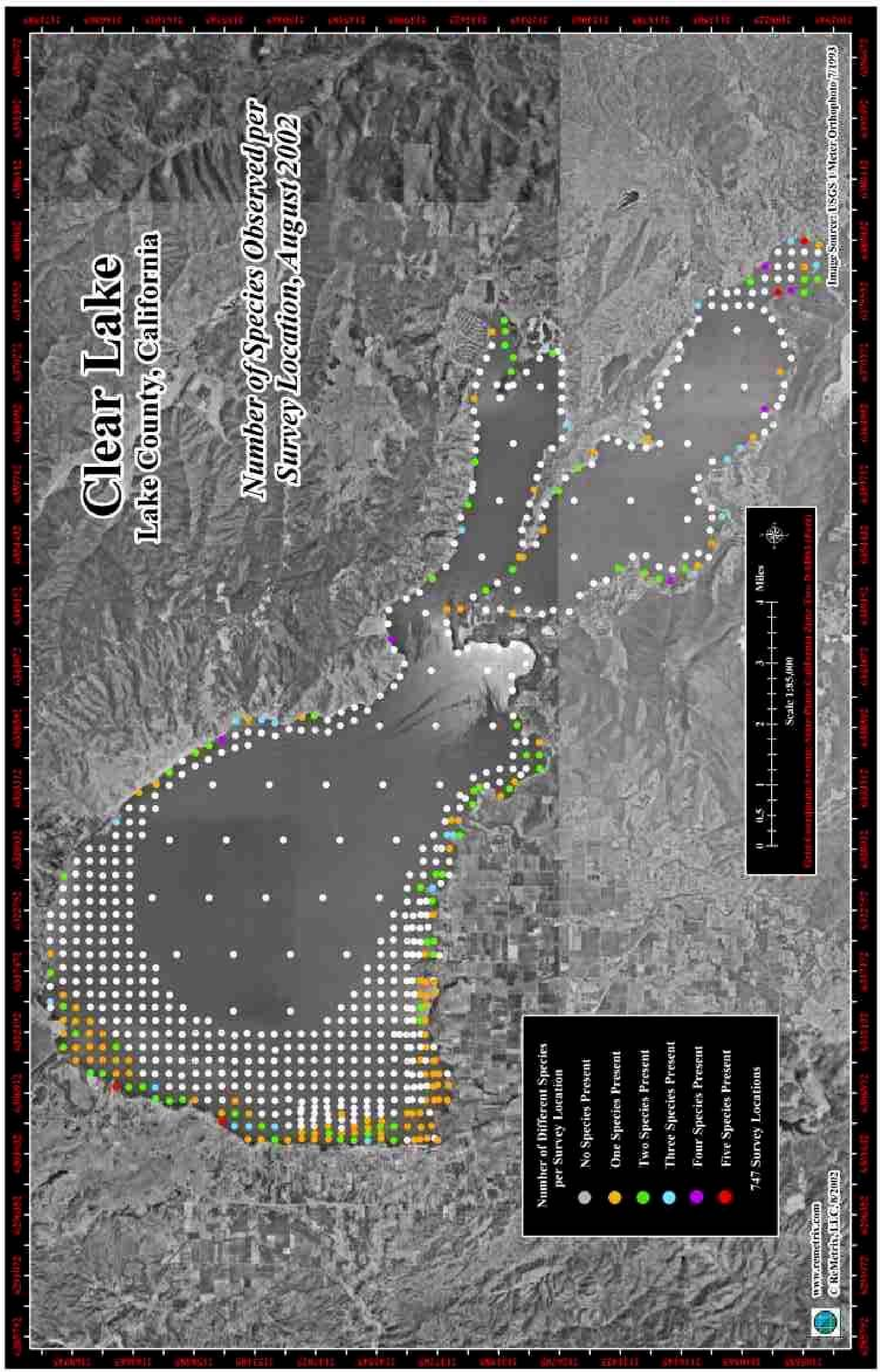

Clear Lake
Lake County, California
Satellite Image of Clear Lake Basin
October 30, 2002
Near-Infrared (False Color)
Scale 1:85,000
Miles
www.remetrix.com


Clear Lake
Lake County, California
Distribution of Hydroacoustic Transects, August 2002
Survey Transects at 500 Meter Spacing (65 Total)
Scale 1:85,000
Miles
Image Source: USGS 1-Meter Orthophoto 7/1993
www.remetrix.com
© ReMetrix, LLC, 8/2002

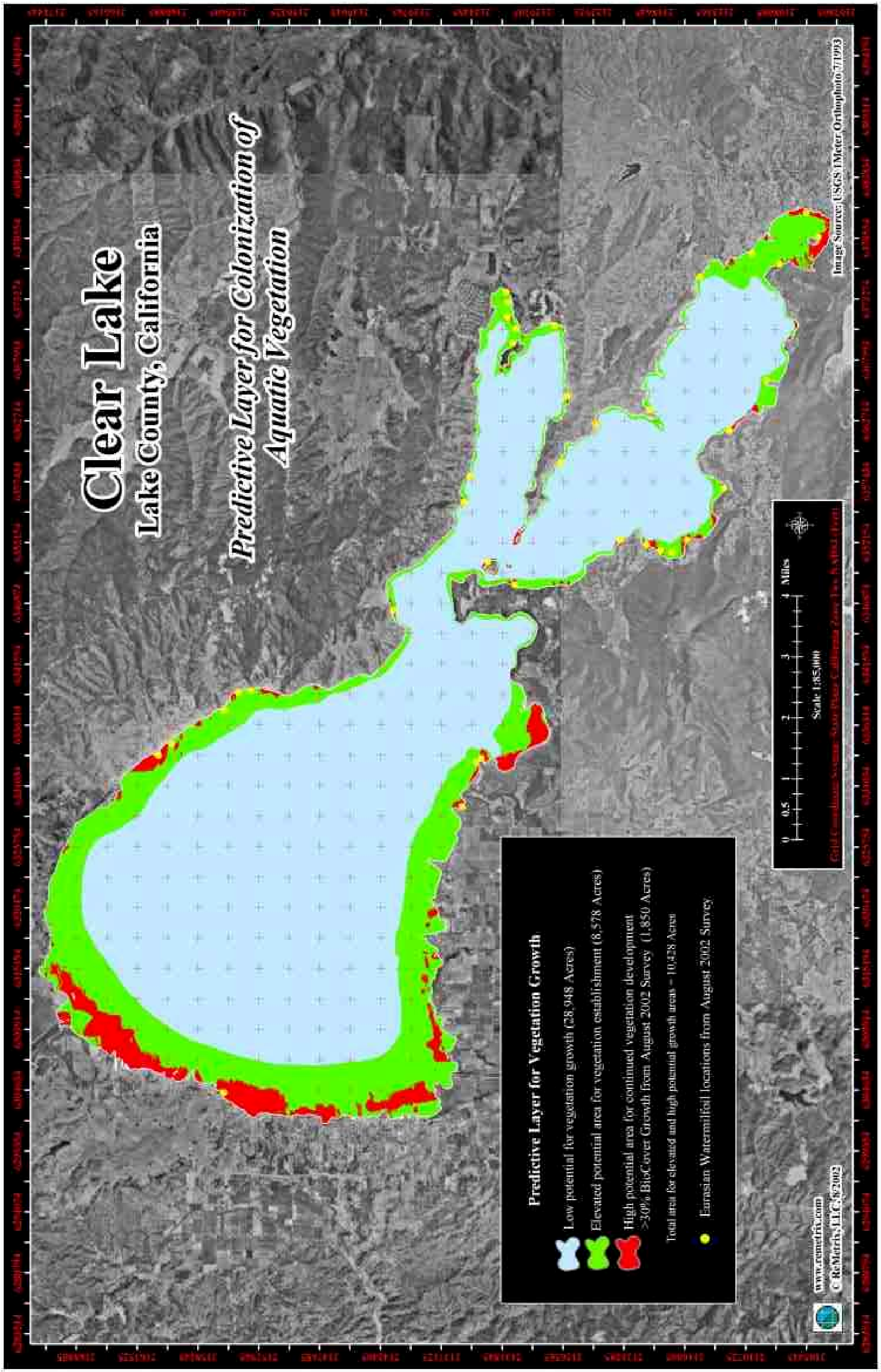

Clear Lake
Lake County, California
Sediment Survey, August 2002
Loam
Sandy Loam
Sand
Cobble
218 Survey Locations
Miles
Image Source: USGS 1 Meter Orthophoto 7/1993

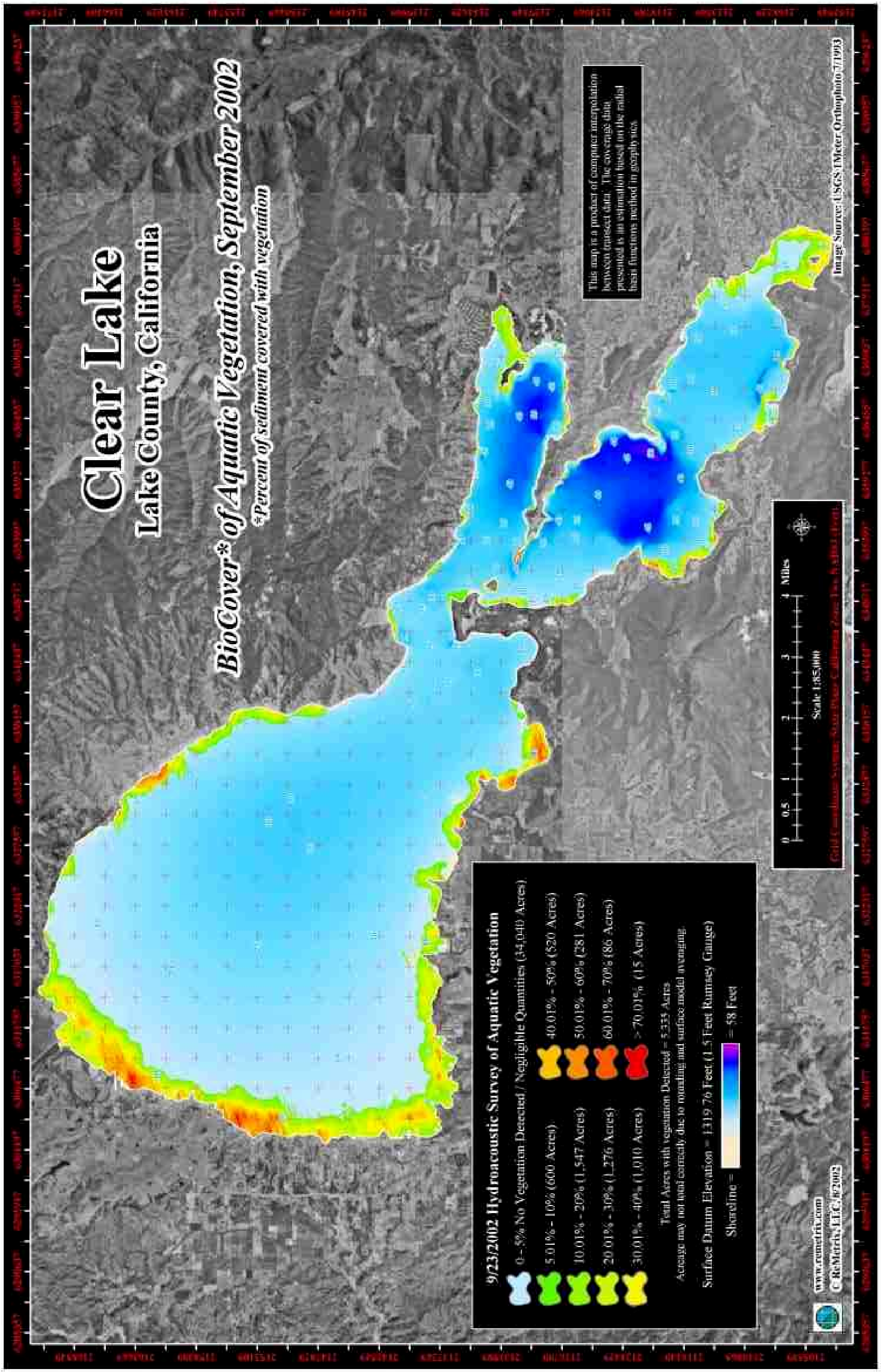

Clear Lake
Lake County, California
Sediment Surface, August 2002
Loam
Sandy Loam
Sand
Cobble
Scale 1:85,000
Miles
Image Source: USGS 1 Meter Orthophoto 7/1993
www.remetrix.com

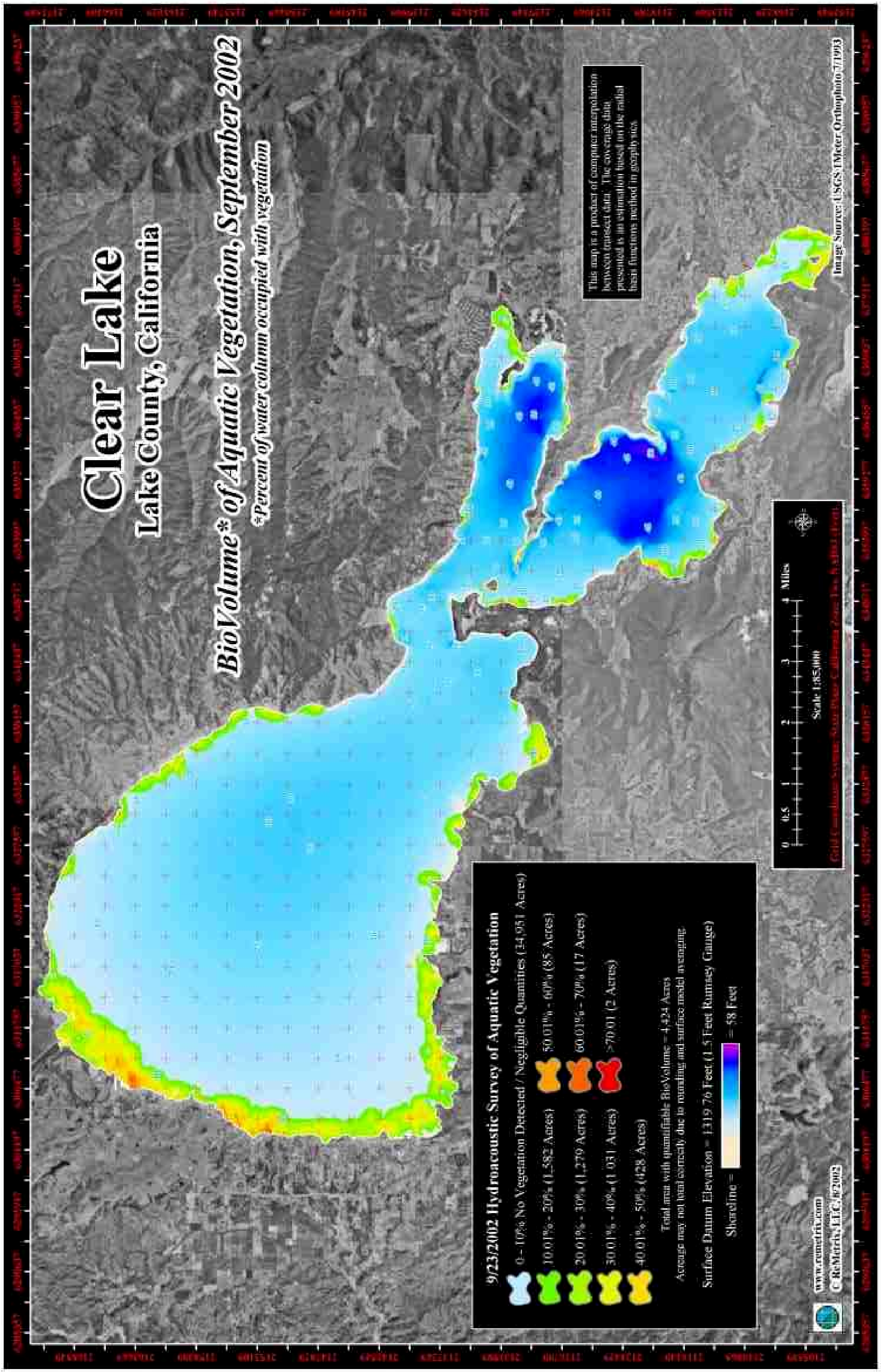

Clear Lake
Lake County, California
Presence/Absence of Submersed
Aquatic Vegetation, August 2002
Observed Occurrences from Physical Samples
Vegetation Present
Vegetation Absent
196 of 747 Survey Locations with
Vegetation Present
Miles
Image Source: USGS 1 Meter Orthophoto 7/1993

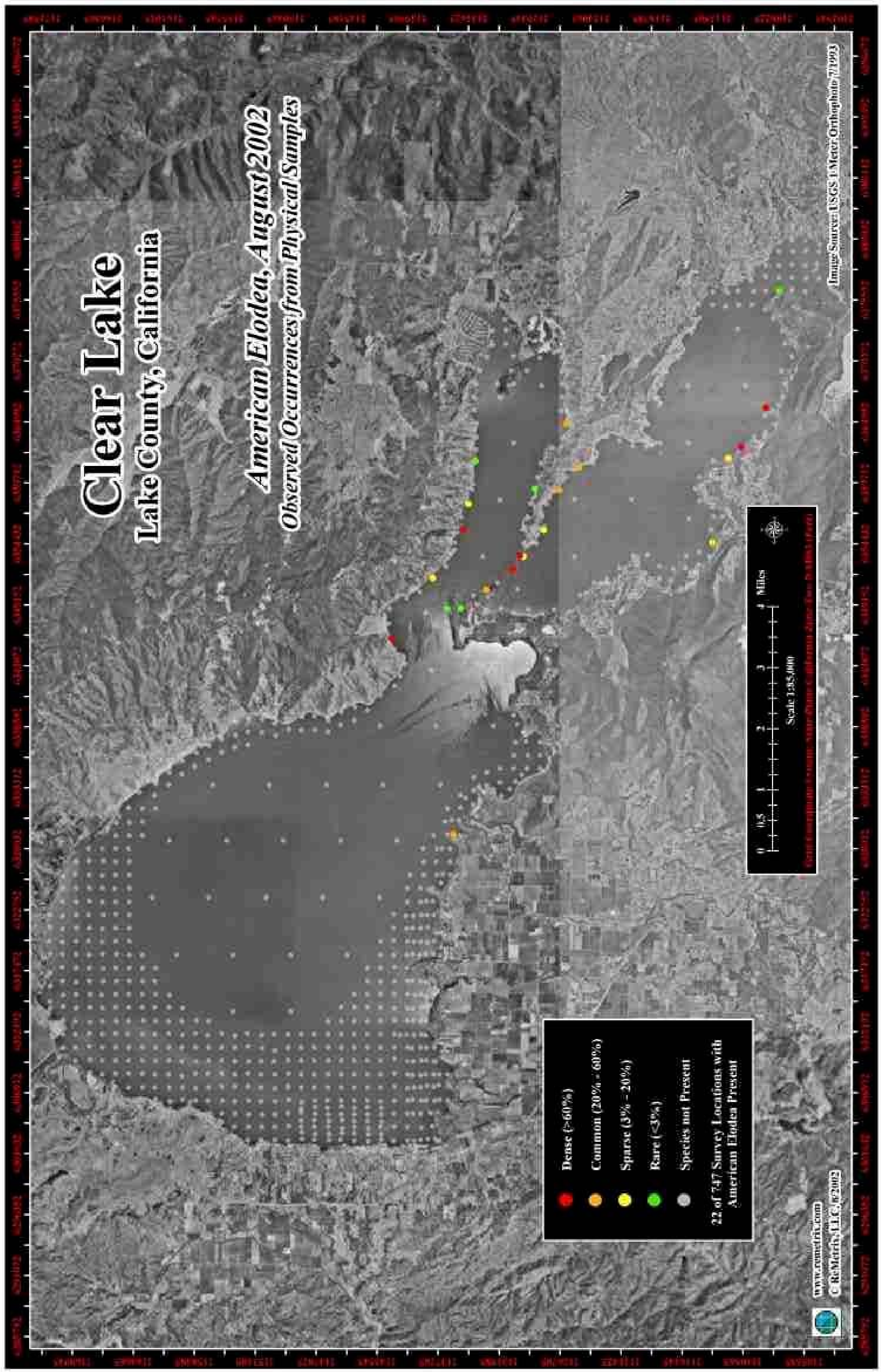


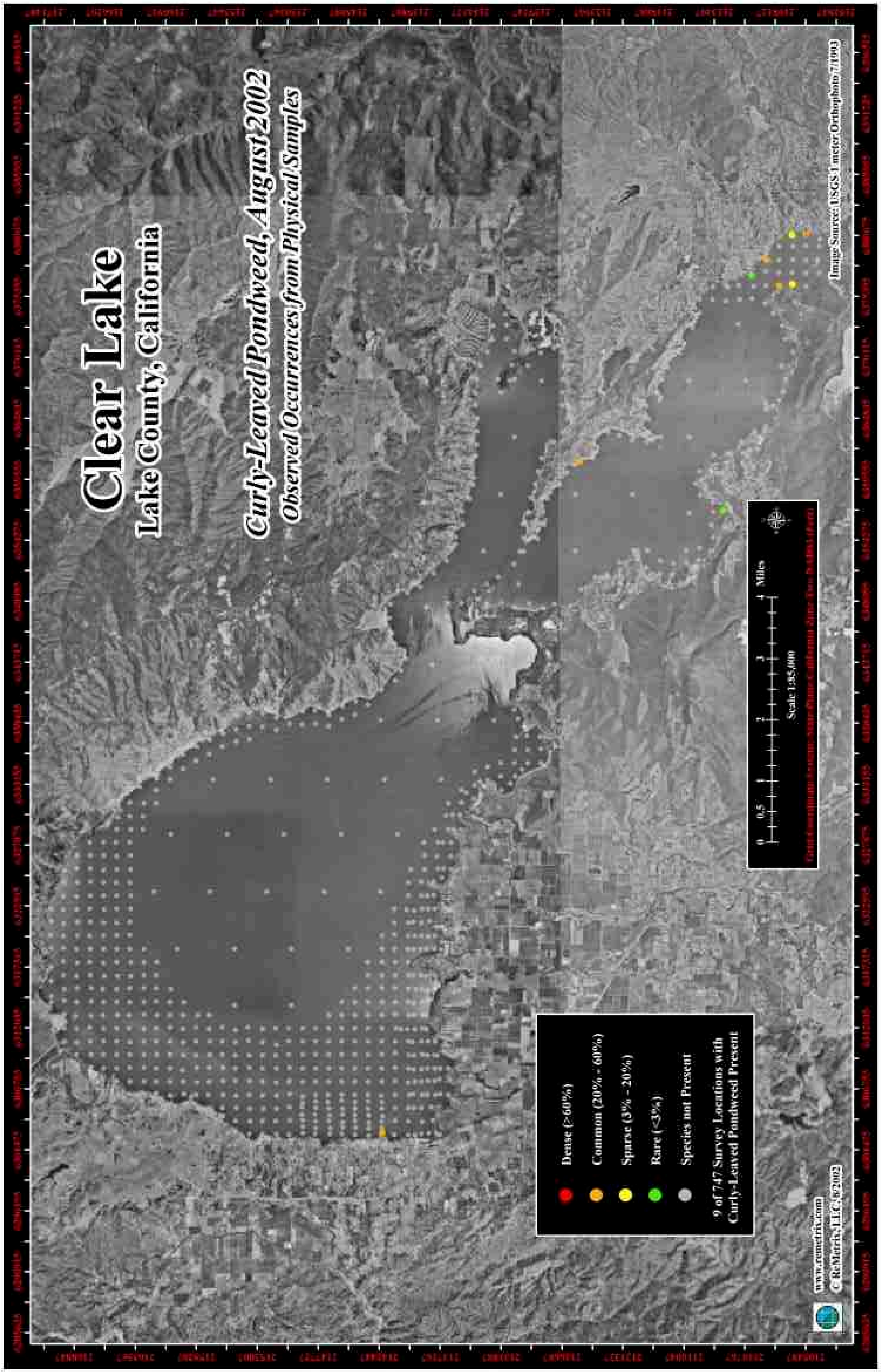
Clear Lake
Lake County, California
Number of Species Observed per Survey Location, August 2002
Number of Different Species per Survey Location
No Species Present
One Species Present
Two Species Present
Three Species Present
Four Species Present
Five Species Present
747 Survey Locations
0 0.5 1 2 3 4 Miles
Scale 1:85,000
Image Source: USGS 1-Meter Orthophoto 7/1993
www.remetrix.com
© ReMetrix, LLC, ©2002

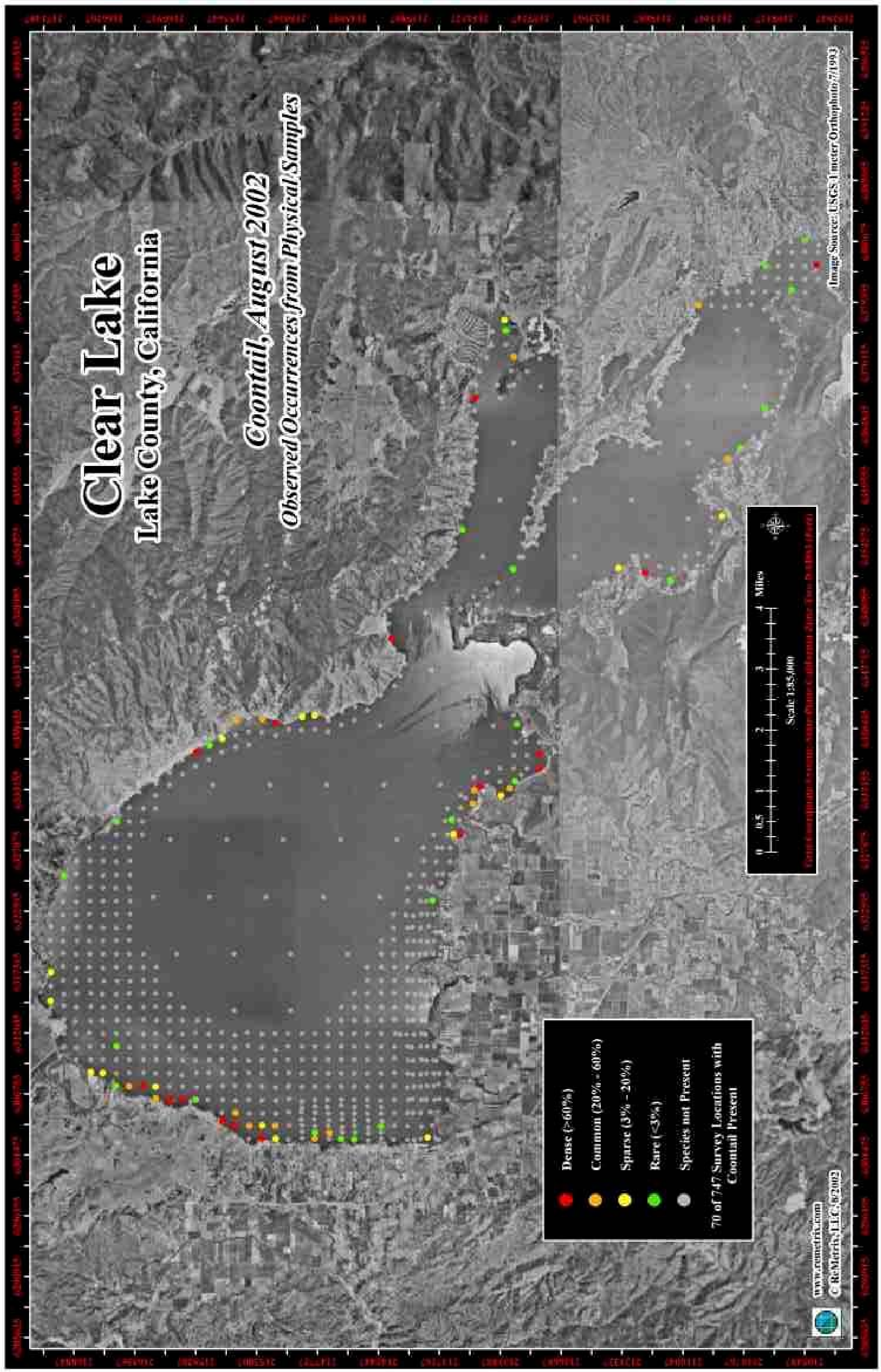

Clear Lake
Lake County, California
Predictive Layer for Colonization of Aquatic Vegetation
Predictive Layer for Vegetation Growth
Low potential for vegetation growth (28,948 Acres)
Elevated potential area for vegetation establishment (8,578 Acres)
High potential area for continued vegetation development
>30% BioCover Growth from August 2002 Survey (1,850 Acres)
Total area for elevated and high potential growth areas = 10,428 Acres
Eurasian Watermilfoil locations from August 2002 Survey
0 0.5 1 2 3 4 Miles
Scale 1:85,000
Image Source: USGS 1Meter Orthophoto 7/1993
www.remetrix.com
© ReMetrix, LLC 2002


Clear Lake
Lake County, California
BioCover* of Aquatic Vegetation, September 2002
*Percent of sediment covered with vegetation

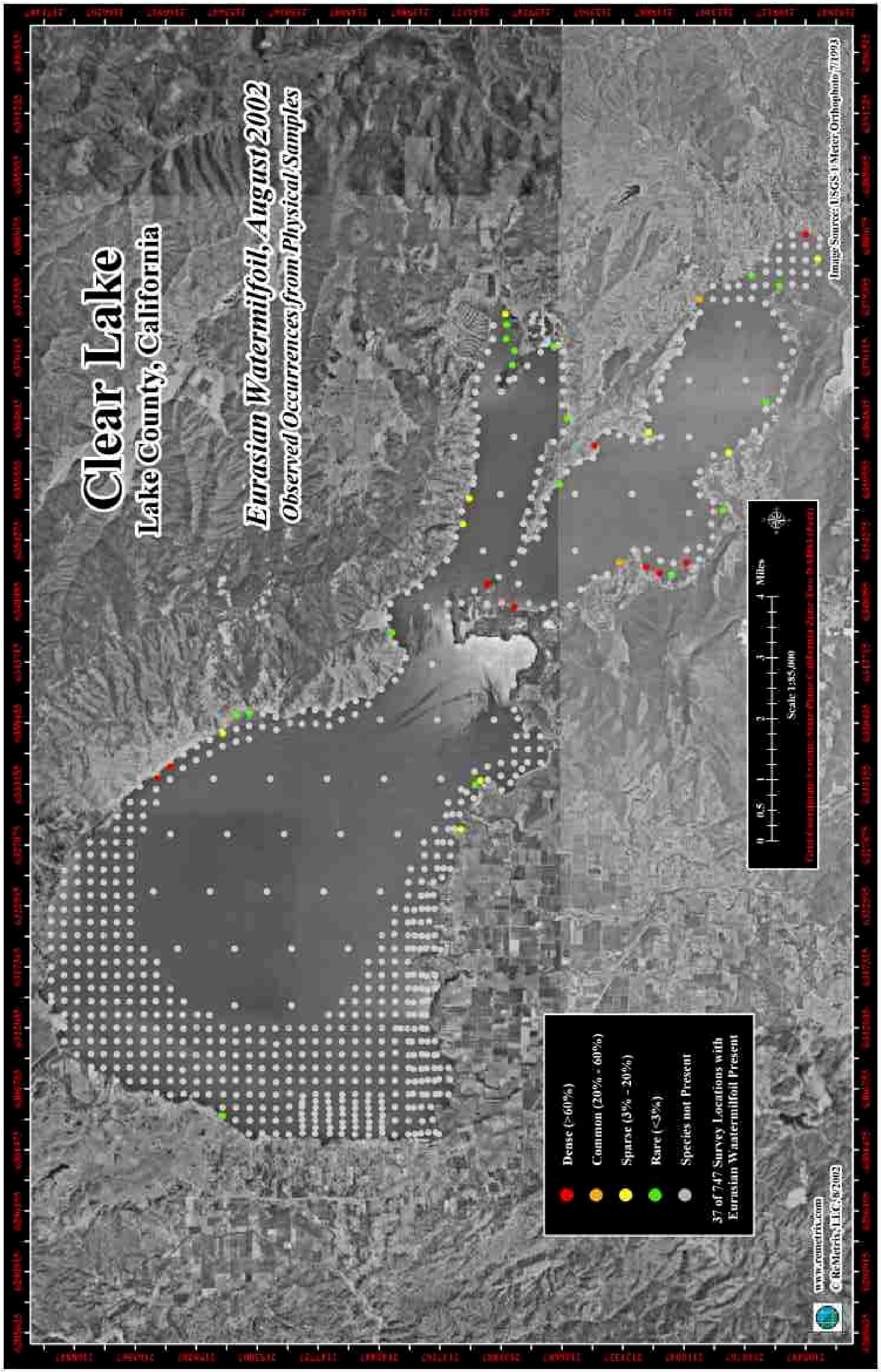

Clear Lake
Lake County, California
BioVolume* of Aquatic Vegetation, September 2002
*Percent of water column occupied with vegetation
9/23/2002 Hydroacoustic Survey of Aquatic Vegetation
0 - 10% No Vegetation Detected / Negligible Quantities (14,951 Acres)
10.01% - 20% (1,582 Acres)
20.01% - 30% (1,279 Acres)
30.01% - 40% (1,031 Acres)
40.01% - 50% (428 Acres)
50.01% - 60% (85 Acres)
60.01% - 70% (17 Acres)
>70.01 (2 Acres)
Total area with quantifiable BioVolume = 4,424 Acres
Acreage may not total correctly due to rounding and surface model averaging
Surface Datum Elevation = 1319.76 Feet (1.5 Feet Rumsey Gauge)
Shoreline =
= 58 Feet
0 0.5 1 2 3 4 Miles
Scale 1:85,000
Image Source: USGS 1Meter Orthophoto 7/1993
www.remetrix.com
© ReMetrix, LLC 9/2002

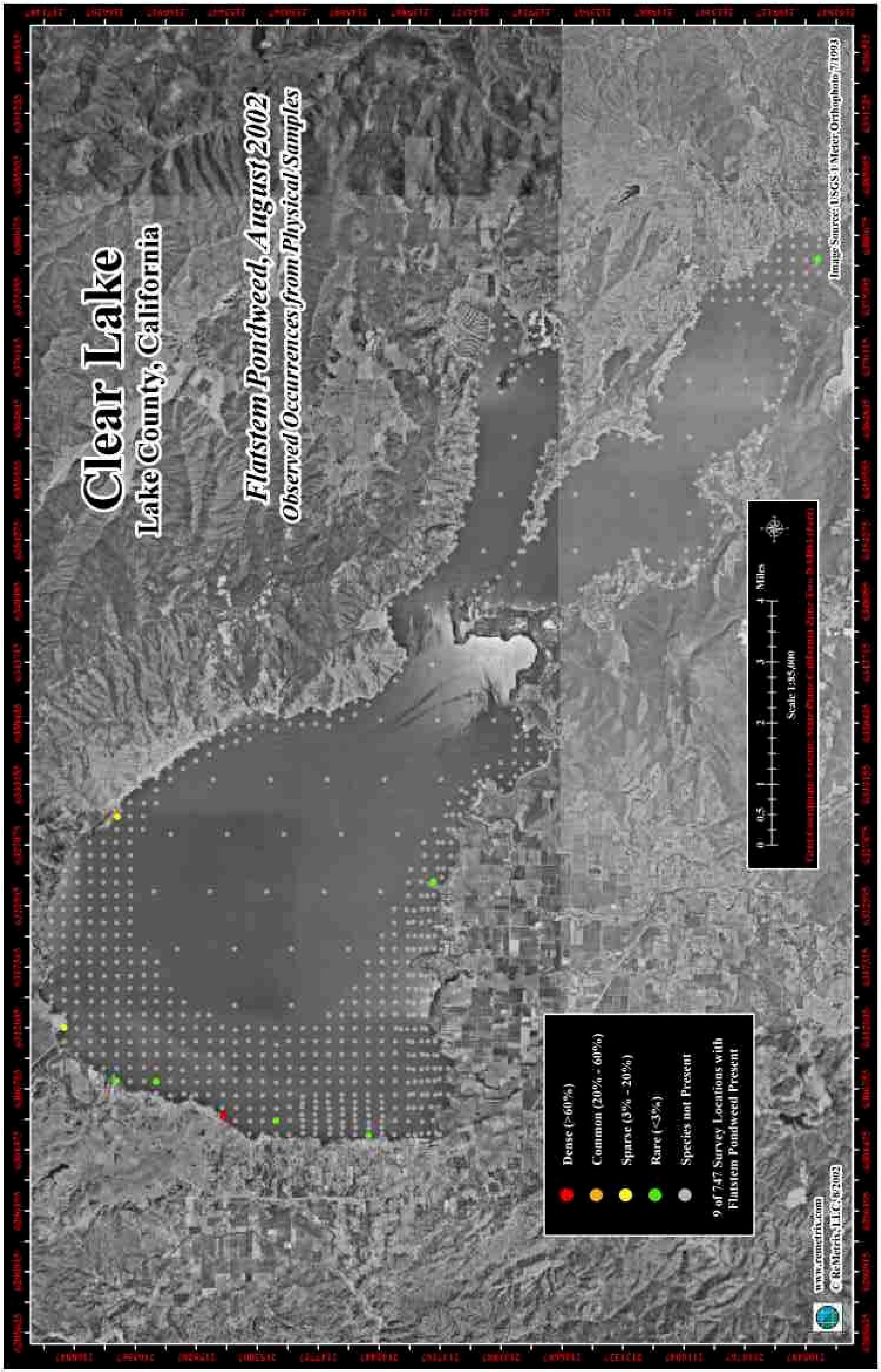

Clear Lake
Lake County, California
American Elodea, August 2002
Observed Occurrences from Physical Samples
Dense (>60%)
Common (20% - 60%)
Sparse (3% - 20%)
Rare (<3%)
Species not Present
22 of 747 Survey Locations with American Elodea Present
Miles
Scale 1:85,000
Image Source: USGS 1-Meter Orthophoto 7/1993
www.remetrix.com
© ReMetrix, LLC, ©2002

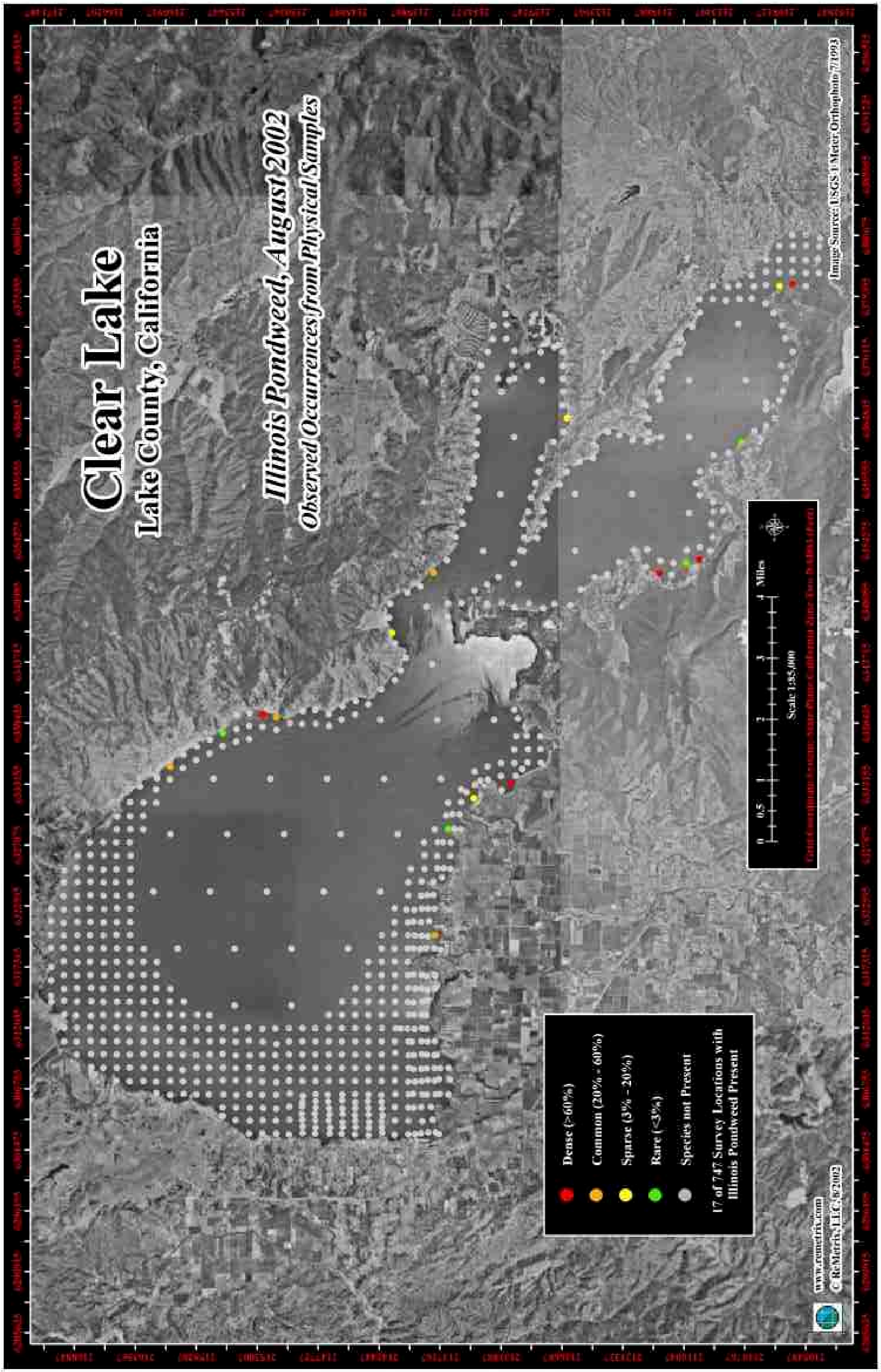

Clear Lake
Lake County, California
Curly-Leaved Pondweed, August 2002
Observed Occurrences from Physical Samples
Dense (>60%)
Common (20% - 60%)
Sparse (3% - 20%)
Rare (<3%)
Species not Present
9 of 747 Survey Locations with Curly-Leaved Pondweed Present
0 0.5 1 2 3 4 Miles
Scale 1:85,000
Image Source: USGS 1 meter Orthophoto 7/1993
www.remetrix.com
© ReMetrix, LLC 2002

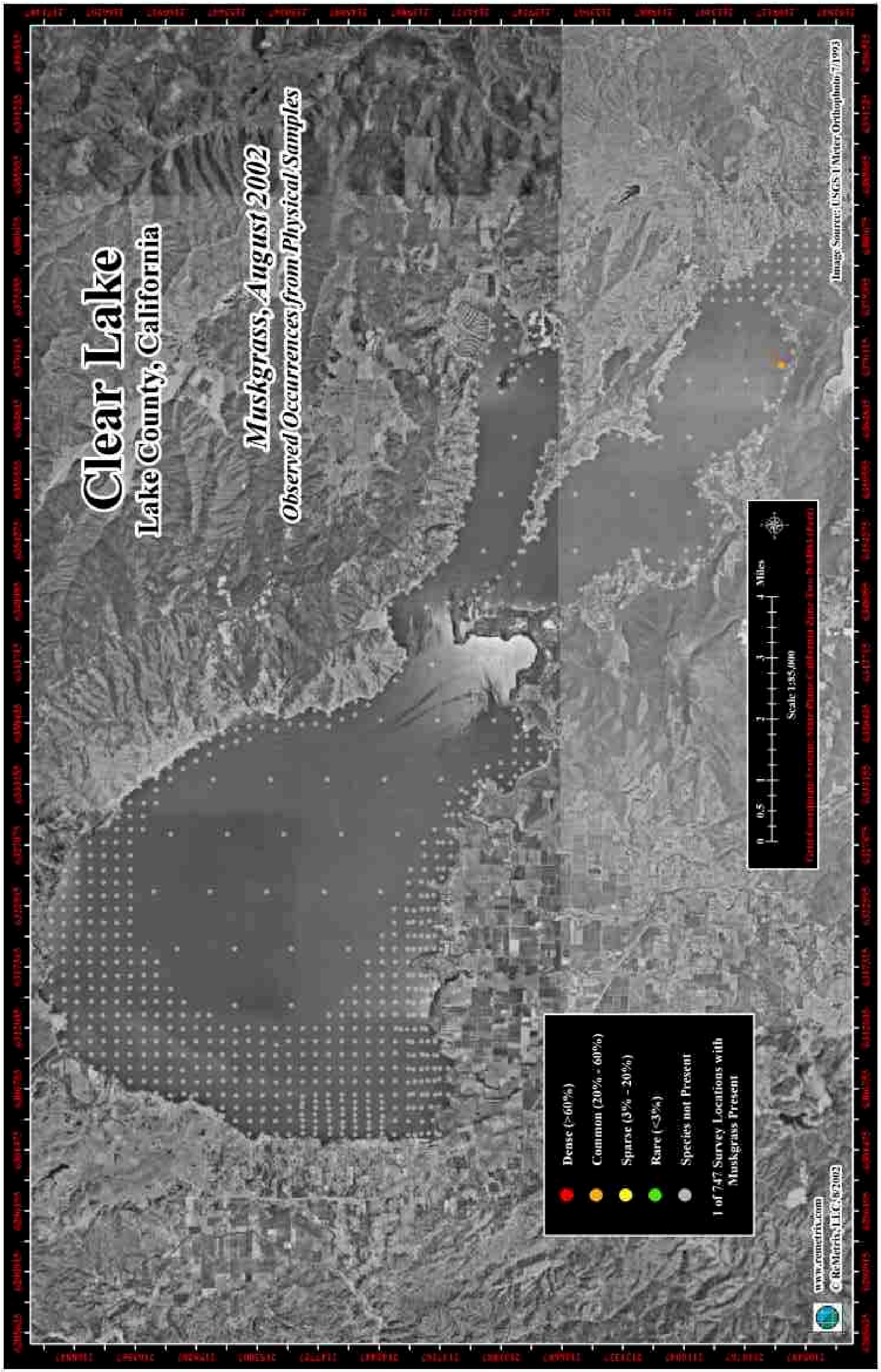


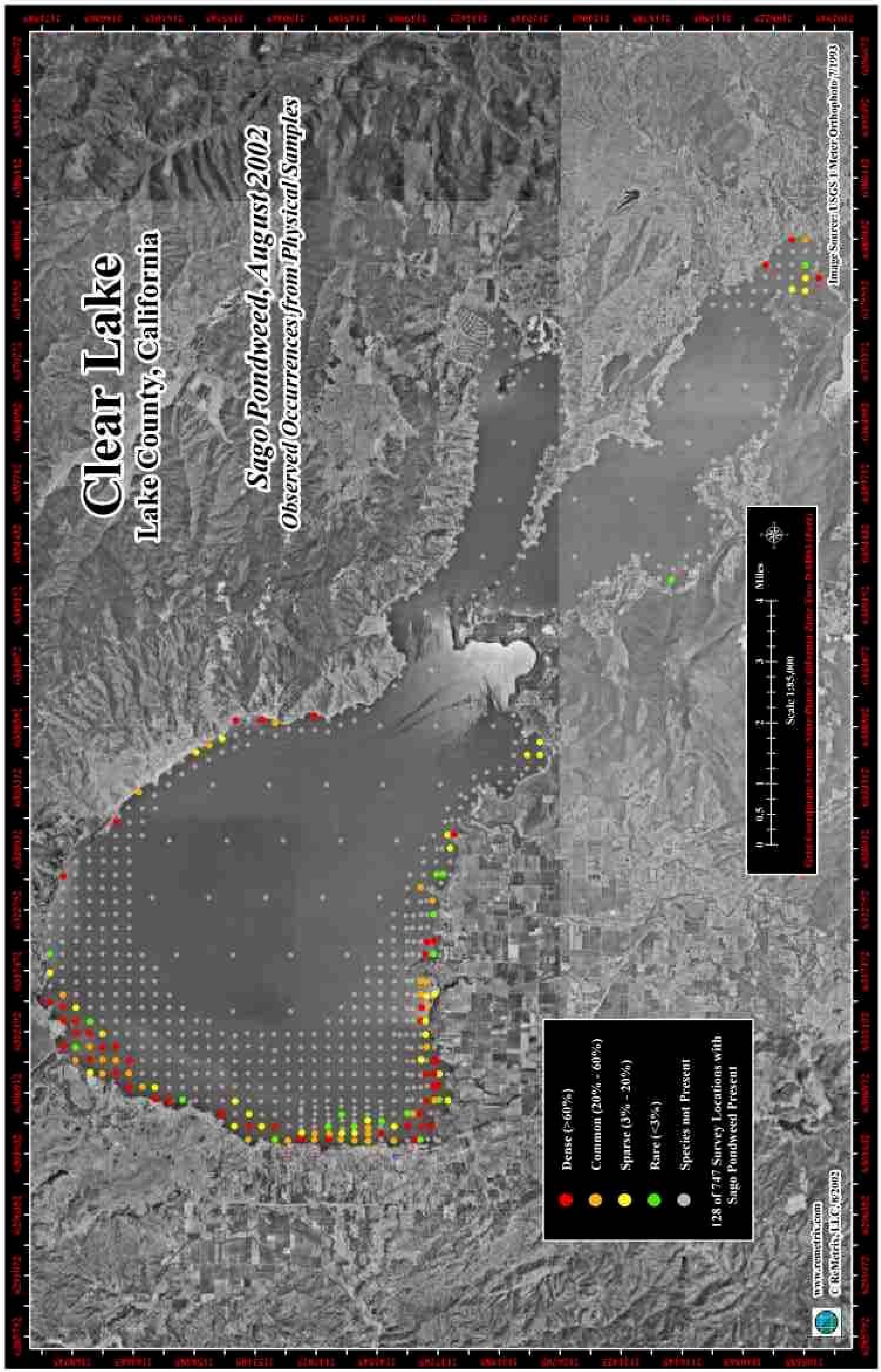
Clear Lake
Lake County, California
Coontail, August 2002
Observed Occurrences from Physical Samples
Dense (>60%)
Common (20% - 60%)
Sparse (3% - 20%)
Rare (<3%)
Species not Present
70 of 747 Survey Locations with Coontail Present
Scale 1:85,000
Miles
Image Source: USGS 1 meter Orthophoto 7/1993
www.remetrix.com
© ReMetrix LLC 6/2002

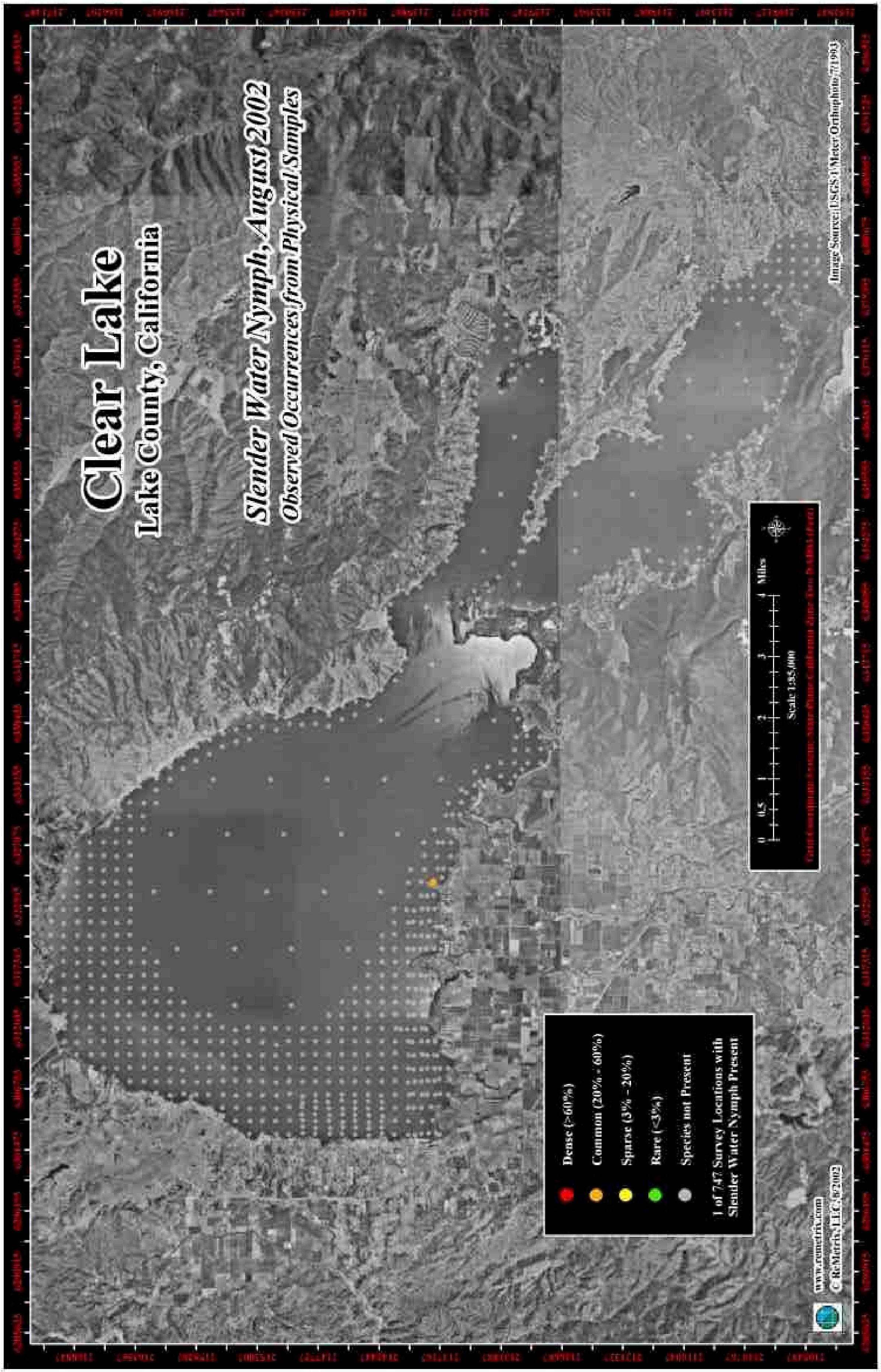

Clear Lake
Lake County, California
Eurasian Watermilfoil, August 2002
Observed Occurrences from Physical Samples
Dense (>60%)
Common (20% - 60%)
Sparse (3% - 20%)
Rare (<3%)
Species not Present
37 of 747 Survey Locations with Eurasian Watermilfoil Present
Scale 1:85,000
Miles
Image Source: USGS 1 Meter Orthophoto 7/1993

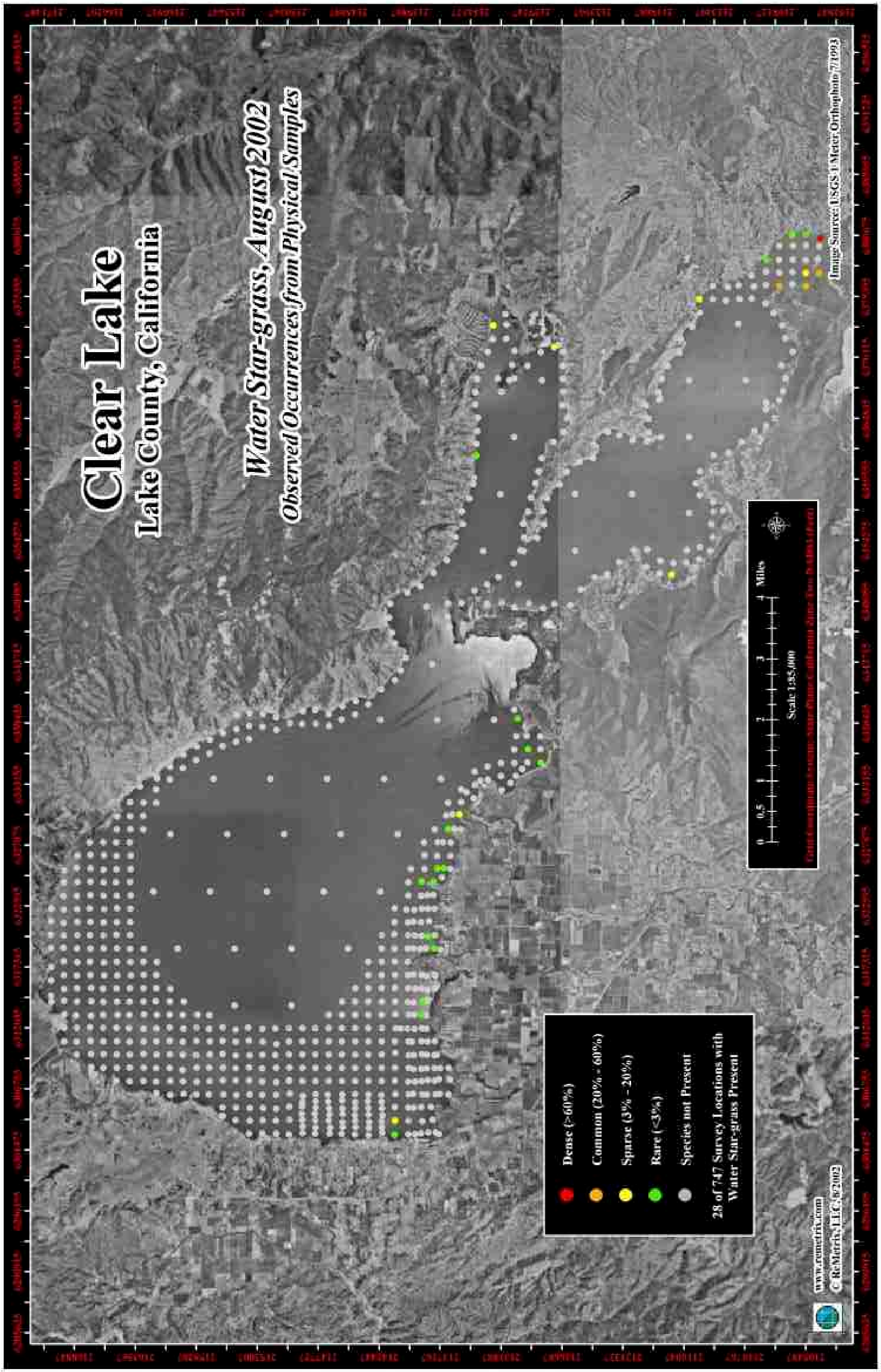

Clear Lake
Lake County, California
Flatstem Pondweed, August 2002
Observed Occurrences from Physical Samples
Dense (>60%)
Common (20% - 60%)
Sparse (3% - 20%)
Rare (<3%)
Species not Present
9 of 747 Survey Locations with Flatstem Pondweed Present
Scale 1:85,000
Miles
Image Source: USGS 1 Meter Orthophoto 7/1993
www.remetrix.com
© ReMetrix, LLC 6/2002

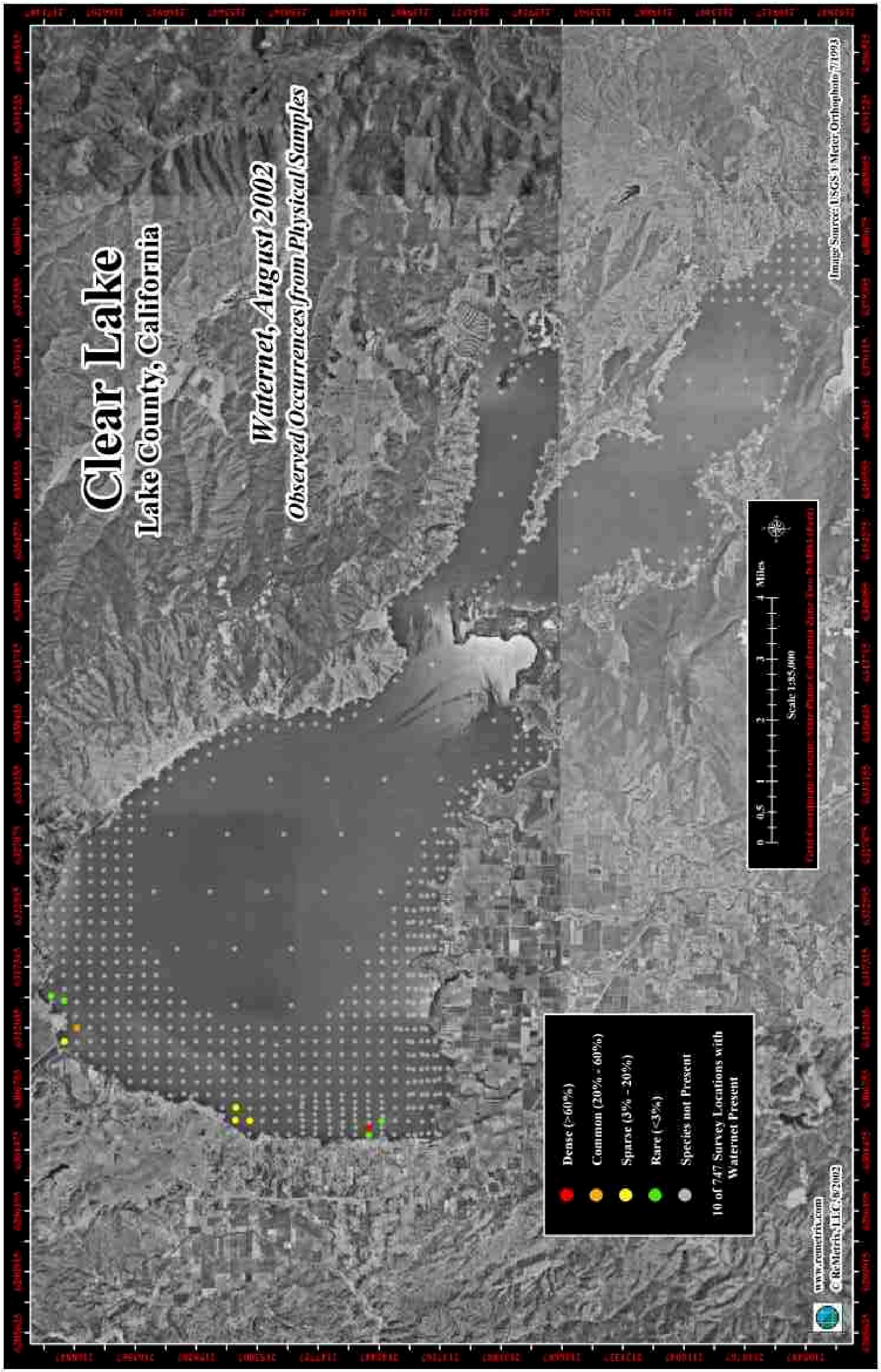

Clear Lake
Lake County, California
Illinois Pondweed, August 2002
Observed Occurrences from Physical Samples
Dense (>60%)
Common (20% - 60%)
Sparse (3% - 20%)
Rare (<3%)
Species not Present
17 of 747 Survey Locations with Illinois Pondweed Present
Scale 1:85,000
Miles
Image Source: USGS 1 Meter Orthophoto 7/1993
www.remetrix.com
© ReMetrix, LLC 8/2002


Clear Lake
Lake County, California
Muskgrass, August 2002
Observed Occurrences from Physical Samples
Dense (>60%)
Common (20% - 60%)
Sparse (3% - 20%)
Rare (<3%)
Species not Present
1 of 747 Survey Locations with Muskgrass Present
Scale 1:85,000
Miles
Image Source: USGS 1 Meter Orthophoto 7/1993
www.remetrix.com
© ReMetrix, LLC 6/2002


Clear Lake
Lake County, California
Sago Pondweed, August 2002
Observed Occurrences from Physical Samples
Dense (>60%)
Common (20% - 60%)
Sparse (3% - 20%)
Rare (<3%)
Species not Present
128 of 747 Survey Locations with Sago Pondweed Present
Scale 1:85,000
Miles
Image Source: USGS 1-Meter Orthophoto 7/1993
www.remetrix.com
© ReMetrix, LLC, ©2002


Clear Lake
Lake County, California
Slender Water Nymph, August 2002
Observed Occurrences from Physical Samples
Dense (>60%)
Common (20% - 60%)
Sparse (3% - 20%)
Rare (<3%)
Species not Present
1 of 747 Survey Locations with Slender Water Nymph Present
0 0.5 1 2 3 4 Miles
Scale 1:85,000
Image Source: USGS 1 Meter Orthophoto 7/1993
www.remetrix.com
© ReMetrix, LLC 2002


Clear Lake
Lake County, California
Water Star-grass, August 2002
Observed Occurrences from Physical Samples
Dense (>60%)
Common (20% - 60%)
Sparse (3% - 20%)
Rare (<3%)
Species not Present
28 of 747 Survey Locations with Water Star-grass Present
Scale 1:85,000
Miles
Image Source: USGS 1-Meter Orthophoto 7/1993
www.remetrix.com
© ReMetrix, LLC 8/2002


Clear Lake
Lake County, California
Waternet, August 2002
Observed Occurrences from Physical Samples
Dense (>60%)
Common (20% - 60%)
Sparse (3% - 20%)
Rare (<3%)
Species not Present
10 of 747 Survey Locations with Waternet Present
Scale 1:85,000
Miles
Image Source: USGS 1 Meter Orthophoto 7/1993
www.remetrix.com
© ReMetrix, LLC ©2002

Appendix F

Permitting

DETAILED GUIDE TO
CLEAR LAKE AQUATIC PLANT MANAGEMENT PERMIT
2003

♦ DO I NEED A PERMIT TO CONTROL WEEDS IN CLEAR LAKE?

All aquatic plant management activities, regardless of extent or method, require a permit!

Most property owners will not posses the machinery for mechanical harvest or the requisite licenses for pesticide application. The Department of Public Works can provide a list of contractors with approved harvest equipment and licensed commercial pesticide applicators (the list is not intended as an endorsement of any business or individual). Usually, an agreement is reached between the lakeshore property owner and/or a private business, and the contractor then applies for the permit.

NOTE:

A SEPARATE PERMIT IS REQUIRED FOR EACH PARCEL

♦ WHO ISSUES A WEED CONTROL PERMIT?

The Lake County Department of Public Works will serve as the Single Point source for obtaining a permit to control weeds on Clear Lake in 2003. Receiving approval to conduct weed control operations on public property can be very complicated, but Public Works will coordinate and expedite the process:

* Permission to control weeds (Department of Public Works),
* Enforcement of herbicide regulations (County Agricultural Commissioner),
* Clearance for weed control activities in hydrilla infested areas (California Department of Food and Agriculture),
* Permission to alter fish and wildlife habitat (California Department of Fish and Game), and
* Permission to discharge a potential pollutant (aquatic herbicide) into public waters (California State Water Resources Control Board).

♦ HOW DO I APPLY FOR A PERMIT?

In order to obtain permission to control weeds in Clear Lake, a person may apply at the Public Works counter in the Lake County Court House, 255 N. Forbes Street, Lakeport. The approval process is initiated by obtaining a Clear Lake Aquatic Plant Management Permit Application.

♦ PERMIT STRUCTURE:

All aquatic plant management activities, regardless of extent or method, must be approved in advance. The approval process is initiated by submission of a "*Aquatic Plant Management Program Application" (see attachment)* to the County of Lake Department of Public Works. Valid applications must be accompanied by an Administrative Map of the Shore of Clear Lake, scale 1"=50' (hereafter referred to as a Lake Bed Map) of the treatment site and requisite fees, when necessary. One permit per parcel is required for all herbicide treatments. The complete application is processed and a copy is circulated to the CDFA Hydrilla Eradiction field office and the Lake County Agricultural Commissioner's Office for approval or denial based on their jurisdictional authority. The applicant will be notified within 48 hours when the application is ready for pickup and signature committing to compliance with all programmatic and specific conditions.

♦ HERBICIDES

Administrative Controls. A greater degree of safety in the use of pesticides can be achieved by implementing rules which restrict who can recommend and use aquatic herbicides. These management practices include Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) regulations concerning product registration and labeling, state regulations governing applicator licensing, and permits:

A. All label directions will be adhered to.

B. Herbicides will be applied by licensed and registered Qualified Applicators (holders of current and valid Qualified Applicators License (QAL) issued by the California Department of Pesticide Regulation) only.

C. The commercial applicator (the permit applicant) shall make a site visit to verify the need for treatment and the suitability of the site for treatment prior to receiving a permit. The information gathered (weed species, growth stage, area) will help the applicator determine the method of control and the appropriate herbicides to employ.

D. Immediately prior to treatment, the commercial applicator will examine a series of indicators and modify treatment plans accordingly. These indicators include (but are not limited to) heavy precipitation, recreational activity, boat traffic, water depth, water turbidity, and wind. If this examination indicates a potential for reduced control efficacy and/or increased water quality impacts, the treatment will be rescheduled. D.O and temperature reading will be collected at 1 foot above the bottom within the treatment area. D. O. levels below 5 ppm and/or temperatures above 80 degree F will act as thresholds which prohibit herbicide applications.

E. Chemical applications shall be cumulatively restricted to an area of no more than 30% of any individual parcel or ownership as measured between extensions of the parcel's lot lines and lakeward from the shoreline for 300feet.

F. A 16 foot wide boat lane out to open water can also be maintained

G. No Herbicide Applications can take place between April 15th and the 1st of June.

Approved Herbicides. Certain practices can reduce the area and duration of impacts to water quality by substituting less toxic materials for more toxic products.

Only those registered herbicides which have minimal spatial and temporal impact on beneficial uses will be considered for use in Clear Lake. Those include copper based herbicides, diquat, fluridone, potassium salts of endothall, fluridone and glyphosate. A Research Authorization with CDPR is being explored for efficacy testing of Rennovate (ai. triclopyr) a systemic herbicide. Rennovate has a federal registration and a California registration is currently being processed. Restricted Use Herbicides will not be considered for use (i.e. 2,4-D, and acrolein).

Notification. Even after all prudent and reasonable safety steps have been accomplished, some individuals feel at risk from herbicides. Making public notification of herbicide applications gives those individuals an opportunity to take the steps they feel are in their best interest. Prior to initial herbicide discharge, the individual applicators shall take steps to notify adjacent and/or potentially affected properties.

A Fee is due when completed permit is picked-up by applicant.

- \$ 100 per permit for herbicide treatments.
- \$ 27 per permit for mechanical/physical cutting and/or pulling projects.

The costs of the National Pollution Discharge Elimination System (NPDES) permit and associated monitoring and reporting will be born by Lake County, and will not be charged to the permit applicant.

Data Collection

The data collected are intended to support an adaptive management program. Analysis of data produced by such documentation will create a basis for comparison of how various program elements meet objectives.

A GIS database has been established to manage the APMP. A polygon and associated characteristics will be generated within 48 hours of permit application. This will allow an ongoing tabulation of the total area managed, according to: time period, area, method, herbicide type, and applicator. Upon submittal of Supplemental Pesticide Use Reports, the GIS database will be updated to reflect actual treatment size, method and conditions.

Applicators will generate a record of the activities performed and the results of the treatment. The water temperature, concentration of dissolved oxygen, and approximate water depth shall be measured and recorded. The amount of herbicide applied and the area treated shall be measured and recorded. A follow-up evaluation and measurement of DO and Temperature will be made at an interval when the greatest mass of dying vegetation might be expected, according to the herbicide employed in aquatic vegetation control.

The applicator will report DO and temperature data with herbicide quantity and area treated per parcel (APN), in the Supplemental Pesticide Use Report. These reports will be sent to the Aquatic Weed Management Program Coordinator, County of Lake Department of Public Works, by the 15th of the following month.

Enforcement/Quality Control

Applicators will be required to carry valid permit(s), including the Lake Bed Map with highlighted permit areas. Before leaving the site, the map must be updated to reflect the actual treatment area. Failure to comply may result in fines and the revoking of all outstanding permits. Agricultural biologists from the Agriculture Commissioner's Office will monitor one application per week during the active treatment season of June through August.

In compliance with NPDES permit requirements, sampling for active ingredients will take place during the same time period at the inflow and outflow of the lake. A dissipation check will occur once during the season for each active ingredient shown. The agriculture biologist will be monitoring DO and Temperature weekly in anticipated treatment sites to determine when thresholds are approaching.

Supplemental Pesticide Use Reports will be submitted to DPW by the 15th of the following month.

Failure to truthfully and adequately complete reports could result in fines and the revoking of all outstanding permits.

♦ MECHANICAL/PHYSICAL CONTROL METHODS

Cutting of aquatic weeds, by any method, increases the risk of spreading *hydrilla* and other invasive species. For this reason, mechanical harvesting is prohibited within ¼ mile of sites where *hydrilla* is being actively managed. Mechanical control and retrieval of cut vegetation may be allowed in areas more than ¼ mile away from active *hydrilla* management areas. Coordination with the California Department of Food and Agriculture (CDFA) Hydrilla Eradication Program will be ongoing to assure compliance with program concerns.

Any control program that results in fragmentation must include a method for the collection of plant fragments and disposal of fragments landward of the high water mark. Fragments must be prevented from reentry into any waterbody until fragments are unviable.

A fee of $ 27.00 per permit will be required for mechanical/physical cutting and/or pulling projects.

♦ OTHER METHODS

Applications for the use of Bottom Barriers, Spot-Dredging, Weed Rolling, etc. will not be accepted at this time.

♦ ALL PERMITS

Permits will be issued by the Department of Public Works upon review and approval of the appropriate agencies. The Department of Public Works will notify applicants when the permit is available and must be picked up at the Public Works Department.

♦ FURTHER INFORMATION

The Lake County Department of Public Works administers the ‘public lands’ of Clear Lake. It is necessary to seek official approval to spray or harvest weeds in Clear Lake because the waters of the lake constitute a public trust, and are not the private property of the lake shore land owner. Courts have established that lakeward of the low water line, Clear Lake is public property, and above that line, the water is considered a public easement to the land it covers. Considered waters of the United States, the lake was entrusted to the state of California. In 1973 administration of the lake was transferred by an act of the Legislature from the State Lands Commission to the County of Lake. The Water Resources Division of the Department of Public Works is responsible for the management of Clear Lake.

The County Agricultural Commissioner enforces laws concerning pesticide usage. This authority includes registration of various license holders, worker protection, reporting of pesticide usage and inspection of activities related to pesticide use to ensure compliance with state and federal laws.

The California Department of Food and Agriculture (CDFA) has been engaged since 1994 in an effort to eradicate Hydrilla, a noxious and invasive aquatic weed. The eradication order is found in state law, and CDFA has broad authority over infested areas. While many public uses have been prohibited in other Hydrilla infested water bodies in California, CDFA has been very cooperative with Lake County, allowing recreation to continue along side the eradication campaign.

The California Department of Fish and Game (CDFG) is responsible for protecting fish and wildlife habitat on public lands and public easements in the state. Since aquatic plants are important fish spawning and rearing habitat, consultation with CDFG before engaging in weed management activities in Clear Lake has been necessary.

The State Water Resources Control Board enforces the federal Clean Water Act in California. Recently (March 2001) the federal courts declared that herbicide use in public waters requires compliance with the CWA. To meet that requirement, the County applied for a National Pollution Discharge Elimination System permit, which will allow the continued use of certain state and federally registered herbicides in Clear Lake. The Department of Public Works bears the burden of administration and compliance with that permit.

2003

Clear Lake Aquatic Plant Management Permit Application

DPW # APM ____________________, **Hydrilla Management Area (1-80, C1-5)**___________, **Lakebed Map** sheet number:______

(Attach a copy of the map, drawing areas of aquatic weed control) **Application received by:**___________ **Date:**______/2003

Assessor's Parcel Number (APN)	Purpose of Weed Mgmt*	Area of Weed Management (square feet)				Method of Weed Management	
		Boat dock access	Swim area	Other	Total Area	Mechanical	Herbicide
APN__________________ Owner _________________							

* 1. Public Facility Safety, 2.Private Resort Safety, 3. Private Residence Safety, 4. Other (specify) ________

Length of 16' wide boat lane predicted _________________ feet, (x 16 = _________sq. ft.) Actual _______________

(To be determined after submittal of Supplemental Pesticide Use Report)

Mechanical

Proposed Method of please circle:

a. Boat-Mounted Harvester b. Hand Pulling and Bagging c. Manual Cutter d. Chain Dragging e. Other (explain):__________________

- Method of Collection (explain) ____ __________________
- Disposal Location ____ __________________
- Owner _________________________________Telephone:___________________ Fax:_______________ __________________
- Contractor ______________________________Telephone:___________________ Fax:________________ __________________

Address:____ __________________

I certify that I am the owner or have permission from owner to engage in weed control activity from the owner of the parcel(s) named on this application.

Owner: ____ Date: _________/_________/__2003

Signature: or

Agent of Owner(s): ____ Date: _________/_________/__2003

Herbicide

Applicator _______________________________Telephone: ___________________ Fax: __________________

Pest Control Operator's Bus. License #______________________Applicator's Q.A.L.#______________________

All herbicides will be applied to Clear Lake by a Qualified Licensed Applicator. I certify that I have obtained permission to engage in weed control activity from the owner of the parcel named on this application. I hereby certify that I will visit the site declared on this application to verify the need for treatment and the suitability of the site for treatment. I agree to use only appropriate herbicides from approved list according to label specifications. I will notify nearby users, of lake water for drinking and irrigation uses, according to label directions.

Signature: ____Date: _________/_________/__2003

page 1 of 2

Clear Lake Aquatic Plant

Management Permit Application

DPW # APM ____________________, page 2 of 2

***************************************ENDORSEMENTS**

California Dept. Food and Agriculture Hydrilla Program Mechanical Chemical:

___________________________________, ____/____/2003 **Approved___ Denied ___** **Approved___ Denied ___**

Signature: Date

Management Area ____________, **Active Hydrilla Treatment Area** Y / N, If Yes, the applicator may apply fluridone in this area before (in the spring) ___________and after (late summer or fall) __________ the CDFA application period. Private applicators cannot interfer with or overlap the CDFA applications. Maximum rate private applicator may apply __________

County Agricultural Commissioner's Office Mechanical: Chemical:

___________________________________, ____/____/2003 **Approved___ Denied ___** **Approved___ Denied ___**

Signature: Date

****

General conditions, and/or mitigation required as a condition of permit:

Mechanical

1. Collection of fragmented material required
2. Disposal of plants landward of high water,
3. Fragments must be prevented from reentry into any body of water

Herbicide

1. Only Approved Herbicide(s) are to be to be applied in accordance with NPDES Permit. Approved Active Ingredients: Copper, glyphosate, diquat, potassium salts of endothal (triclopyr, fluridone - with special permission only)
2. Supplemental DPR pesticide report per each permit/parcel
3. No herbicide applications between April 15 and June 1

HOLD HARMLESS: Except with respect to active negligence of a party indemnified herein, to the fullest extent permitted by law, the permittee shall indemnify and hold harmless the COUNTY and its agents, officers and employees against and from any and all claims, lawsuits, actions, liabilities, losses, damages, and expenses and costs (including but not limited to attorney's fees) brought for, or on account of, injuries to or death of any person or persons, including employees of permittee, or injuries to or destruction of property, including the loss of use thereof, arising out of, or alleged to arise out of, or resulting from, the performance of the work permitted herein, provided that any such claim, lawsuit, action, liability, damage, loss, expense, or cost is caused in whole or in part by any negligent or intentional act or omission of permittee, or anyone directly or indirectly employed by permittee, or anyone for whose acts permittee may be liable, regardless of whether or not it is caused by the passive negligence of a party indemnified hereunder.

Applicant's acceptance:____ Date:__________/__________/___________

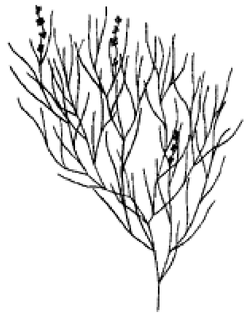
Application Final Approval

Fee Paid Total Fees Paid __________ Check Number _________ Date:_____/_____/2003

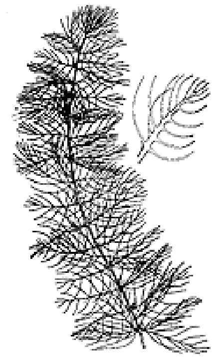
- ❑ Lakebed Map Attached
- ❑ Treatment Area Highlighted
- ❑ Area calculation verified

$100 Herbicide, $27 Mechanical/Physical

County of Lake Dept. of Public Works Signature:__________________________________ Date:_____/_____/2003


Sago Pondweed

QUICK GUIDE TO AQUATIC PLANT MANAGEMENT PERMITS


Eurasian Water Milfoil

♦ DO I NEED A PERMIT TO CONTROL WEEDS IN CLEAR LAKE?

All aquatic plant management activities, regardless of extent or method, REQUIRE A PERMIT and must be approved in advance.

A SEPARATE PERMIT IS REQUIRED FOR EACH PARCEL

♦ HOW DO I APPLY FOR A PERMIT?

In order to obtain permission to control weeds in Clear Lake, a person may apply at the Public Works counter in the Lake County Court House, 255 N. Forbes Street, Lakeport. The approval process is initiated by submitting a Clear Lake Aquatic Plant Management Permit Application.

♦ PERMIT STRUCTURE:

The approval process is initiated by submission of a "*Aquatic Plant Management Program Application"* to the County of Lake Department of Public Works. Valid applications must be accompanied by:

1. Administrative Map of the Shore of Clear Lake, scale 1"=50' (often referred to as, a Lake Bed Map), used to indicate the area to undergo control.
2. An Appropriate Fee is due when completed permit is picked-up by applicant.
   $ 100 per permit for herbicide treatments.
   $ 27 per permit for mechanical/physical cutting and/or pulling projects.

♦ CONTRACTORS:

Most property owners will not posses the machinery for mechanical harvesting or the requisite licenses for pesticide application. Below is the current list of contractors with approved harvest equipment and/or licensed commercial pesticide applicators (the list is not intended as an endorsement of any business or individual). Usually, an agreement is reached between the lakeshore property owner and the contractor. The contractor then applies for the permit.

Pestmaster Services
Attn: Dennis Yows
P. O. Box 912
Upper Lake, CA 95485
Phone No.: 275-3333
Fax No.: 275-0171
e-mail: dennisy@pacific.net

Wooster Aquatic Weed
Attn: Craig Wooster
3415 White Oak Way
Kelseyville, CA 95451
Phone No.: 279-8993
Fax No.: 277-8048
e-mail: bellhaven@bellhaven.com


Largeleaf and Illinois Pond Weed

HERBICIDE PERMIT CONDTIONS

A. Herbicide applications shall be cumulatively restricted to an area of no more than 30% of any individual parcel or ownership as measured between extensions of the parcel's lot lines and lakeward from the shoreline for 300feet.

B. A 16 foot wide boat lane out to open water can also be maintained

C. Approved Herbicides. Only those registered herbicides which have minimal spatial and temporal impact on beneficial uses will be considered for use in Clear Lake. Those include copper-based herbicides, diquat, fluridone, potassium salts of endothall and glyphosate.

D. Supplemental Pesticide Use Reports will be submitted, by the applicator, to Agriculture Commissioner's Office by the 15th of the month following each treatment. Failure to truthfully and adequately complete reports could result in fines and the revoking of all outstanding permits.

E. No Herbicide Applications between April 15th and June 1st.

F. Other restrictions also apply. For a more detailed list of conditions contact the Program Manager.


Curly Pondweed

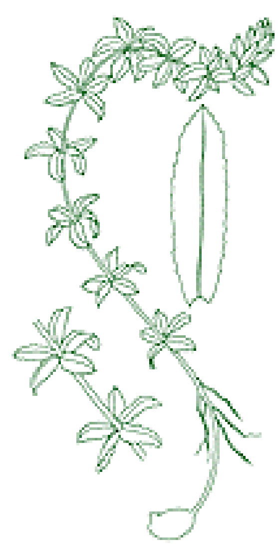
♦ MECHANICAL/PHYSICAL PERMIT RESTRICTIONS

Cutting and pulling of aquatic weeds, by any method, increases the risk of spreading *hydrilla* and other invasive species. For this reason, mechanical harvesting is discouraged and prohibited within ¼ mile of sites where *hydrilla* is being actively managed. Mechanical control and retrieval of cut vegetation <u>may</u> be allowed in areas more than ¼ mile away from active *hydrilla* management areas. The southeastern portion of the Lower Arm is off limits to this method to prevent fragments from entering Cache Creek. Coordination with the CDFA Hydrilla Eradication Program will be ongoing to assure compliance with their eradication efforts.

Any control program that results in fragmentation must include a method for the collection of plant fragments and disposal of fragments landward of the high water mark. Fragments must be prevented from reentry into any waterbody until fragments are unviable.

♦ OTHER METHODS

Applications for the use of Bottom Barriers, Spot-Dredging, Weed Rolling, etc. will not be accepted at his time


Hydrilla

Appendix G

List Licensed Applicators

Current Licensed Aquatic Weed Herbicide Applicators:*

Herbicide

Pestmaster Services
Attn: Dennis Yows
P. O. Box 912
Upper Lake, CA 95485
Phone No.: 275-3333
Fax No.: 275-0171
e-mail: dennisy@pacific.net

Herbicide/Mechanical

Wooster Aquatic Weed
Attn: Craig Wooster
3415 White Oak Way
Kelseyville, CA 95451
Phone No.: 279-8993
Fax No.: 277-8048
e-mail: bellhaven@bellhaven.com

*As of the completion of this document Spring 2003. Please call Department of Public Works for an updated list (707) 263-2341

Appendix H

Impacts of Various Control Methods on Water Quality

POSITIVE AND NEGATIVE IMPACTS OF VARIOUS MACROPHYTE CONTROL TECHNIQUES ON WATER QUALITY

Impacts on Water Quality	Herbicide Treatment (selective)	Herbicide Treatment (nonselective)	Biological Control (selective)	Mechanical Shredding (nonselective)	Harvesting (nonselective)
Potential Negative Impacts					
Macrophyte tissue decomposition & stimulation of algal growth	N	Y	?	Y	N
High dissolved oxygen demand	N	Y	?	Y	N
Enhanced sediment resuspension during treatment	N	N	N	Y	Y
Enhanced sediment resuspension after treatment	N	Y	?	Y	Y
Direct removal of invertebrates and fish	N	N	N	N	Y
Potential Positive Impacts					
Enhanced reoxygenation after treatment	Y	Y	?	Y	Y
Removal of readily mobilized nutrients from the system	N	N	N	N	Y

Appendix I

Environmental Compliance (NPDES)

ENVIRONMENTAL COMPLIANCE

National Pollution Discharge Elimination System (NPDES) Permit

A major obligation during 2002 was the implementation and compliance with the NPDES permit. This permit stems from the 9th Circuit Federal Appeals Court decision late 2001. In that case:

- An irrigation district in Oregon made some errors in application of an aquatic herbicide (acrolein) resulting in a fish kill.
- An environmental group sued, arguing that the use of aquatic herbicides was in violation of the Clean Water Act (CWA)
- The defense argued that they are not required to comply with the CWA, because they follow all the product label instructions under Federal Insecticide Fungicide and Rodenticide Act (FIFRA).
- Two large bodies of law are involved in this argument, both laws are under the jurisdiction of the USEPA: CWA and FIFRA.
- The 9th Circuit Court of Appeals agreed with the environmental group, and effectively stretched the fabric of the CWA over the use of aquatic pesticides.
- What is (somewhat) unique about the CWA is the empowerment of citizen's groups to sue for damages in the event of non-enforcement. If the County declined to obtain coverage under this NPDES permit, we could potentially expose ourselves to lawsuits. By putting ourselves under the wing of the State Water Resources Control Board, we have cover from that liability, and this was determined in consultation with County Counsel.

The County applied for coverage under the permit. The Central Valley Regional Water Quality Control Board will be the enforcing authority.

The main burden of NPDES permit was the development of a Monitoring and Reporting Plan (MRP) and associated Quality Assurance Program Plan (QAPP) and ultimately involving extensive sampling and analysis of water. The CDFA Hydrilla Eradication Program was in the same predicament as Lake County. An inordinate amount of time and monies went to comply with this requirement before and during the 2002 season. Cost associated with the permit sampling, analysis and reporting will continue into the foreseeable future,

STATE WATER RESOURCES CONTROL BOARD

FACT SHEET
FOR WATER QUALITY ORDER NO 2001-12-DWQ
STATEWIDE GENERAL NATIONAL POLLUTANT DISCHARGE
ELIMINATION SYSTEM (NPDES) PERMIT FOR DISCHARGES
OF AQUATIC PESTICIDES TO WATERS OF THE
UNITED STATES (GENERAL PERMIT)
GENERAL PERMIT NO. CAG990003

BACKGROUND

On March 12, 2001, the Ninth Circuit Court of Appeals decided that discharges of pollutants from the use of aquatic pesticides to waters of the United States require coverage under an NPDES permit, (Headwaters, Inc. v. Talent Irrigation District). The Talent decision was issued just prior to the major season for applying aquatic pesticides. Because of the serious public health, safety, and economic implications of delay in such applications, this General Permit has been developed on an emergency basis in order to provide coverage for broad categories of aquatic pesticide use in California. The State Water Resources Control Board (SWRCB) will rescind or revise this General Permit if the law as stated in the Talent decision changes.

Coverage under this General Permit is available to public entities for discharges of pollutants to waters of the United States ("water bodies") associated with the application of aquatic pesticides for resource or pest management. This limitation to "public entities" is based on the provisions of the SWRCB's *Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California* (the State Implementation Policy, or SIP) allowing categorical exceptions from meeting priority pollutant criteria/objectives for resource or pest management control measures conducted by "public entities." "Public Entity" is defined in the SIP to include "the federal government or state, county, city and county, city, district, public authority, or public agency." The categorical exception provision also gives examples of management programs that such public entities may conduct: vector or weed control, pest eradication, or fishery management. The entities that conduct such programs vary in legal structure, but all have in common a public role of protecting waterways and/or the public health from harmful organisms. This General Permit is available to all such entities regardless of legal structure, including mutual water companies, public water purveyors, investor-owned utilities, and homeowners' associations.

The SIP further provides that the categorical exception is for resource or pest management conducted by public entities "to fulfill statutory requirements, including, but not limited to, those in the California Fish and Game, Food and Agriculture, Health and Safety, and Harbors and Navigation codes." Some of these statutory provisions do not mandate the management programs but make their implementation discretionary. The exception is properly read to include such discretionary programs.

This General Permit **does not** cover indirect or non-point source discharges from agricultural or other applications of pesticides to land that may be conveyed in storm water or irrigation runoff. This General Permit **does not** cover applications of pesticides that are **not registered for use on aquatic sites**. This General Permit **does** cover the uses of properly registered and applied aquatic pesticides that constitute discharges of "pollutants" to waters of the United States.

The aquatic pesticides covered by this General Permit will be applied directly into the water body, and/or directly to organisms in the water or on the water surface with the purpose and intent of killing the target aquatic organisms. The impacts of these chemicals may not be limited to the target organisms – other plants and aquatic life in the treatment area may be impacted. Due to water movement at the treatment locations, the residual pesticides can be carried to adjacent areas while concentrations in the water are still high enough to cause adverse impacts not only to aquatic organisms but also to other beneficial uses, such as irrigation, municipal water supplies and recreation (such as swimming). As part of the pesticide registration process conducted by the U.S. Environmental Protection Agency (USEPA) and Department of Pesticide Regulation (DPR), adverse impacts relevant to these beneficial uses have been evaluated and determined not to be unreasonable. A purpose of this Order is to minimize the areal extent and duration of adverse impacts to beneficial uses of water bodies treated with aquatic pesticides.

To qualify for coverage under this General Permit, dischargers must meet the following criteria:

1. The discharger must submit a fully completed Notice of Intent (NOI), a project map, and first annual fee.
2. The discharger must be a public entity.
3. Dischargers must be licensed by DPR or Department of Health Services (DHS) if such licensing is required for such public entities, to apply aquatic pesticides.

The basic requirements of this General Permit include:

1. The discharger must follow all pesticide label instructions and any Use Permits issued by a County Agricultural Commissioner.
2. The discharger must implement best management practices (BMPs).
3. The discharger must comply with monitoring requirements.

WATERS OF THE UNITED STATES

This General Permit regulates the addition of pollutants associated with the application of aquatic pesticides to navigable waters. “Navigable waters,” means waters of the United States. “Waters of the United States” include all waters currently used, used in the past, or susceptible to use in interstate commerce; all interstate waters; all other waters the use, degradation, or destruction of which would or could affect interstate or foreign commerce. Waters of the United States include waters used by interstate or foreign travelers for recreation, waters from which fish or shellfish are taken and sold in interstate or foreign commerce, impoundments of and tributaries to waters of the United States, and wetlands adjacent to waters of the United States. For instance, irrigation canals that exchange water with natural streams and lakes are waters of the United States.

EMERGENCY CONDITIONS

This General Permit is being issued under emergency conditions. On March 12, 2001, the Ninth Circuit Court of Appeals in Headwaters, Inc. v. Talent Irrigation District determined that discharges of aquatic pesticides to waters of the United States require coverage under an NPDES permit. Discharge of aquatic pesticides by the public entities covered by this General Permit is necessary at this time. These public entities conduct resource or pest management programs in order to fulfill statutory requirements and to protect beneficial uses of water and the public health. Many of the public entities would be unwilling to perform the activities prior to issuance of an NPDES permit because of the substantial liability they could incur for discharging aquatic pesticides in violation of the Clean Water Act (CWA).

Because of the emergency nature of this General Permit, many of the actions that would normally occur prior to issuance of a permit granting a categorical exception to priority pollutant objectives/criteria have not yet occurred. This General Permit is issued as a limited term permit, and it will expire January 31, 2004. During the term of this General Permit, activities will occur that will provide the basis for a full-term permit in the future. The public entities subject to the General Permit will complete necessary California Environmental Quality Act (CEQA) documents to justify the categorical exception. The public entities will develop monitoring plans that will be the basis of monitoring requirements in the next permit. The SWRCB will consider issuing future permits that are more limited in nature as to specific pesticides, types of resource and pest management programs, or areas of the State. The future permits will be based on the submittals received during this General Permit term, will specify whether categorical exceptions are warranted, and will ensure that other applicable water quality standards, including the antidegradation policy, are achieved.

RELATED PESTICIDE REGULATIONS

DPR and the County Agricultural Commissioners (CACs) regulate the sale and use of pesticides in California. Pesticide applications subject to this General Permit must be consistent with the pesticide label instructions and any Use Permits issued by the CACs. According to federal law, pesticide label language is under the sole jurisdiction of USEPA. Label language and any changes thereto must be approved by USEPA before the product can be sold in this country. DPR cannot require manufacturers to make changes in labels; however, DPR can refuse to register products unless manufacturers address unmitigated hazards by amending the pesticide label. As part of the pesticide registration process, USEPA and the California Department of Pesticide Regulation (DPR), evaluate data submitted by registrants to assure that a product used according to label instructions will cause no harm (or "adverse impact") on non-target organisms that cannot be reduced (or "mitigated") with protective measures or use restrictions. Registrants are required to submit data on the effects of pesticides on target pests (efficacy) as well as nontarget effects. Data on nontarget effects include plant effects (phytotoxicity), fish and wildlife hazards (ecotoxicity), impacts on endangered species, effects on the environment, environmental fate, breakdown products, leachability and persistence.

Requirements that are specific to use in California are included in many pesticide labels that are approved by USEPA. Applicators of a pesticide designated as a restricted material must either be licensed by DPR or must work under the supervision of someone who is licensed. For aquatic herbicides, this must be a holder of a Qualified Applicator Certificate with the category “aquatic.” Use must be reported to the CAC where required by law or by agreement with DPR.

State regulations require that the CAC determine if a substantial adverse environmental impact will result from the proposed use of a restricted material. If the CAC determines that this is likely, the commissioner may deny the Use Permit or may issue it under the condition that site-specific use practices be followed (beyond the label and applicable regulations) to mitigate potentially adverse effects. DPR conducts scientific evaluations of potential health and environmental impacts and provides commissioners with information in the form of suggested permit conditions. DPR’s suggested permit conditions reflect minimum measures necessary to protect people and the environment. CACs use this information and their evaluation of local conditions to set site-specific limits in permits.

The State’s pesticide regulation laws provide special procedures for vector control agencies operating under cooperative agreements. (See, e.g., Food and Agricultural Code § 11408(e). The application of pesticides by mosquito abatement districts and other vector control agencies is regulated by a special arrangement among the DHS, DPR, CACs, and vector control agencies. Vector control districts are not directly regulated by DPR. Instead, supervisors or applicators are licensed by DHS. Pesticide use by vector control agencies is reported to the CAC in accordance with a 1995 Memorandum of Understanding (MOU) among DPR, DHS, and the CACs for the Protection of Human Health from the Adverse Effects of Pesticides and with cooperative agreements entered into between DHS and vector control agencies, pursuant to Health and Safety Code section 116180.

WATER QUALITY STANDARDS

USEPA established water quality criteria for priority pollutants in the National Toxics Rule and the California Toxics Rule, and Regional Water Quality Control Boards (RWQCBs) establish water quality objectives for priority pollutants in basin plans. The SWRCB has adopted the SIP that contains implementation provisions for these water quality criteria and objectives. The SIP provides that categorical exceptions may be granted to allow short-term or seasonal exceptions from meeting the priority pollutant criteria/objectives if "necessary to implement control measures … for resource or pest management conducted by public entities to fulfill statutory requirements." The SIP specifically refers to vector or weed control, pest eradication, and fishery management as bases for categorical exceptions. This General Permit grants a categorical exception from water quality criteria and objectives for priority pollutants for the application of aquatic pesticides by public entities in the exercise of resource or pest management powers authorized by State statute. The SWRCB recognizes that the discharges of pollutants may also cause or contribute to exceedance of water quality standards for parameters or constituents that are not priority pollutants. This General Permit does not require immediate compliance with such water quality standards, but requires that the dischargers implement additional BMPs to eliminate or reduce the pollutants that are causing or contributing to exceedance.
As a condition to retaining the categorical exception, dischargers must comply with conditions that are included in the General Permit. Further, consistent with the SIP exception, dischargers are allocated a temporal zone of impact on beneficial uses of water within which there may be a temporary exceedance of criteria, but the resulting impact must be transient, and must allow for full restoration of water quality and protection of beneficial uses upon project completion. The SIP exception applies only to water quality criteria/objectives for priority pollutants and not to other water quality standards, such as the antidegradation policy.

For parameters or constituents that are not priority pollutants, dischargers must implement appropriate BMPs to achieve compliance with other applicable water quality standards contained in a Statewide Water Quality Control Plan or in an RWQCB Basin Plan. If the discharges of any non-priority pollutants cause or contribute to exceedance of water quality standards, the dischargers are required to develop and implement improved BMPs to prevent or reduce such pollutants.

EFFLUENT LIMITATIONS

NPDES permits for discharges to surface waters must meet all applicable provisions of Sections 301 and 402 of the CWA. These provisions require controls of pollutant discharges that utilize best available technology economically achievable (BAT) and best conventional pollutant control technology (BCT) to reduce pollutants and any more stringent controls necessary to meet water quality standards.

It is not feasible at this time for the SWRCB to establish numeric effluent limitations for pollutants in discharges associated with aquatic pesticide applications. Establishment of numeric effluent limitations for pollutants is not feasible because: (1) aquatic pesticide applications are made directly to the water body and/or to organisms in the water or on the water surface, (2) there may be numerous short duration intermittent pesticide releases to surface waters from many different locations, and (3) there are numerous pesticides used, including many inert ingredients, and the SWRCB does not have the ability to establish numeric effluent limitations for each of these constituents. Therefore, pursuant to Title 40, Code of Federal Regulations (CFR) Section 122.44(k), the effluent limitations contained in this General Permit are narrative and include requirements to implement appropriate BMPs, including compliance with all pesticide label instructions. The BMPs required herein constitute BAT and BCT, and they will be implemented to minimize the areal extent and duration of impacts caused by the discharge of pollutants and to allow for full restoration of water quality and protection of beneficial uses of the receiving waters following completion of resource or pest management projects.

BEST MANAGEMENT PRACTICES (BMPs)

The development of BMPs provides the flexibility necessary to establish controls to minimize the areal extent and duration of impacts caused by the discharge of pollutants and to allow for full restoration of water quality and protection of beneficial uses of the receiving waters following completion of resource or pest management projects. This flexibility allows dischargers to implement different BMPs for different types of applications and different types of waters.

Much of the BMP development has been incorporated in the pesticide regulation process by the USEPA, DPR, DHS, and CACs. As discussed above, the dischargers must be licensed by DPR or DHS if such licensing is required for the aquatic pesticide application project. The pesticide use must be consistent with the pesticide label instructions and any Use Permits issued by CACs.

A pesticide label has been reviewed by both USEPA and DPR scientists to ensure that a product used according to label instructions will cause no harm (or "adverse impact") on non-target organisms that cannot be reduced (or "mitigated") with protective measures or use restrictions. Many of the label directions constitute BMPs to protect water quality and beneficial uses. Label directions may include: precautionary statements regarding toxicity and environmental hazards; directions for proper handling, dosage, application, and disposal practices; prohibited activities; spill prevention and response measures; and restrictions on type of water body and flow conditions.

A Use Permit issued by the CAC incorporates applicable suggested permit conditions from DPR and local site-specific conditions necessary to protect the environment. State regulations require that specific types of information be provided in an application to the CACs for a pesticide use permit. The CACs review the application to assure that appropriate alternatives were considered and that any potential adverse effects are mitigated. The CACs also conduct pre-project inspections on at least 5 percent of projects.

The General Permit requires that the dischargers must comply with all pesticide label instructions, DPR and DHS regulations, and any Use Permits issued by the CACs. The General Permit also specifies the steps that will be followed to identify and implement appropriate BMPs that are designed to maximize efficacy of control efforts and minimize adverse impacts to the environment. These steps are:

1. *Preliminary site evaluations*. The discharger will conduct a site inspection to verify the need for treatment, options to treatment (including non-toxic and less toxic alternatives), and suitability of the site for treatment.
2. *Alternative Control Measures*. The discharger will evaluate other available BMPs and alternative control measures to determine if there are feasible alternatives to the selected aquatic pesticide application project that could reduce potential water quality impacts.
3. *Secondary site evaluations and pre-treatment monitoring*. The discharger will determine the type and intensity of treatment needed. This evaluation will include measurement and analysis of indicators to provide information on potential efficacy and water quality impacts.
4. *Treatment*. Immediately prior to treatment, the discharger will examine a series of indicators and modify treatment plans accordingly. These indicators may include day length, precipitation, recreational activity, sunlight, tidal water exchange, water depth, water flows, water turbidity, and wind. If this examination indicates a potential for reduced control efficacy and/or heightened water quality impacts, the treatment will be rescheduled.
5. *Post-treatment*. The discharger will assess control efficacy and water quality impacts. The results of this assessment will be evaluated by the discharger to refine project

operations through an adaptive management process.

The selection of control measures that use non-toxic and less toxic alternatives is an example of an effective BMP. Mosquito Control Districts and other vector control agencies can select larvicides for mosquito control in some situations that have very low toxicity and pose very little or no threat to the environment. Specifically, (a) for microbial larvicides (e.g., *Bacillus thuringiensis israelensis, Bacillus sphaericus*), USEPA has concluded that they do not pose risks to wildlife, non-target species, or the environment; and (b) for methoprene, USEPA has concluded that, as used in mosquito control programs, it does not pose unreasonable risks to wildlife or the environment. Thin film larvicides (e.g., Agnique) also have low inherent toxicity.

The General Permit includes requirements for the dischargers to identify and implement additional BMPs and alternative control measures where such additional BMPs and measures will prevent or reduce impacts to water quality.

MONITORING REQUIREMENTS

The General Permit requires that the dischargers comply with the Monitoring and Reporting Program (MRP) that is incorporated as Attachment B of the General Permit. Dischargers are also required to submit technical and monitoring reports as directed by the appropriate RWQCB's Executive Officer. The MRP requires that the dischargers develop and implement Monitoring Plan (Plans) to:

1. Document compliance with the requirements of the General Permit;
2. Support the development, implementation, and effectiveness of BMPs; and
3. Demonstrate the full restoration of water quality and protection of beneficial uses of the receiving waters following completion of resource or pest management projects.
4. Identify and characterize aquatic pesticide application projects conducted by the discharger.
5. Assure that projects are monitored that are representative of all pesticides and application methods used by the discharger.

Dischargers must comply with these requirements either individually or by joining with other dischargers to participate in one or more Regional Pesticide Monitoring Program(s) (RPMPs). Any discharger planning to comply through an RPMP must so indicate at Section VI. of the NOI (Attachment A).

The establishment of the RPMPs by groups of dischargers that use similar pesticides and application methods provides an opportunity for dischargers to cost-effectively comply with the MRP. By combining resources and selecting a limited number of representative projects, the

RPMPs will be able to conduct monitoring efforts that are comprehensive and technically sound.

Each Discharger shall submit a Plan to the appropriate RWQCB(s) **by March 1, 2002** for approval. Copies of Plans developed by RPMPs shall be provided to the SWRCB and each RWQCB. The Plan submitted by a discharger should describe any individual monitoring activities and incorporate by reference the RPMP Plans that have been prepared by RPMPs in which the discharger is participating. The Plan must include monitoring of a representative project for each pesticide identified by the discharger at Section IV. B. of the NOI. The dischargers and RPMPs shall implement the Plans **by July 1, 2002** in accordance with any modifications required by the RWQCB.

The MRP lists six monitoring elements that must be incorporated in all monitoring plans except for some plans for vector control projects. Monitoring exemptions may be appropriate for vector control projects that use microbial larvicides, thin film larvicides, and methoprene. These aquatic pesticides may represent the non-toxic or less toxic pest control alternative with reduced or no threat to the environment. Furthermore, feasible specific quantitative test methods may not be available for these pesticides at label application concentrations. Dischargers of these pesticides should document the rationale for not including plan elements where appropriate.

The MRP requires the dischargers to submit a monthly report to the RWQCB documenting specific information for each aquatic pesticide treatment site. The discharger is also required to submit a calendar-year annual report to the RWQCB by January 31 of the following year (beginning January 2003). The report shall include a summary for the previous year including but not limited to (1) objectives of the monitoring program(s); (2) results; and (3) interpretation of data in relation to frequency, duration, and magnitude of impacts to beneficial uses.

NOTIFICATION REQUIREMENTS

To obtain coverage under this General Permit, an NOI and the first annual fee ($400.00) must be submitted. A separate enrollment is required for discharges located within more than one RWQCB’s boundary, as defined in Section 13200 of the California Water Code. Each enrollment will cover all discharges occurring within the boundaries of that RWQCB. Only one annual fee must be submitted to the SWRCB for all covered discharges from one entity.

Signing the certification on the NOI signifies that the discharger intends to comply with the provisions of this General Permit. Dischargers are authorized to discharge upon submission of a complete and accurate NOI application for coverage. The NOI Form A is included as Attachment A within this General Permit package. The fully completed NOI, a project map, and first annual fee constitute a complete application for coverage under this General Permit. An

NOI must be signed to be valid. Dischargers who submit a valid NOI application are not required to submit an individual permit application.

The authorization to discharge under this General Permit is terminated upon receipt of a Notice of Exclusion (NOE)[1] or upon the adoption of either an individual or other general NPDES permit covering the discharge. The discharger must submit additional information if requested by the SWRCB or RWQCB. The RWQCB may determine that a discharger submitting an NOI is not eligible for coverage under this General Permit and may require submittal of an application for an individual permit. Individual application forms will be provided by the appropriate RWQCB.

The completed NOI application must be submitted to the following address:

Larry Nash
Regulation Unit
Division of Water Quality
State Water Resources Control Board
P.O. Box 100
Sacramento, CA 95812

This General Permit will expire on January 31, 2004. Enrollees who are covered under this General Permit must obtain coverage under another general permit for aquatic pesticide applications or an individual NPDES permit.

[1] An NOE is a one-page notice that indicates that the proposed discharger is NOT eligible for coverage under this General Permit and states the reason why.

Appendix J

Lake County Aquatic Plant Management Ordinance

BOARD OF SUPERVISORS, COUNTY OF LAKE

STATE OF CALIFORNIA

ORDINANCE NO. 2625

AN URGENCY ORDINANCE ESTABLISHING THE CLEAR LAKE AQUATIC PLANT MANAGEMENT PROGRAM FOR THE COUNTY OF LAKE

THE BOARD OF SUPERVISORS OF THE COUNTY OF LAKE ORDAINS AS FOLLOWS:

SECTION 1: The Board of Supervisors of the County of Lake adopts this ordinance to establish the Clear Lake Aquatic Plant Management Program to control aquatic plants in Clear Lake in the County of Lake and to promote the public health, safety and welfare of Clear Lake for the public. This Board finds these specific compelling reasons which necessitate the adoption of this ordinance. They are as follows:

1. Nuisance aquatic plants are a specific and serious detriment to the public health and safety for the public boating and recreational use of Clear Lake.
2. The nuisance aquatic plant problem was previously being addressed by the State of California, Department of Fish and Game, which has just notified the County that it will no longer be the lead agency, issue permits or provide support for the control of nuisance aquatic weeds in Clear Lake.
3. Many Lake County residents depend on access to Clear Lake for their livelihood since tourism is a significant industry in Lake County.
4. Nuisance aquatic plants, if allowed to spread in Clear Lake without management, would have a significant adverse effect on the boating safety, commerce and navigation, and the general welfare of Lake County.
5. A permitting process addressing aquatic plant management must be immediately enacted by the County to address the urgent problem of nuisance aquatic plants.

SECTION 2: Chapter 26 is hereby added to the Lake County Code and it shall read as follows: " CLEAR LAKE AQUATIC PLANT MANAGEMENT

Sec. 26-1. General Purpose.

The purpose of the chapter is to improve and protect the public's interest in the waters and the bed of the waters in and around Clear Lake, and to insure that aquatic weeds will not interfere with or prevent commerce, navigation, fishery, and recreation by establishing minimum standards for aquatic plant management activities in the nearshore and foreshore of the lake.

Sec. 26-2. General Provisions.

2.1 Compliance. All activities designed to control or modify the growth of nuisance aquatic plants by any method, including but not limited to pesticide control, mechanical or physical removal, biological control, bottom barriers, weed rollers, rototilling, rotovating, physical shading with barriers or dyes and fertilization, within the nearshore and foreshore of Clear Lake, shall be in compliance with the terms of this chapter. Permits shall be granted or denied in conformity with the standards and provisions set forth in this chapter.

2.2 Interpretation and Severability. The provisions of this chapter shall be liberally construed to effectuate their purposes. If any section, clause, provision or portion of this chapter is adjudged unconstitutional or invalid by a court of competent jurisdiction, the remainder of this chapter shall not be affected thereby.

2.3 Short Title. This chapter may be cited and referred to as the "Clear Lake Aquatic Plant Management Ordinance".

Sec. 26-3. Definitions.

3.1 For the purposes of this chapter, words in the present tense include the future tense; words in the singular number include the plural number; works in the plural number include the singular number; and the word “shall” is mandatory, not permissive, unless the context indicates that a directory meaning is intended.

3.2 For the purposes of this chapter, the following words shall be interpreted as follows:

3.21 *Application*: Documents which supply the data necessary for review of a project subject to the provisions of this chapter.

3.22 *Aquatic Nuisance*: Any organism which lives or propagates, or both, within the aquatic environment and interferes with, or impairs the use or enjoyment of, the aquatic resources of Clear Lake.

3.23 *Aquatic Plant*: Any plant including a floating, emergent, submersed, or ditchbank species growing in, or closely associated with, an aquatic environment, and includes any part or seed of such plant.

3.24 *Aquatic Plant Management*: Any activity designed to control or modify the growth of aquatic plants to protect human health, promote safety, enhance recreation and navigation while, to the greatest degree practicable, preventing injury to non-target plants, animal life, and property.

3.25 *Aquatic Plant Management Permit*: A document issued by the Lake County Department of Public Works to control nuisance aquatic vegetation under the provisions of this chapter.

3.26 *Backshore:* The zone extending landward from the high water mark to a height of 11.5 feet on the Rumsey Gauge, not to exceed 100 feet landward of the high water mark.

3.27 *Department:* The Lake County Department of Public Works.

3.28 *Emergent Aquatic Vegetation*. Plants that are rooted in the sediments, extend above the water surface and are self-supporting.

3.29 *Eradication Program*: A method for the control of non-native aquatic plants in which control techniques are utilized in a coordinated manner in an attempt to eliminate all the target plants on a permanent basis in a given geographical area.

3.30 *Fragments*: Pieces of aquatic plants that have been broken, as during mechanical/ physical control by hand, with assistance of a tool or machine or by harvesting boat.

3.31 *Foreshore*: The zone lying between the low water mark (0.00 feet Rumsey) and the high water mark (7.79 feet Rumsey). This zone is also the area of the Public Trust Easement that is defined in “Lyon v. State of California, 29 Cal. 3d 210.”

3.32 *Floating Aquatic Vegetation*: Free-floating plants which are not attached to the sediments and that float on the water surface or just below it. Most have roots that extend into the water for nutrient uptake. Rooted floating plants are attached to the sediment and have leaves that float on the water surface. These plants may or may not be self-supporting.

3.33 *Herbicide*: Any product designed to control vegetation by use of chemicals that restrict the growth of plants.

3.34 *High Water Mark*: For the purposes of this chapter, the high water mark for Clear Lake shall be as defined in Judgment No. 17806, County of Lake, State of California ex. rel., State Lands Commission v. M. Maroni Smith, trustee of U. A. Local 38, Convalescent Trust Fund; “The high water line of Clear Lake is the high water elevation of 7.79 feet, Rumsey Gauge Datum.”

3.35 *Lake*: Unless otherwise indicated, Clear Lake.

3.36 *Lakebed Maps:* Administrative maps of the shore of Clear Lake. Originally prepared by State Lands Commission and updated by Lakebed Management.

3.37 *Licensed Certified Aquatic Pesticide Applicator*: Pursuant to sections 407, 11701, 12976, 14005, 14102 of the California Food and Agriculture Code and section

6530 et seq. of Title 3 of the California Code of Regulations, a person who holds a current license issued by the State of California with the aquatic pest endorsement.

3.38 *Low Water Mark*: For purposes of this chapter, the low water mark for Clear Lake shall be as defined in Judgment No. 17806, County of Lake, State of California ex. rel., State Lands Commission v. M. Maroni Smith, trustee of U. A. Local 38, Convalescent Trust Fund; "The low water line of Clear Lake constituting the boundary between sovereign ownership and upland fee ownership is the elevation Zero (0.00) feet, Rumsey Gauge Datum as surveyed by the State Lands Commission and described in a set of maps titled "Maps of Low Water Line of Clear Lake, Lake County, California".

3.39 *Mechanical/Physical Control*: Any method for aquatic vegetation control during which plants are cut, torn or pulled out of substrate. Includes control by hand, with assistance of a tool or machine or by harvesting boat.

3.40 *Nuisance Aquatic Plant*: Any part, including but not limited to seeds or reproductive parts, of an aquatic plant, which has the potential to hinder the growth of beneficial plants, to interfere with irrigation or navigation, or to adversely affect the public welfare or the natural resources of Lake County.

3.41 *Person*: Individuals, firms, associations, joint ventures, partnerships, estates, trusts, business trusts, syndicates, fiduciaries, corporations, and all other groups or combinations.

3.42 *Pesticide*: Any chemical product registered for use in California to chemically control or regulate aquatic plant growth, pursuant to section 12753 of the Food and Agriculture Code.

3.43 *Public Trust Lands*: Pursuant to Chapter 639 of the Laws of 1973, of the State of California, the submerged lands in Clear Lake below the low water mark that are entrusted to the County of Lake, and to its successors.

3.44 *Rimland Property Owner*: A person who possesses fee title to property that includes the foreshore area of navigable waters and backshore areas.

3.45 *Riparian Vegetation (or shoreline riparian vegetation)*: Trees, shrubs and other plants that grow on Clear Lake beach areas within the nearshore or foreshore.

3.46 *Shorezone*: The area composed of the nearshore, foreshore, and backshore.

3.47 *Submersed Aquatic Vegetation*: Plants that grow completely below the water surface and depend on the surrounding water for support of the plant body.

3.48 *Supplemental Pesticide Use Report*: A report on herbicides used and area treated by permit, includes post treatment DO and temperature.

3.49 *Unviable*: Incapable of growing or developing.

3.50 *Zero Rumsey Gauge*: The level of Clear Lake as defined in the stipulated Judgment and Decree rendered October 7, 1920, in the Mendocino County Superior Court case, Gopcevic v. Yolo Water and Power Company, et al., as being 20.1 feet below the elevation of the center of a concrete star in the northeast corner of the Courthouse Park on Third and Main Street in Lakeport.

Sec. 26-4. Permitted Management Methods.

4.1 All activities shall be in compliance with state regulations as found in California Code of Regulations Title 3, Division 6, sections 6000-6920 and California Food and Agriculture Code, Division 6 and 7, sections 12751-13188.

4.2 Approved Herbicides.

A. Only the following program approved herbicides may be used and must be applied by a licensed applicator:

1. Glyphosate
2. Diquat
3. Copper compounds
4. Fluridone

5. Potassium salts of endothal
6. Triclopyr

B. All herbicide applications shall cease if and when water temperature reaches 80 degrees F (27 degrees Celsius) and/or the Dissolved Oxygen (DO) falls to 5ppm or below measured one foot below the surface, anywhere in the treatment area.

C. Proposed fluridone treatments within an active management location may be allowed with additional conditions specified by the California Department of Food and Agriculture.

4.3 The Department shall require the use of the herbicide which it determines has the least adverse effect upon human health, safety, recreational uses, non-target plants, fish and wildlife. In determining which pesticide shall be used the following criteria shall be considered:

A. Which herbicide will provide the greatest protection to human health, safety and recreational uses.

B. Which herbicide will provide the greatest protection to non-target plant and animal life.

C. Which herbicide will be the most effective at controlling the target plant species.

4.4 Mechanical and physical control activities must be conducted in such a way as to:

A. Not cause the spread of nuisance aquatic species.

B. Collect all fragments produced by the technique employed.

C. Dispose of fragments above the mean high water mark in such a way as to prevent reentry into any water, until such time as fragments are unviable.

D. Limit use of mechanical/physical techniques to areas ¼ mile or greater away from nearest Active Hydrilla Management Area.

Sec. 26-5. Aquatic Plant Management Permit Procedure.

5.1 No person shall undertake or carry out any of the management methods set forth in Sec. 26-4 within the nearshore or foreshore without first obtaining an Aquatic Plant Management Permit from the Department. This shall not apply to any pests or plants under quarantine or eradication by the State of California or any of its subdivisions.

5.2 Following notice to the permittee, the Department is authorized to amend a permit issued pursuant to this chapter during the term of the permit to restrict or limit the scope of the permitted activity. This shall be done if necessary to ensure the protection of human health, safety, recreation, plant and animal life and property.

5.3 A permit issued pursuant to this chapter may not be transferred to a new owner or assignee of the permitted property, unless the new owner applies to the Department for a permit transfer, signs an agreement for such transfer, and pays the required transfer fee.

5.4 If any changes, additions, or modifications to the permit are requested by the applicant, an application for a new permit may be required. Amendments shall not be considered as a permit extension.

5.5 Herbicide treatments require individual permits for each parcel.

5.6 Permits are valid only for the calendar year in which they are approved.

5.7 Fees. The Board of Supervisors shall establish, by ordinance, fees for an Aquatic Plant Management Permit, which shall be paid to the Department.

5.8 Applicants for any permit required pursuant to the terms of this chapter shall submit the application information and reports required to the Department or other public agency with jurisdiction. No permit shall be issued unless the application is complete and there is compliance with all the requirements of this chapter.

5.9 Permit Requirements:

A. The applicant shall submit a map of the proposed treatment area, including a diagram of the proposed area for aquatic plant management which shall be drawn on a Lakebed Map (scale: 1”=50’) specifying the following information:

1. Shoreline boundaries of the property.
2. All prominent features such as docks, etc. located near the shoreline.
3. Dimension of the control area.

B. The permit application shall be submitted according to the following requirements:

1. Each permit application shall be submitted on the Clear Lake Aquatic Plant Management Application, which is available from the Department.
2. All permit documents shall be submitted in an 8 1/2 by 11 inch format and be of good quality and clearly legible.
3. A permit application may be submitted by an agent of the property owner provided that the name, address, telephone number of the legal property owner, and agent is provided on the application.

Sec. 26-6. Review Process.

6.1 A copy of the permit application shall be forwarded by the Department to the County Agriculture Department for review and approval by the California Department of Food and Agriculture Hydrilla Eradication Program and the County Agriculture Commissioners Office. After return to the Department, staff will notify permit applicant of status.

Sec. 26-7. Permit Approval.

7.1 A permit for an activity listed in section 26-4 shall not be approved unless the Department determines that the issuance of the permit is in the public interest, and that the permit is necessary to enhance fishery, commerce and navigation and lake access derived from the activity, and that the activity is otherwise lawful.

7.2 In considering a permit application, the Department shall give serious consideration if other agencies deem the proposed aquatic plant management action unnecessary. The findings of the opposing agency shall be considered prior to permit issuance.

7.3 A permit shall not be issued unless it is shown that an unacceptable disruption will not result to the aquatic resources. In determining whether a disruption to the aquatic resources is unacceptable, the criteria set forth in this chapter shall be considered.

7.4 Permits are not valid until permit applicant or an authorized agent acknowledges and agrees in writing to each and every condition.

Sec. 26-8. Conditions of Permit.

8.1 Conditions of Herbicide Permits shall comply with Section 26-4.1 through Section 26-4.3 and the following provisions:

A. Treatment shall be limited to no more than 30 percent of the area designated by a continuation of property lines lakeward of shore for 300 feet except where:

1 .The property is owned by a public entity and is operated primarily to provide public access to the lake.

2. Commercial property that is primarily operated for the purpose of providing recreational and navigational access to the lake.

B. Best Management Practices (BMP's) for Aquatic Herbicide use shall be followed.

C. The Department shall require the permittee to post the treated area prior to treatment according to conditions included in the permit and/or herbicide label. Permits that have posting requirements prior to conducting aquatic weed management activity of the treatment area shall provide as follows:

1. Signs shall be posted along the shoreline of the treatment area not more than 100 feet apart. To allow for drift of a chemical, the adjacent shoreline shall also be posted, if allowed by the adjacent landowners.
2. Posting requirements at public and commercial facilities shall require signs posted in conspicuous locations, such as at the entrances, boat ramps and docks.
3. Posting of signs shall be accomplished with a printed sign approved by the Department, which shall include the permit number, the name, address and telephone number of the person, organization, or certified applicator conducting the treatment, and the name of the chemical or chemicals used and restrictions on the use of treated water pursuant to the permit, if applicable.

E. The Department may require the permittee to proceed with aquatic plant management activity only if a Department representative is present.

Sec. 26-9. Incomplete Permit.

9.1 Any Permit Application for Aquatic Plant Management without sufficient information to adequately review a proposal or use may be rejected by the Department within thirty (30) calendar days from the date of receipt by the Department.

Sec. 26-10. Denial of Permit.

10.1 The Department shall deny a permit application in any of the following circumstances:

A. The proposed use of a chemical product is inconsistent with its label.

B. The application proposes treatment of too large an area.

C. The application proposes treatment inconsistent with the CDFA Hydrilla Eradication Program.

D. If an applicant has committed 2 or more violations of other permits previously issued, conditions of a permit, or these rules within one (1) calendar year and has not cured said violation after written notice by the Department to cure said violations.

E. The cumulative total of proposed treatments exceed the established maximums allowed in the program.

Sec. 26-11. Revocation or Suspension of Permit.

11.1 The Department may revoke or suspend an active permit on notice by certified mail to the permittee, in any of the following circumstances:

A. Submission of false or inaccurate information in the permit application.

B. A violation of permit conditions, Sections 26-4 through Section 26-9, or any other applicable federal, state or local regulation.

C. Failure to file a complete, accurate and legible Supplemental Pesticide Use Report within 15 days of the end of the month in which herbicide treatment occurred.

11.2 The notice shall specify the grounds for the suspension or revocation.

Sec. 26-12. Enforcement.

12.1 It shall be the duty of the Department to enforce the provisions of this chapter. Following notice as required by Section 26-11, the Department may revoke or suspend an Aquatic Plant Management permit when any of the circumstances set forth in Section 26-11.1 exists. A person whose permit is suspended or revoked may appeal the action to the Board of Supervisors pursuant to the provisions of this chapter. All operations shall cease during the time which the permit is suspended or revoked.

12.2 A violation of any provision of this chapter is punishable as an infraction by a fine not exceeding one hundred dollars ($100.00), or as a misdemeanor by a fine of not more than five hundred dollars ($500.00), or by imprisonment in the County jail for a period of not more than six (6) months, or by both such a fine and imprisonment. Each and every day during any portion of which any violation of this chapter is committed, continued, or permitted shall be deemed a separate offense.

Sec. 26-13. Arrest and Citation Powers.

13.1 The following officers and employees of the County of Lake are hereby given arrest and citation powers pursuant to Section 836.5 of the Penal Code:

A. Director of Public Works.

B. Assistant Director of Public Works

C. Clear Lake Lands Coordinator.

D. Water Resources Program Manager

E. Engineering Technician

F. Agricultural Commissioner

G. Deputy Agricultural Commissioner

H. Agricultural Biologist

I. Community Development Director

13.2 The above named officers and employees shall enforce the provisions of this chapter and all other laws related to Aquatic Plant Management.

Sec. 26-14. Non-enforcement Appeals.

14.1 In General. Any non-enforcement action or determination by the Department under the terms of this chapter shall be final in the absence of an appeal.

14.2 Department Action. Any non-enforcement action or determination by the Department may be appealed to the Board of Supervisors by any party of interest as follows:

A. An appeal may be filed in writing within fourteen (14) calendar days of the action or determination.

B. The appeal must be filed with the Clerk of the Board of Supervisors.

C. Payment of the appropriate fee must accompany the appeal.

The Clerk of the Board of Supervisors shall set a hearing for said appeal and mail to the appellant written notice of the time, date and place of said hearing at least fourteen (14) calendar days prior to said hearing. The Board of Supervisors may affirm, reverse, or modify the determination of the Department. The action of the Board of Supervisors shall be final.

Sec. 26-15. Enforcement Appeals.

15.1 The Board of Supervisors shall have the power to hear and decide administrative appeals based on the enforcement or interpretation of the provisions of this chapter. Appeals of enforcement actions which consist of the issuance of a citation for a violation of this chapter shall not be allowed.

15.2 A written notice of violation or stop work order issued by a County Official or authorized employee may be appealed to the Board of Supervisors as follows:

A. The appeal must be filed in writing within five (5) working days of receipt of the notice of violation or stop work order.

B. The appeal must be filed with the Clerk of the Board of Supervisors.

15.3 Upon receipt of such administrative appeal and any required fee, the Clerk of the Board of Supervisors shall set the matter for hearing at the next available regularly scheduled meeting of the Board of Supervisors. Notice of the time, date and place of the hearing shall be provided to the appellant at the time of filing the appeal.

15.4 The Board of Supervisors shall render its decision at the close of the hearing.

15.5 The Board of Supervisors decisions on all enforcement appeals shall be final."

SECTION 3:

The amounts set forth below are hereby established as the fees for the Nuisance Aquatic Plant Management permits issued by the Department and appeals pursuant to Chapter 26 of the Lake County Code. The Department shall collect the fees set forth below before issuing permits.

♦ Aquatic Weed Herbicide Permit $100.00

To be distributed as follows:

DPW – Water Resources $100.00

- ♦ Aquatic Weed Mechanical Harvest Permit $ 27.00

  To be distributed as follows:

  DPW – Water Resources $ 27.00

- ♦ Permit Transfer $15.00

  To be distributed as follows:

  DPW – Water Resources $ 15.00

The Clerk to the Board of Supervisors shall not accept an appeal until the following fee has been collected:

Administrative Appeal Fee $250.00

SECTION 4:

The fees set forth below are hereby established as the fees for services for public agencies as defined in Government Code 6103.7 by the Department of Public Works. The Department of Public Works shall collect from such public agencies fees for inspecting and monitoring aquatic weed permits as follows:

1. Actual costs necessarily incurred for inspections and monitoring, including but not limited to :
   a. Hourly charges for employee time
   b. Materials testing
   c. Outside professional services
   d. Mileage charge for employee travel

SECTION 5:

This ordinance is an urgency ordinance for the immediate preservation of the public health and safety and shall take effect immediately in accordance with Section 25123 of the Government Code of the State of California. The facts constituting such urgency are: The season for nuisance aquatic plants is imminent and unless this ordinance becomes effective immediately no process will exist for the management of nuisance aquatic plants. Nuisance aquatic plants are a detriment to the public health and safety for the public boating and recreational use of Clear Lake. Nuisance aquatic plants, if allowed to spread without management, will limit access to and use of Clear Lake for commerce, navigation and recreation and cause an economic hardship since tourism is a significant industry in Lake County.

SECTION 6:

The Board of Supervisors finds this ordinance is exempt from the California Environmental Quality Act because it falls within Categorical Exemption Class 7.

SECTION 7:

All ordinances or parts of ordinances or resolutions in conflict herewith are hereby repealed to the extent of such conflict and no further.

SECTION 8:

This ordinance shall take effect immediately, and before the expiration of fifteen days after its passage, it shall be published at least once in a newspaper of general circulation printed and published in the County of Lake.

/ / /

/ / /

/ / /

/ / /

/ / /

/ / /

/ / /

/ / /

The foregoing ordinance was introduced before the Board of Supervisors on the 18th day of March, 2003, and passed by the following vote on the 18th day of March, 2003.

AYES: Supervisors Robey, Smith, Farrington, Brown and Lewis

NOES: None

Absent: None

ATTEST: KELLY COX — COUNTY OF LAKE

Clerk to the Board

By:___________________________ — ______________________________ Chair, Board of Supervisors

Deputy

APPROVED AS TO FORM:
CAMERON REEVES
County Counsel

By:___________________________

\\PWSERVER\DATA\DPW\DATA\08FLOOD&.LKB
\Aquaticplants\Aquatic Plan Mgmt Ordinance 2-19-03.doc

Appendix K

Managing Aquatic Plants Task Force (MAP)

Overview of Proposed Recommendations

This one-page overview provides a summary of a proposed interim plan. The remainder of this interim plan defines the basis for these recommendations.

Managing Aquatic Plants Task Force Mission

It is our mission to develop an effective, consensus-based plan of aquatic plant management for Clear Lake which balances the needs of local residents, lakefront property owners, civic, and business leaders, regulatory agencies, and the recreational public with the habitat needs of fish and wildlife.

--Managing Aquatic Plants task force, Nov. 29, 2000

Summary of Recommendations

The Managing Aquatic Plants task force recommends the County of Lake adopt management programs that will allow varied recreational uses of the lake by stakeholders as follows:

1. adopt by ordinance, a streamlined, single-point permitting process for aquatic weed control projects.

2. adopt programs to promote restoration of native riparian vegetation.

3. develop comprehensive maps to provide data necessary for management decision-making.

4. support erosion control and encourage additional sewage collection systems in the lake's watershed because of their impact to nutrient loading in Clear Lake.

5. educate its citizens in order to promote more effective lake watershed management.

6. recommend the Clear Lake Management Plan include hiring a freshwater ecologist, limnologist, or warm-water fishery biologist to work full-time on the many lake and watershed issues to ensure future health of the lake from a broad, lakewide perspective.

7. continue to actively cooperate with the Hydrilla Eradication project conducted by the state department of food and agriculture and any other such effort in the future.

Short Term Management Goals

Plant Control Strategy Objectives
The following objectives shall guide short-term (one-two years) management:

Management of aquatic plants on and in Clear Lake shall be based on the multiple use concept. This means all uses of the water and littoral zone shall be considered in any management action.

Ensure lake users reasonable and easy access to the lake.

Define use zones to delineate areas of special biological significance for protection from weed control activities. Such maps shall be affixed as appendices for inclusion in this General Plan for Aquatic Plant Management, to serve as data sources in permitting processes and/or consideration in defining long-term strategies.

Include these maps as part of the educational program as well.

Provide permittees the most appropriate methods guidelines for aquatic plant management in order to reduce unnecessary damaging effects on the lake ecosystem.

Define a single-point permitting process for lakefront property owners who wish to control the submerged aquatic weeds within the littoral zone of Clear Lake adjacent to their property. Such permit process shall be completed in a timely manner and be compliant with all applicable law.

Develop a list of data needs or studies prerequisite to preparing the programmatic Environmental Impact Review (EIR) for local aquatic plant management permitting program. Facilitate discussions with various community-based, regional and other affected organizations.

Create a monitoring program so that ongoing aquatic weed control projects are observed and relevant data recorded.

Include provisions to create a public forum for the evaluation of this plan on a semi-annual basis for the duration of its implementation.

As short term plans are redrawn and updated, the current status of noxious weed issues – such as hydrilla or possibly new invasive species—must be considered. Any short term strategy planners must first educate themselves as to current issues on the lake.

Long Term Management Solutions

<u>Streamlined Single-point Permit Process</u>*(Under construction)*

The County Agricultural Commissioner will oversee the permitting process as defined in "Short term Management Solutions," and coordinate agency participation.

Urge the Clear Lake Advisory Subcommittee (CLAS) or other standing committee advisory to the Board of Supervisors to maintain communication with and consider the needs of aquatic plant issue stakeholders as defined in this document.
Develop a list of long-term needs of each user group, and define where conflicts arise. Establish minimum requirements of each user group.

Encourage decision-makers to define the legal, institutional, and environmental constraints that affect local management of aquatic plant communities before attempting any management action

Recommend CLAS and other decision-makers develop an understanding of the lake's ecology in consideration of any management action. Determine and evaluate to the extent possible interactions of the Lake and its living parts including current and proposed treatments.

Maintain comprehensive maps (GIS) depicting data relevant to land use around the lake; human uses of the lake; aquatic plant mats; water content or quality; wildlife habitat; substrate; hydrilla finds and treatment areas; and subsequent aquatic plant management areas.

Encourage planners and aquatic plant managers to establish use zones--areas of special biological significance or areas of greatest public benefit within the lake's perimeter

Identify methods/treatments of vegetation management, cost effectiveness of varying treatments and other pertinent variables. Develop a draft of "Appropriate Management Methods."

Develop monitoring, tracking and evaluation components for long term plan.

Develop educational outreach program/publications for long term plan.

Identify and pursue funding sources to help accomplish various objectives.

Define permit process for individual, commercial and other entities.

Sponsor public forums annually to present and discuss the plan.

Lakewide Algae/Plant control

Entertain discussion or provide a forum for new, alternative, or innovative ideas regarding Clear Lake algae and plant issues. Such forum could be part of the semi-annual review provided in other sections of this plan.

Watershed-wide strategies

*(Under construction)*Recommend the Clear Lake Management Plan include hiring a fresh water ecologist, limnologist, or warm water fishery biologist to work full-time on the multitude of lake and watershed issues to ensure the future health of the lake from a broad, lakewide perspective. Consideration should include:

aquatic plants
algae
fish population dynamics
fish speciation
other factors affecting water quality
relationships among the above
coordination among agencies

adopt the Habitat Restoration Rewards program with the two-fold goal of permanently increasing native riparian vegetation and providing property owners relief from aquatic weed nuisance. Adopt other programs to promote restoration of native riparian vegetation.

Education

> "Lake Neighborhood" civic groups are a logical forum to be pursued at the county level. The lake perimeter is easily divided into five "Neighborhoods." Property owners, residents and business people in these areas could form local groups for education as well as some "Public input" sessions possibly to help disseminate information about lake management, any permitting process etc. If the plan involves boat lanes or other micro-drawing actively involvement of the locals or "folks on the front lines" will be crucial.

The Five Neighborhoods, defined using the hydrilla project map zones:

1-20 Lakeport
21-36 North Shore
37-46 Oaks Arm
47-70 Clearlake Arm
71-80 Kelseyville

Other educational projects…(Incomplete):
Series of articles in local newspapers
Brochure
One-day workshop on lake ecology focusing on plants
Radio programs

MAP task force Recommendations

The Managing Aquatic Plants task force recommends the County of Lake:

1. Adopt by ordinance, a single-point permitting process streamlining the requirements for private, commercial and public entities to control nuisance aquatic vegetation adjacent to their properties. The ordinance changes would provide the county, through the department of agriculture, the management control necessary for broad oversight. Several state and federal agencies and departments have responsibilities that might be affected when vegetation is controlled. The permitting process will be developed with interagency agreement. (Details of the current permit structure shall be maintained in Appendix X)

2. Adopt the Habitat Restoration Rewards program with the two-fold goal of permanently increasing native riparian vegetation and providing property owners relief from aquatic weed nuisance. Adopt other programs to promote restoration of native riparian vegetation.

3. Develop comprehensive maps to provide accessible data necessary for management decision-making; support in any way possible the studies, research and experimentation necessary, as described in the Short Term and Long Term Management Solutions sections of this plan, to supply data to create those maps.

4. Support erosion control and encourage additional sewage collection systems in the lake's watershed because of their impact to nutrient loading in Clear Lake. Heed the recommendations of the Clean Lakes Project, as defined in its executive summary, particularly those concerning erosion control.

5. Implement an educational program including Lake Neighborhoods etc. in order to promote more effective lake watershed management.

6. Recommend the Clear Lake Management Plan include hiring a fresh water ecologist, limnologist, or warm water fishery biologist to work full-time on the many lake and watershed issues including fish population dynamics; factors affecting water quality; and the relationships of plankton, aquatic plants, fish, water quality etc. to ensure the future health of the lake from a broad, lakewide perspective.

7. Continue to actively cooperate with the Hydrilla Eradication Project managed by the California Department of Food and Agriculture and any other such effort in the future.

--Managing Aquatic Plants task force, April 18, 2001.

Appendix L

General Types of Aquatic Plant Management Problems

General Types of Aquatic Plant Management Problems

Issues can be categorized in economic, ecological, sociological and regulatory. Aquatic macrophytes can be beneficial or problematic in aquatic systems depending on the defined uses of the aquatic systems (Table 1). Because lakes and reservoirs can not be all things to all people, even the macrophyte abundance within a given lake can be beneficial or problematic depending on one's use of the lake or reservoir

Even when reasonable people join to help shape a management strategy for a water body, several elements inevitably come into conflict. Among the more obvious are differences in desired uses for the water from each of the various interest groups, and varying degrees of knowledge about water quality, fisheries management, and aquatic plant management options. Another important difference can be simply our own level of experiences with aquatic and wetland plant management problems.

It is probably safe to say that no two people see exactly the same things when they assess a water body. Long-term residents who have witnessed algae blooms or coontail mats come and go will probably react very differently than new arrivals to the neighborhood that have never before seen the dramatic changes that can occur in a dynamic lake. For example, the loudest voices at the homeowner's association meeting may be from the members unable to remember how extensive the blue-green algal slicks were before the improvements in water clarity. Others may simply have never recreated or lived around water before, and may be very unsure about exactly what constitutes a serious problem, and what is a normal occurrence.

To further complicate the situation, things that look like problems may not be, and seriously degraded conditions may not attract any attention at all. We humans are extremely visually oriented, and can be easily impressed by rather small changes. Doubling of a water primrose infestation from 50 to 100 feet of shoreline over a two-year period may mean something dramatic is happening to water depth. Is sediment filling in the bottom or is it simply the re-invasion following last year's mechanical removal project? Regardless, the expansion of primrose will probably be noticed by many, unlike the subtler and probably far more important changes that may be taking place to the water chemistry of the lake. Reliable historical information, collected in an appropriate manner by knowledgeable people, can do more than almost anything else to resolve discussions of "what is happening to the lake?" A coordinated and comprehensive water quality monitoring program supplemented by a citizen volunteer programs can yield valuable information to help guide lake management decisions.

The purpose of this section is to identify types of aquatic and wetland plant management problems, both to inform ourselves about the many issues and options involved, and to help recent arrivals to the lakefront gain a better understanding about how serious their "own" particular problems are or are not.

Finally, If Lake Management staff believes in a different management strategy than the user groups, it may ultimately be the politicians that determine the outcome. Recognizing that there is science, there is human experience, there are disparate interests, and that these are rarely isolated from each other is an important part of learning about resolution of aquatic and wetland plant management problems.

Impact of Varying Aquatic Macrophyte Abundance on Some Lake Uses

Lake Use **Macrophyte Abundance**

Consumptive Uses	*Zero*	*Moderate*	*High*
Drinking Water	(-,+)	(-,+)	(-,+)
Power Production	(+)	(-,+)	(-)
Irrigation	(+)	(-)	(-)
Flood control	(+)	(-,+)	(-)

Navigation	*Zero*	*Moderate*	*High*
Commercial	(+)	(-,+)	(-)
Recreational			
Power Boating	(+)	(-,+)	(-)
Sailing	(+)	(-)	(-)
Rowing	(+)	(-,+)	(-)

(-), Problematic; (+), beneficial; (-, +), both problematic and beneficial depending on circumstances

Lake Use **Macrophyte Abundance**

Aesthetic Properties	Zero	Moderate	High
Property Values	(-,+)	(-,+)	(-)
Scenic Values	(-,+)	(-,+)	(-,+)
Health	(-,+)	(-,+)	(-,+)
Body Contact (Swimming)	(+)	(-,+)	(-)
Education	(-,+)	(-,+)	(-,+)
Scientific	(-,+)	(-,+)	(-,+)

Flora and Fauna	Zero	Moderate	High
Fishing	(-,+)	(-,+)	(-)
Hunting	(-,+)	(-,+)	(+)
Non-Consumptive Viewing	(-,+)	(-,+)	(-,+)
Species Composition	(-,+)	(-,+)	(-,+)
Plants	(-,+)	(-,+)	(-,+)
Invertebrates	(-,+)	(-,+)	(-,+)
Mollusks	(-,+)	(-,+)	(-,+)
Reptiles	(-,+)	(-,+)	(-,+)
Amphibians	(-,+)	(-,+)	(-,+)
Fish	(-,+)	(-,+)	(-,+)
Birds	(-,+)	(-,+)	(-,+)
Mammals	(-,+)	(-,+)	(-,+)

(-), Problematic; (+), beneficial; (-, +), both problematic and beneficial depending on circumstances

Tables modified from Canfield and Hoyle

Sport Fishing

The impact that aquatic plants have on fish populations is visible and can be measured given the money, equipment and time. The impact that aquatic plants have on fishing is also visible but not so easy to measure. Anglers who are used to fishing the edge of aquatic plant mats for largemouth bass are usually distraught and their catching decreases when that habitat is controlled. High numbers of largemouth bass may be present in a water body, and individual fish weight may be in the trophy category, but if angling methods and physical access do not match the water body's sports fish patterns, catch may be very low. Largemouth bass are typically found in or around something physical, including changes in bottom slope, dead trees, etc. When rooted aquatic plant coverage in a lake is high, largemouth bass forage among openings in the weed mats. This pattern is one that can be observed easily, and catching of bass from openings in dense weed mats is a standard successful practice in many reservoirs and lakes. If vegetation is reduced, however, anglers often maintain their standard angling techniques, both in fishing location and in baits, while the largemouth bass are returning to their former habits of association with topographical features. Successful anglers adapt as conditions change and take of sports fish may have more to do with angler patterns than with the number, type, or dominance of the aquatic vegetation present. While it may be inconvenient to change angling techniques, the presence or absence of aquatic vegetation in this example is only a problem if the angling population views it as such. There are several cases where aquatic vegetation can be a problem to all fishing regardless of the angling methods. Most of these are physical blockages of access for people with boats or bank fishing for people without boats. Aquatic macrophytes can also cause fish kills by contributing to oxygen depletions and it is hard to catch fish when there are few fish in the lake.

Invisible Problems

Invisible problems, like insect born diseases that could be linked to aquatic plants may be the most difficult aquatic plant problems to define and resolve. Aquatic plants can also change water chemistry slightly, yielding invisible behavioral changes in the biological components of an aquatic system. For example, abundant aquatic vegetation can decrease dissolved oxygen in the water that impacts fish feeding patterns that may cascade through an entire aquatic system. These are difficult problems to understand, let alone incorporate into a management plan. Thus, it is important for all parties helping to develop a management plan to have at least a general understanding of what's going on in the water that we can't "see," why and how it is measured, and what the measurements tell us.

Insects, Diseases, and Other Problems

Each year, a number of cases of equine encephalitis and West Nile Virus (WNV) are reported to disease centers in the U.S. Mosquitoes carry these diseases, and several other equally dangerous diseases. Mosquitoes and other insects find suitable breeding sites in slow moving waters found in

many aquatic systems. Successful recruitment of mosquitoes and other insects into biting adults requires the escape of immature larval stages from predators.

Aquatic plants can provide excellent mosquito hiding areas in the slow moving water. Roots of water hyacinth often shelter numerous organisms, and thick mats of submersed vegetation can screen prey items from hungry fish and invertebrate predators. Reduction of thick aquatic plant growth may not reduce the number of eggs laid in a particular area, but it may allow small fish and invertebrates the opportunity to feed on mosquito eggs, larvae, and emerging adults.

Insect problems related to aquatic plants are not really "invisible," since some simple observations can often identify the types and general amounts of larval insects in a water body. Lake County has a Vector Control District (LCVCD) (Mosquito Abatement) that performs assessments of mosquito levels. In addition to observations of the water body, LCVCD also conducts sophisticated examinations of the disease levels within the insect vector populations. LCVCD have raised issues over certain shoreline vegetation (creeping water primrose) being a vector control problem for the mosquito vector of West Nile Virus.

"Swimmer's itch" is a skin irritation associated with water contact. The organisms that cause swimmer's itch are highly varied, but some are part of a life cycle between parasites and animals. In one example, a trematode uses birds, fish and some invertebrate (e.g., snail, clam, or worm) to complete its life cycle. At one stage in the cycle a free-swimming cercaria actively seeks to penetrate a host, which is usually a bird or fish, to form metacercaria. The free-swimming cercaria are also able to penetrate human skin just enough to cause a reaction, either a physical reaction to the invasion, or an actual allergic reaction. Populations of the snails are often very high in reservoirs and lakes with large aquatic plant populations. Control of aquatic plants is often used as a first step in reducing this collection of organisms. Although, few cases have been reported in Clear Lake, other water bodies in the county have had documented cases reported.

County staff collecting D.O. and Temperature readings associated with Aquatic plant management activities.

Dissolved Oxygen

Living in an atmosphere that readily and regularly mixes thoroughly, we don't often stop to think about the distribution of oxygen and its levels of availability for us to breathe, at least until we climb to 10,000 ft or higher. Even in fairly confined spaces (cars, homes, closed offices), enough air exchange normally occurs with the "outside" to keep oxygen deprivation from being a recognized problem. It is a very different story in water. Oxygen moves very slowly through liquids. The bottom layer of a deep lake might have almost no oxygen at all. We could then see fish and invertebrates avoiding the oxygen depleted water; possibly moving into it briefly, but then moving to more oxygenated water very quickly. If we could somehow get very close to oxygen depleted water, we might see small organisms, even some fish, dying as they lost muscle control before getting to better quality water.

How do aquatic plants affect oxygen concentrations in a water body and can they cause a problem? A difficult concept to grasp for many is that plants need oxygen just like animals, and plants can also die under very low oxygen conditions. If plants photosynthesize (produce their own food from sunlight, carbon dioxide, and an impressively complex set of associated chemical products, enzymes and reactive surfaces), which yields oxygen as a by-product, why do they need oxygen? The answer is very simple: they need oxygen for exactly the same reasons that animals need oxygen, to allow the complete breakdown of energy storage products to release chemical products for growth, and energy for chemical reactions (respiration).

Plants use carbon dioxide and sunlight to photosynthesize energy storage products (sugars and starches), but to use those products efficiently, they, like animals, must have access to oxygen. In a 24-hour period under situations of low light like cloudy days, the amount of oxygen used in respiration exceeds the amount produced in photosynthesis. If the situation persists, oxygen depletions can occur drastically affecting all organisms in the area. Managing aquatic plants at a moderate abundance can reduce the probability of having oxygen depletions caused by aquatic plants during cloudy weather.

The control of aquatic plants that leaves the dead plants in an aquatic system can also create an oxygen problem. Dead aquatic plants are no longer supplying oxygen through photosynthesis and bacteria use oxygen as they break down the aquatic plants causing oxygen depletion. This information should always be considered whenever the management of aquatic plants is planned.

Dead fish resulting from oxygen depletion in thick bed of aquatic plants

Appendix M

Internet Resources

RESOURCE LIST - INTERNET SITES

Center for Aquatic and Invasive Plants
University of Florida Gainesville, FL
http://aquat1.ifas.ufl.edu/

National Biological Survey
Nonindigenous Aquatic Species
http://www.nfrcg.gov/nas/nas.htm

North American Lake Management Society
http://www.nalms.org/

US Army Engineer Waterways Experiment Station
Vicksburg, MS
http://www.wes.army.mil/

U.S. Department of Agriculture
http://plants.usda.gov

USDA Aquatic Weed Laboratory
Davis, CA
http://veghome.ucdavis.edu/aquaticweed/aquatic.htm

Washington State Department of Ecology
Aquatic Plant Management Program
http://www.wa.gov/ecology/wq/plants/aquahome.html

Aquatic Plant Management Society
http://www.apms.org

Appendix N

Harvester Manufacturers

List of manufacturers of conventional harvesting equipment for aquatic plant control in open water areas.

Company	*Address*	*Phone and Fax*	*Web Site and Email*	*Products*
Aquamarine	1444 S. Waukesha Waukesha, WI 53186	262-547-0211 phone 262-547-0718 fax	www.aquamarine.com weedharvesters@aol.com	harvesters, trash skimmers, transporters, shore conveyors
Aquarius Systems	200 N. Harrison St North Prairie, WI 53153	800-328-6555 phone 262-392-2984 fax	www.aquarius-systems.com info@aquarius-systems.com	harvesters, trash skimmers, transporters, shore conveyors
Texas Harvesting	4443 Mammoth Grove Rd Lake Wales, FL 33853	863-696-7200 phone 863-696-2922 fax	www.texasaquaticharvesting .com info@texasaquaticharvesting .com	large-capacity harvesters, transporters, shore conveyors
United Marine International LLC	700-76 Broadway PMB 301 Westwood, NJ 07675	201-664-7500 phone 201-664-7501 fax	www.trashskimmer.com LShenman@aol.com	harvesters, trash skimmers, transporters, shore conveyors

Note: List based on information available to writers as of spring 2003. Any omission unintentional.

Appendix O

List of Aquatic Herbicide Manufacturers

LIST OF AQUATIC HERBICIDE MANUFACTURERS AND CONTACT INFORMATION.

Manufacturer	Address	Telephone and Fax	Website	Herbicide Trade Name	Active Ingredient
Applied Biochemists	W175 N11163 Stonewood Dr, Suite 234 Germantown, WI 53022	800-558-5106 phone 262-255-4268 fax	www.appliedbiochemists.com	NAVIGATE CUTRINE	2,4-D BEE Copper
Cerexagri, Inc.	630 Freedom Business Center, Suite 402 King of Prussia, PA 19406	800-438-6071 phone 610-491-2801 fax	www.cerexagri.com	AQUATHOL K HYDROTHOL 191 AQUAKLEEN	endothall endothall 2,4-D BEE
Griffin, LLC	2509 Rocky Ford Rd Valdosta, GA 31601	800-242-8635 phone 912-244-5813 fax	www.griffinllc.com	AVAST!	fluridone
SePRO, Corp.	115560 N Meridan St, Suite 600 Carmel, IN 46032	800-419-7779 phone 317-580-8290 fax	www.sepro.com	SONAR AS SONAR SRP SONAR PR RENOVATE	fluridone fluridone fluridone triclopyr
Syngenta, Inc.	1800 Concord Pike Wilmington, DE 19850	302-476-2000 phone	www.syngenta-us.com	REWARD	Diquat
Dow AgroSciences	Indianaplois, IN 46268	317-337-3000	www.dowagro.com	RODEO GARLON 3A	glyphosate triclopyr

Appendix P

Funding Options

Funding Options

Introduction

The question of how to pay for aquatic plant management is a recurring theme for many communities addressing lake management issues. Appendix M illustrates a variety of short- and long-term financing opportunities that may be pursued to implement watershed management activities. Appendix M is divided into 2 sections: local financing tools and grant-funding opportunities.

The following section describes specific financial mechanisms that the County may consider to raise revenue to dedicate to funding environmental protection. Tools for raising revenues for environmental protection at the local level are diverse and continually expanding. This section discusses the following local finance tools:

LOCAL FINANCE TOOLS

Taxes

Taxes are the largest source of revenue for state and local spending and are imposed on individual and business income and property, and commodity sales. Taxes typically have a broader revenue base than other types of financing tools and therefore can generate high revenues at relatively low rates. Dedicating a surcharge on an existing tax to environmental programs, or even a percentage of existing taxes, involves little additional administrative cost. Local governments sometimes can pass a “piggyback” tax on existing state taxes, generating local revenue. Typically income, property, and sales data are already reported, thus further reducing administrative costs of new surcharges. Public opposition to new or increased taxes often hinders legislative passage. Unlike fees, many taxes are used for general budgetary support and historically have remained undedicated to particular programs, with clear exceptions such as gasoline taxes. Frequently, institutions do not exist for arranging the dedication of taxes to particular programs, or there may be constitutional or statutory limitations on dedication, or earmarking, as it is often termed. Depending on the market in question, some taxes may be inappropriate financing mechanisms for those activities that require a predictable amount of revenue every year. Tax bases may shrink as a result of general economic conditions or behavioral responses to tax imposition, such as conservation of product use or product substitution in the case of some selective sales taxes. Also, unless the tax is targeted to a particular type of property, income or sales, there is only an indirect relationship between the tax base and use of funds—what is termed a weak cost/benefit relationship (EPA 1999).

General Taxes

A general tax is a tax whose burden falls upon very broad sections of the general public, such as wage earners or property owners. State and/or local general taxes are charged against personal and corporate income, property, and commodity sales. Income taxes are levied as a percentage of the money earned by an individual wage earner or corporation. Property taxes are based on a percentage of the value of property owned. General commodity taxes, called sales and use taxes, are imposed as a percentage of the commodity value, or as a flat rate per transaction, and are contrasted with selective sales taxes. General taxes may fund environmental projects through earmarking or specific tax surcharges or add-ons.

Historically, states have set the rules for how local governments are organized and conduct their affairs, including raising money. Recently however, localities have appeared more active in seeking and receiving more finance discretion for increasing taxes.

General taxes typically have a broader revenue base than other revenue sources and therefore can generate high revenues at relatively low rates. Not only is the tax base large, but income tax rate structures typically are graduated, or proportional, thus increasing equity. Sales and property taxes are more regressive. When local support is high, temporary local tax surcharges may be an effective environmental financing avenue.

Imposing or increasing general taxes generally requires legislative action, and public opposition often hinders its passage. Because general taxes are not aimed at a particular type of environmentally related property, income, or transaction, there is only an indirect relationship between the tax base and the use of the funds (i.e., a weak cost/benefit relationship). General taxes are a more traditional source of revenue for programs such as education and social services, and thus may be already "tapped out." It may be difficult to safeguard the earmarking of portions of general taxes for environmental purposes over time, because the competition from other programs will persist. A serious concern is whether earmarking general tax revenues constitutes sound budgetary and fiscal policy, because earmarking constrains current policy makers' ability to direct funds where they may be most needed, or demanded, at any particular time.

Historically, general taxes have not been the best source for environmental funding compared to revenue sources aimed at more specific products or activities with a more direct relationship to the environment. In particular, state earmarking has been rare. However, in recent years states have granted localities more authority to levy tax surcharges or add-ons that have been dedicated to the environment, especially parks and conservation (EPA 1999).

Sales and Use Taxes

Described as the cornerstone of the state-local revenue system in virtually every region of the country, the sales tax is the second largest source of income for state and local governments and typically the most popular tax among voters. Local park and open space sales tax set-aside measures have proved successful in numerous instances.

Sales taxes offer local communities several advantages as park and open space funding tools. They are relatively easy to collect, as most local governments piggyback their portion of the tax onto the state tax, and the total sum is collected at the register. Reporting costs are also fairly low, and although revenues fluctuate with the economy, a small percentage can usually generate substantial revenues for everything from park maintenance to recreational improvements to open space acquisition.

Sales taxes are either general or specific in form. General sales taxes are levied on the sale of goods or services at the retail level. Specific, or selective, sales taxes are imposed on specific items such as alcohol, tobacco, and gasoline, and revenues are often earmarked for specific projects (Hopper 1998).

Selective sales taxes include all other sales and use taxes that are not applied to the general public as a whole. These taxes are sometimes termed excise taxes. They are levied either as a percentage of the sale or price of the item, or as a flat charge per item. The Transient Occupancy Tax, generally imposed on lodging fees and borne by tourists, is an example of a selective sales tax. Occupancy taxes could be used to finance operating costs for parks and natural areas that attract tourists. For example, Flagstaff, Arizona has a 0.2% 10-year tax on hotels, bars, and restaurant charges dedicated to beautification, greenways, and trails, as well as marketing and economic development. Other selective sales taxes include:

alcoholic beverage taxes
amusement taxes
energy taxes
fertilizer/pesticide taxes
green product taxes*
hard-to-dispose taxes*
hotel and resort taxes*

insurance premium taxes
litter control taxes
marine and aviation taxes
miscellaneous selective sales taxes
motor fuel taxes*
motor vehicles sales and registration taxes
petroleum products taxes
real estate transfer taxes*
rental car taxes
tobacco taxes*
watercraft sales taxes
*most highly rated mechanisms by the EPA

Compared to general sales taxes, selective sales taxes have been used more widely by states and localities. Some selective sales taxes are collected annually at the point of production, as opposed to the point of sale, to enhance administrative efficiencies in collection. For example, gasoline taxes typically are paid by manufacturers, who then are reimbursed from revenues collected at the gasoline pump.

Selective sales taxes are more easily dedicated to a particular environmental program compared to general sales taxes, because there often is a more direct relationship between the particular type of product in the tax base and the use of the funds for environmental purposes. State use of selective sales taxes is widespread and is increasing for environmentally related products and services (EPA 1999).

Property Taxes

The property tax is considered the least popular of all state and local taxes because it is paid in a large lump sum as opposed to small additions to each purchase. The primary advantage of imposing a property tax is that it provides a steady source of revenue, less affected by downturns in the economy than either the sales or the income tax. In addition, property taxes are relatively easily administered at the local level, revenues can be accurately predicted, and the tax burden is fairly equitably distributed (Hopper 1998). Real property taxes are charged to property owners as a percentage of the current assessed value of property. They are limited to local governments, and require voter approval. There are 2 main ways localities use property taxes to fund environmental projects. The first is to earmark a specific portion of annual revenues, which is rare. The second is to direct a property tax increase or surcharge, temporary or permanent, to a specific purpose. Most local governments have administrative systems in place for assessing real estate values and collecting taxes, which reduces administrative costs. Voter approval of tax increases to pay for specific environmental projects, and visible results, helps ensure revenue dedication. Additional monies can be leveraged when public commitment is clear, including matching funds (Hopper 1998). Despite the dislike of property taxes, voters in many communities have been willing to accept an increase when revenues are specifically earmarked for parks. An added incentive can be independent oversight into the administration of the spending, often in the form of a citizens' commission. Any land-based protection or recreation program could be funded through the property tax, as well as any environmental infrastructure popular enough to be approved by residents. Revenues can go to local trust funds, serve as collateral for general obligation or revenue bonds, and leverage state. An example of successful implementation of the property tax is the voter-approved property tax assessments in Alameda and Contra Costa Counties, which have been approved to pay for the upkeep of trails throughout the East Bay (Hopper 1998)

Real Estate Transfer Taxes

A real estate transfer tax is a tax levied on the sale of certain classes of property—residential, commercial, or industrial—which increases with the size of the property being sold. Sometimes sellers (who have typically seen the value of their homes rise over the years) assume the financial burden. Other times the cost is imposed on buyers, who, it is argued, are making an investment in the future of a community. At the local level, the real estate transfer tax can create substantial funds for park and open space acquisition, particularly in fast-growing communities. On the other hand, it can also inflate real estate values and slow the market. Because revenues from the tax fluctuate with the real estate market, income can be difficult to predict. In addition, winning approval in the face of special interest opposition has proven to be a stumbling block for some communities (Hopper 1998).

Fees

In contrast to taxes, fees are used much less universally and generate far less revenue. Fees are fixed charges paid for governmental administrative services such as permit issuance, activities such as park fees, and for utility services (impact fees). Of these, only user fees raise significant revenue.

A fee is a financial charge for services rendered or activity undertaken. Fees can be based on the service provided or benefit received, including potential negative environmental impacts. Fees establish direct links between the demand for services and the cost of providing them. For example, local utilities require customers to pay for the cost of providing water and wastewater services. State permitting fees are used to finance the cost of processing permit applications, e.g., NPDES permit fees.

Inspection/monitoring fees cover the inspection and certification of equipment, facilities, or employees for environmental compliance. Park and recreation fees finance oversight of the general public's environmentally sensitive activities. Revenue yield from administrative service and activity fees is typically modest, although the utility fee revenue stream may be significant. Another characteristic of administrative service and activity fees is that many are one-time charges, i.e., imposed only once, or imposed periodically at the times of demand. In contrast, most utility user fees are recurrent charges imposed at regular intervals. Well-structured fees can be an equitable means of matching program costs to program beneficiaries. In many cases, instituting a fee essentially eliminates a subsidy for a government service, freeing up general revenues that could be used to fund other environmental programs. Thus, by definition many fees have a very close cost/benefit relationship and, if graduated rate structures are used, are highly equitable. Because they are imposed at the time of service, or through regular billing, they may be relatively easy to collect. Behavioral shifts do not reduce revenue potential as much as with sales taxes. Because they are targeted to a specific service or group, fees have a narrower revenue base than most taxes. Increased use of administrative service and activity fees by localities is a well-established trend in environmental program funding, encouraged by the federal government. Most administrative service and activity fees are used solely to offset government operating costs, and, although equitable and directly related to costs and benefits, they provide only a modest revenue yield. In an effort to raise more revenue and cover more budgetary costs, the number of state fees has proliferated in recent years, and may have led to some public backlash.

User Fees

Parking fees, entrance fees, dog tags, and park and recreation fees are examples of the many different kinds of user fees collected by local governments. User fees are generally intended to cover the cost of providing goods or services. Typically, the fees are collected from any user, although local governments can also create special districts and charge user fees for services provided to people in a defined area. These user charges are imposed in addition to or in place of the property tax discussed in the special district section. Because they are voluntary and generally exempt from tax limitation laws, user fees are an increasingly popular financing tool for local lawmakers. Far more than federal or state governments, local governments collect user fees. These funds are often used to pay for activities such as maintenance and operations (Hopper 1998).

Impact Fees

An impact fee is a one-time charge that private entrepreneurs, often developers, must pay to the local government in order to undertake their projects. In turn the revenue from the impact fee finances public goods and services that are associated with the project, but that the developer would not provide voluntarily. Water and sewer lines, streets and bridges, and parks and recreational facilities are typical impact fee–funded projects. Opponents of impact fees argue that the added cost of development and, in some cases, a decreased availability of affordable housing renders this funding mechanism inequitable. However, impact fee legislation typically calls for the use of a citizens' advisory committee and outlines accounting requirements and time limits for expenditures. Some statutes specifically address the concern for affordable housing and employment. Impact fees are a common and proven tool used by local governments to help pay for the acquisition, construction, and maintenance of parks and recreational facilities near new residential, commercial, and industrial developments (Hopper 1998).

Licensing and Recreation Fees

These are fees charged to individuals for the privilege of engaging in activities. Examples include the privilege of mooring boats on state waters, using state parks and campgrounds, or for hunting, boating, or fishing licenses. Both state and local governments use these fees for a variety of purposes. Some local governments charge mooring fees at municipal marinas run by port authorities, where the income pays for port operations. State and local governments charge fees for park use. Fees for fishing and boating licenses also are charged by most states. The federal government uses park and recreational fees extensively for its facilities. License revenues could cover the costs of environmental programs associated with the activity. For example, a share of boat license fee or mooring fee revenues could be used to finance pump-out facilities for boat toilets. Park fees can be levied wherever state or local governments incur costs for the provision of recreation services. Camping fees can be used to fund improved access to and maintain camping sites. These fees can cover expenses for public use of environmentally sensitive areas, and still represent an untapped revenue source in many states. Charging fees would allow state general revenues to be used for other purposes. Most license fees have a built-in enforcement mechanism because the licensing government can revoke the privilege granted with the license if fees are not paid, and provide a direct cost/benefit relationship. Equity is enhanced because tourists must pay for the environmental impacts of increased tourism in an area. It may be difficult to institute recreational fees if use of state waters and parks has historically been free. Such fees may have a disproportionate impact on lower-income segments of the population who may have few other low-cost recreational opportunities. Because they generally apply only to a limited population, most license fees have a small revenue base, and it may be difficult to raise significant revenues if fees are set at low levels. Second issues involve enforces questions.

Special Assessment Districts

Special assessment districts are separate units of government that manage specific resources within defined boundaries. As self-financing legal entities, they have the ability to raise a predictable stream of money, such as taxes, user fees, or bonds, directly from the people who benefit from the services—often parks and recreation (Hopper 1998). Special districts target costs and benefits of services to a particular population. For example, a drinking water district might be formed to finance extending municipal drinking water services to a newly developed area. In a number of states, special districts may issue revenue bonds. Local governments use special districts to finance capital facilities independently, relieving the burden on general debt capacity. For example, regional port authorities issue revenue bonds to finance port construction and/or renovation. Consortiums of local governments form special districts to address common problems. Examples include regional air quality and solid waste management authorities. One advantage of special districts is that costs are borne only by taxpayers that will benefit from improvements. Regional special districts can provide more specialized services than smaller governments (e.g., a regional solid waste authority may be more able to finance a solid waste facility than any 1 county). Special districts can issue bonds, which reduces debt load on the general-purpose government. However, special districts are not directly accountable to the electorate (most special district officials are appointed, not elected) and therefore may require special legislation in some areas. The use of special districts to help pay for parks has a long history in California.

Business Improvement Districts

A similar, yet newer and more controversial, financing tool is the business improvement district or BID. Like special assessment districts, BIDs assess residents within set boundaries for additional services, such as park maintenance and public safety. They are unique, however, in that they establish a partnership between property owners and businesses in downtown or commercial areas for the purpose of improving the business climate in a defined area. Impetus for the BID generally comes from business and property owners hoping to attract new customers by cleaning up sidewalks, improving parks, increasing lighting, etc. These business owners want better city services and are willing to pay for them—within their neighborhood. In some places, they are willing to take on nongovernmental tasks, such as marketing, to supplement city services. BIDs are growing in popularity.

Like special assessment districts, BIDs are created and funded with the approval of their residents. People derive a sense of ownership and responsibility for their park, as well as accountability with respect to government spending. Conversely, there is the sentiment in parts of California that government should be funding infrastructure improvements without adding layers of taxes and taxing districts. Another disadvantage of BIDs is that they do not provide a dedicated city- or countywide funding stream for open space. The major criticism, however, has been that BIDs are an inequitable open space financing method, not likely to be found in poorer neighborhoods where residents cannot afford to tax themselves (Hopper 1998).

Benefit Assessment Districts

Benefit assessment districts assess a defined constituency and provide benefits to those residents, such as roads, water, parks, and recreational facilities. Unlike BIDs or special assessment districts, these districts lack a partnership, structure, or separate governmental body with management responsibilities. The districts typically place a levy on a property in such as way that the benefit is comparable to the assessment. California's state enabling legislation, called Mello-Roos after the sponsoring legislators, has given residents throughout the state the option of assessing themselves to pay for such infrastructure and services. Several types of benefit assessment districts and opportunities for assessment are available for watershed management efforts (Knox 1996):

Benefit Assessment Act of 1982 allows cities, counties, and special districts to establish benefit assessment districts for drainage, flood control, street lighting, and maintenance of roads, streets, and highways. These districts usually require majority voter approval.

Habitat Maintenance Districts allow cities and counties to levy assessments for long-term natural habitat maintenance in accordance with plans approved by the DFG. Projects may include land acquisition, construction, or rehabilitation of facilities needed to restore, enhance, or maintain natural habitat including grading, clearing, removal of debris, installation of curbs, gutters, etc., water irrigation, drainage facilities, or electrical facilities.

Open Space Maintenance Districts permit cities and counties to assess land to maintain, improve, and protect open species by removing fire hazards, planting trees and shrubs, and acquiring fire prevention equipment.

Bonds

A bond is a written promise to repay borrowed money on a definite schedule and usually at a fixed rate of interest for the life of the bond. Bonds can stretch out payments for new projects over a period of 15 to 30 years. State and local governments repay this debt with taxes, fees, or other sources of governmental revenue. As discussed in this section, it is the source of pledged security or repayment for bonds, or the type of collateral used, that defines the type of bond, for example, general obligation bonds, a myriad of revenue bonds, or hybrids.
Because most government bonds are tax-exempt, bondholders are generally willing to accept a correspondingly lower rate of return on their investment than they would expect on a comparable commercial bond. Bond financing, therefore, can often provide state and local governments with low-interest capital.
Some state and local governments are required by statute to seek voter approval for certain types of bond issues. For example, most state and local governments cannot issue general obligation bonds without voter approval. If achieving this type of approval is difficult or time-consuming, state and local governments may want to consider issuing bonds that do not require voter approval, or exploring other options for capital financing, even if interest costs may be higher.
The Tax Reform Act of 1986 altered the tax-exempt status of some government-issued bonds. The Act reclassified bonds into 2 categories, governmental purpose bonds and private activity bonds. Governmental purpose bonds are automatically tax-exempt, but private activity bonds must meet certain criteria in order to be classified as tax-exempt. To qualify as a governmental purpose bond, at least 90%of the bond proceeds must be used by a state or local government, and no more than 10%of the debt service on the bond may be derived from or secured by a trade or business. If a bond does not meet these criteria, it is classified as a private activity bond. Private activity bonds that are issued for specific public-purpose project—such as water supply facilities, sewage treatment plants, solid waste disposal facilities, and some hazardous waste plants—can be tax-exempt. However, each state is limited to issuing private activity bonds in the amount of $50 per capita or $150 million each year, whichever is greater. Since the 1980s, local borrowing capital to acquire parks, natural areas, and open space has increased substantially. Bonds are unique and attractive park financing mechanisms because they provide large sums of up-front cash. As such, borrowing—either outright or tied to a financing mechanism—is a common park and open space tool used by county and municipal governments.

A variety of borrowing options is available, including long-term bonds and short-term debt instruments:

General Obligation Bonds are secured by the issuer's full faith, credit, and taxing power to make timely payments of principal and interest. A general obligation bond is essentially a loan taken out by a city or county against the value of the taxable property in the locality.
General obligation bonds have provided a key source of funds for park and open space acquisition and development at the state and local levels. The advantages of these bonds are that they allow for the immediate purchase of land and distribute the cost of acquisition. General obligation bonds are not used for park maintenance and can be difficult to achieve. General obligation bonds require either voter approval (sometimes by 2/3 of the electorate), or legislative approval, or both. They can also be costly because interest charges are tacked onto the cost of the project. Additionally, there is typically a great deal of competition for general obligation bonds among the many local programs in need of financing.

Revenue Bonds are paid from the proceeds of a tax levied for the use of a specific public project or with the proceeds from fees charged to those who use the facility that the bonds financed. A benefit of this funding tool is that these bonds are not constrained by debt ceilings like general obligation bonds. Additionally, voter approval is rarely required because the government is not obligated to repay the debt if the revenue stream does not flow as predicted. A disadvantage is that revenue bonds are typically more expensive to repay than general obligation bonds.

Certificates of Participation (COPS) are becoming increasingly important tools that local governments are using to protect open space and natural lands. COPS are lease-purchase arrangements that allow a government to pay for a property over time. Because payments are made year by year, the transaction is not formally considered debt. COPS do not require a referendum and do not affect a community's debt limit.

Short-Term Debt Instruments. Promissory notes and bond and tax anticipation warrants can also provide communities with park and open space protection financing options. Although more costly to the borrower, these mechanisms can help local governments that have limited long-term bonding authority but sufficient income to cover the debt service of a loan (Hopper 1998).

Mitigation Land Banks

Mitigation land is a publicly owned and managed natural site that has been purchased or protected with public or private funds, in the form of direct payments, voluntary land donations, and/or required mitigation credits to permittees for set fees, which may be banked. Mitigation banking was begun to meet wetland mitigation requirements for development impact. For decades, mitigation has helped communities lessen the adverse impact of development by requiring developers to set aside key portions of sensitive land. This mitigation can take place either on the site where the development is occurring or off-site. Off-site mitigation allows developers to contribute to a land bank and protect sensitive natural areas and wetlands in other parts of the community. The mitigation idea is used by governments to acquire any valuable natural area, perhaps unrelated to the affected area, to compensate for negative construction consequences. Here, the mitigation bank is the special account to support the property. Public agencies may require mitigation from other public agencies.

Mitigation land banking is often the best option when development violations have already occurred on-site or when key natural areas are targeted for protection. It also offers local governments flexibility in their land use decisions and gives communities the ability to protect a single, larger area rather than smaller, scattered tracts of land. By doing so, mitigation provides the greatest value for people, wildlife, and threatened ecosystems (Hopper 1998). States and localities may operate multiple mitigation banks, with the bank serving as the account for a particular parcel of mitigation land. Requiring compensatory mitigation is consistent with, and advertises, the goal of protecting natural areas including wetlands. Mitigation banking offers a potentially more efficient and beneficial approach than conventional case-by-case, off-site mitigation, by providing larger mitigation parcels, partnerships between government and conservation groups, attention to ongoing management, and interagency cooperation. Mitigation may reduce costly development delays. Ongoing management of mitigation lands is costly, and must be factored into revenue projections. Some mitigation packages are still too small for ecological protection (EPA 1999).

Grant-Funding Opportunities for Watershed Management Activities

Numerous grant-funding opportunities are presently available for watershed management activities throughout Northern California. This section highlights the programs most appropriate for the Clear Lake Basin. Each grant program is presented in a standard format with an overview, eligibility requirements, and contact information.

NRCS Wildlife Habitat Incentives Program

The Wildlife Habitat Incentives Program (WHIP) provides financial incentives to develop habitat for fish and wildlife on private lands. Participants agree to implement a wildlife habitat development plan and USDA agrees to provide cost-share assistance for the initial implementation of wildlife habitat development practices. USDA and program participants enter into a cost-share agreement for wildlife habitat development. This agreement generally lasts a minimum of 10 years from the date that the contract is signed.

Eligibility. Individuals must own or have control of the land under consideration. All lands are eligible for WHIP, except: federal land; land used for mitigation; land currently enrolled in the Water Bank Program, Conservation Reserve Program, Wetlands Reserve Program, or other similar programs; land subject to an Emergency Watershed Protection Program floodplain easement; and land where USDA determines that impacts from on-site or off-site conditions make the success of habitat improvement unlikely.

Schedule. Applications are accepted throughout the year. The ranking and selecting of offers of producers will occur periodically during designated periods.

Funding Limit. There is no formal funding limit.

Contact. Wildlife Habitat Incentives Program Coordinator
USDA NRCS
2121-C 2nd Street, Suite 102
Davis, CA 95616-5475
(530) 792-5600
(530) 792-5790 Fax

USEPA Environmental Education Grants Program

The Grant Program sponsored by EPA’s Office of Environmental Education supports environmental education projects that enhance the public’s awareness, knowledge, and skills to make informed decisions that affect environmental quality. The Grant Program seeks to increase public awareness and knowledge about environmental issues and provide the skills to make informed decisions and take responsible actions.

Eligibility. Any local education agency, state education or environmental agency, college or university, not-for-profit organization, or noncommercial educational broadcasting entity may submit a proposal. Tribal education agencies, which may also apply, include a school or community college that is controlled by an Indian tribe, band, or nation.

Schedule. Applications are due in November.

Funding Limit. Two funding levels are available: 1) $25,000 and less, and 2) greater than $25,000. A matching share of 25% is required.

Contact. Environmental Education Grants Program
Office of Environmental Education (1704 A)
1200 Pennsylvania Avenue, NW,
Washington, DC 20460
(202) 260-8619
www.epa.gov/enviroed

USEPA Environmental Justice Grants Program: Small Grants Program

The Office of Environmental Justice's Small Grants Program was established in 1994 to provide financial assistance to eligible community groups (community-based/grassroots organizations, churches, schools, other nonprofit organizations, local governments, tribal governments that are working on or plan to carry out projects to address environmental justice issues).

Eligibility. Any affected nonprofit community organization 501c (3) or 501c(4) or federally recognized tribal government is eligible.

Schedule. Applications are ususally due in February.

Funding Limit. Up to $15,000 per grant is available. No matching share is required.

Contact. USEPA Environmental Justice Grants Regional Coordinator
75 Hawthorne Street
San Francisco, CA 94105
(415) 744-1565
(415) 744-1605
http://es.epa.gov/oeca/oej/grlink1.html

USEPA Environmental Justice Grants Program: Environmental Justice through Pollution Prevention (EJP2) Grant Program

This program promotes pollution prevention efforts that address environmental justice concerns in affected communities. Eligible recipients of the grant funds include incorporated nonprofit environmental organizations, environmental justice organizations, and community grassroots organizations (including religious and civic groups, local governments, and federally recognized tribal governments). EPA will limit eligibility to projects involving: (1) helping small businesses and institutions prevent pollution in communities; (2) fostering partnerships between industrial facilities and communities; (3) demonstrating agricultural pollution prevention; and (4) improving tribal environments.

Schedule. Generally Annually

Funding Limit. Contact the funding agency for funding limit information.

Contact. Grants Coordinator Eligibility. Any incorporated nonprofit community organization, local government, or federally recognized tribal government is eligible.

Office of Planning and Research
1400 Tenth Street, Room 121
Sacramento, CA 95814
(916) 323-7450
(916) 323-3018
http://www.epa.gov/opptintr/ejp2/

SWRCB Water Quality Planning Implementation Grant/CWA Section 205(j)

This program seeks to fund water quality planning projects that will reduce, eliminate, or prevent water pollution and enhance water quality. Surface and ground waters throughout the State are impaired by a variety of types of pollution. Polluted runoff carrying sediment, nutrients, trace metals, pesticides, and pathogens is a major contributor to water quality problems in California. Water quality planning activities that will lead to the reduction and/or prevention of pollution, or restoration of polluted water bodies, are consistent with the goals of the State Water Resources Control Board (SWRCB).

Eligibility. Section 205(j) planning grants are limited to local public agencies, including special districts (e.g., resource conservation districts, sanitation districts, or water districts, and councils of governments, city and county agencies). These funds are available for water quality planning activities and assessment activities aimed at reducing or preventing pollution to ground and surface waters, or restoring polluted water bodies or watersheds.

Schedule. Varies

Funding Limit. The maximum amount that may be requested for 205(j) planning projects is $125,000. Requests below $25,000 will not be considered because of the administrative costs associated with the contract process. 205(j) planning grants require a minimum twenty-five (25) percent nonfederal match (dollars or in-kind services not supported by federal programs) of the total project costs.

Contact. State Water Resources Control Board
Division of Water Quality, Water Quality Planning Unit
1001 I Street, 15th Floor
Sacramento, California, 95814

SWRCB Nonpoint Source Implementation Grant/CWA Section 319(h)

This program seeks to fund nonpoint source (NPS) implementation projects that will reduce, eliminate, or prevent water pollution and enhance water quality. Surface and ground waters throughout the state are impaired by a variety of types of nonpoint source pollution. Polluted runoff is a major contributor to water quality problems in California. Management activities that lead to the reduction and/or prevention of pollutants, such as excessive sediments, nutrients, toxic trace metals, pesticides, pathogens, industrial or commercial toxicants, or airborne emissions deposited by rain or snow, are a goal of the state's NPS Pollution Control Program.

Eligibility. Nonprofit organizations, local government agencies including special districts (e.g., resource conservation districts or water districts), Indian tribes, and educational institutions are eligible to receive 319(h) implementation funds. State or federal agencies may qualify if they are collaborating with local entities and are involved in watershed management or are proposing a project of “statewide” significance. These funds are available for the implementation of activities that reduce or prevent NPS pollution to ground and surface waters

Schedule. Varies

Funding Limit. Contact the funding agency for funding limit information.

Contact. SWRCB, Division of Water Quality
Watershed Pollution Prevention Section
1001 I Street, 15th Floor, Sacramento, California 95814

916/341-5906
nps_pubs@swrcb.ca.gov.

SWRCB Wetlands Program Development/CWA Section 104 (b)(3)

To assist states, Indian tribes, and local government in implementing new programs relating to wetland preservation and enhancement. California has lost more than 90% of its historical wetlands, largely in response to economic and development pressures. Wetlands provide many beneficial uses, including enhancing water quality, managing stormwater flows, providing habitat, enhancing water supply, controlling sedimentation and erosion, reducing flood losses, and providing recreational opportunities. Section 104(b)(3) funds are to be used to focus on innovative demonstration and special projects. Among the efforts eligible for funding are research, investigations, experiments, training, environmental technology demonstrations, surveys, and studies related to the causes, effects, extent and prevention of pollution. These activities or projects could fall under one of the following 104(b)(3) funding categories as indicated in guidance to the regions:

- Institutional Coordination
- NPDES Permits
- Environmental Management Systems (EMS)
- Monitoring and Assessment
- Program Measures and Environmental Indicators

- Public Participation/Outreach

Eligibility. State water pollution agencies, state resource agencies, and other public agencies.

Schedule. Deadlines and procedures are established by region. States should work with the appropriate regional office to develop a preliminary package or proposal to submit. The range of approval/disapproval time for regional review is approximately 60 days.

Funding Limit. The range of financial assistance for these project grants is generally $25,000 to $500,000.

Contact. EPA Region IX
Watershed Management Division
75 Hawthorne Street
San Francisco, CA 94105
Phone (415) 744-1974
Fax (415) 744-1078

CALFED Watershed Program

The Watershed Program aims to provide financial and technical assistance for watershed activities that help achieve the mission and objectives of CALFED, and to promote collaboration and integration among existing and future watershed programs. The Watershed Program objectives include ecosystem quality, water supply, water quality and levee system integrity.

Eligibility. Any public or private party with an interest in the management of watersheds providing water to or receiving water from the Bay-Delta system is eligible.

Schedule. Varies

Funding Limit. Contact the funding agency for funding limit information.

Contact. CALFED Watershed Program
1416 Ninth Street, Suite 1155
Sacramento, CA 95814
(916) 657-2226

CALFED Ecosystem Restoration Program Implementation Plan

The goal of the Ecosystem Restoration Program is to restore or mimic ecological processes and to increase and improve aquatic and terrestrial habitats to support stable, self-sustaining populations of diverse and valuable species.

Eligibility. Any private or public party with an interest in ecosystem restoration may apply. This includes, but is not limited to (1) landowners (2) local agencies (3) private non-profit organizations, (4) private for-profit entities, (5) tribes, (6) universities (7) joint ventures, (8) State agencies, and (9) Federal agencies.

Schedule. Applications are tentatively due in fall.

Funding Limit. Contact the funding agency for funding limit information.

Contact. CALFED Ecosystem Restoration Program
1416 Ninth Street, Suite 1155
Sacramento, CA 95814
(916) 657-2666

Resources for Other Grant-Funding Opportunities

The California Resources Agency is currently developing a web-based database of funding opportunities for watershed management activities.
Contact: Kristen Cooper-Carter
California State University, Chico, College of Engineering, Computer Science and Technology
400 West First Street
Chico, CA 95929
530-898-6442
Website: http://watershed.ecst.csuchico.edu

Rural Council of Rural Counties (RCRC)
www.ecivis.com
lakeca16

Additional funding opportunities may be found in the following texts:

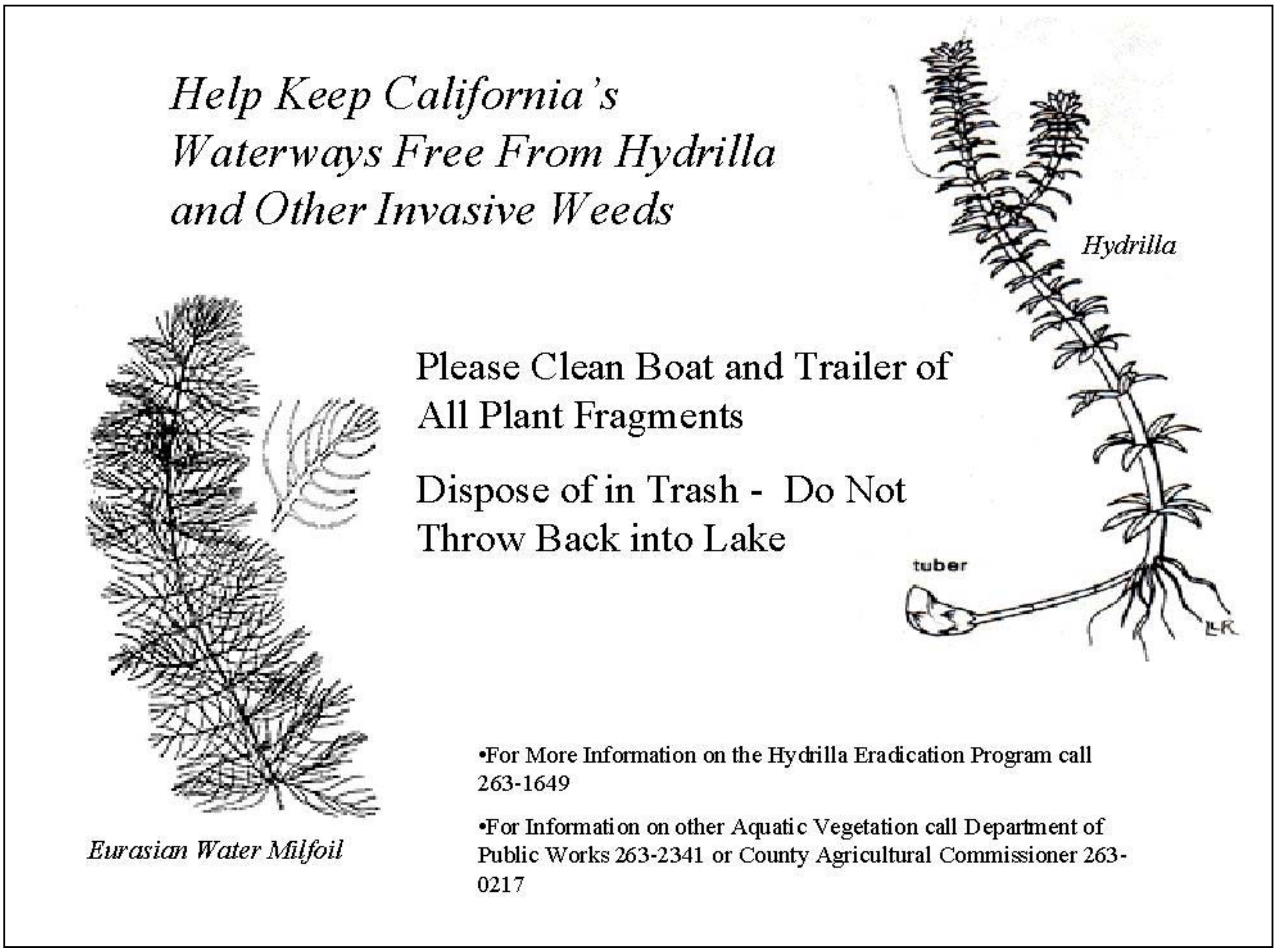
- The Directory of Funding Sources for Grassroots River and Watershed Conservation Groups (River Network)
- Community-Based Environmental Protection (U.S. Environmental Protection Agency)
- Funding Opportunities for Watershed Programs and Projects (Sacramento River Watershed Program).
- Proposition 50
- Proposition 40
- PRISM grant

Appendix Q

Signage at Public Launch Facilities

Signage Update

Joint project at public access points around the lake, winter 2003. Paid for out of CDFA Hydrilla funds.



Monitoring and Reporting Program
for the
Clear Lake Integrated Aquatic Plant Management Plan

Section 6 AQUATIC PESTICIDE SPECIMEN LABELS AND RESTRICTIONS

Aquacide (Aquacide Co.)
DMA 4 IVM (Dow AgroSciences)
Navigate (Applied Biochemists)
Sculpin (SePRO)
Weedar 64 (Nufarm)

Algimycin-PWF (Applied Biochemists)
Captain (SePRO)
Captain XTR (SePRO)
Cutrine-Plus (Applied Biochemists)
Cutrine-Ultra (Applied Biochemists)
Harpoon (Applied Biochemists)
Komeen (SePRO)
Nautique (SePRO)

Aquathol K (UPI)
Aquathol Super K (UPI)

Ecotriclopyr 3 SL (Vegetation Mgmt)
Kraken (Phoenix)
Navitrol DPF (Applid Biochemists)
Renovate 3 (SePRO)
Renovate OTF (SePRO)

Cygnet Plus (Brewer International)

Renovate MAX G (SePRO)
Renovate LZR (SePRO)
Triclopyr 3 (Alligare)

Reward (Syngenta)

Sonar A.S. (SePRO)
SonarOne (SePRO)
Sonar SRP (SePRO)

Accord Concentrate (Dow AgroSci)
Aquastar (Agri Star)
AquaPro (SePRO)
Rodeo (Dow AgroSciences)
Roundup Custom (Monsanto)
Touchdown Pro (Syngenta)

Galleon SC (SePRO)

Phycomycin (Applied Biochemists)
Grean Clean (BioSafe Systems)
Green Clean PRO (BioSafe Systems)
PAK 27 (Solvay Chemicals)

SECTION 1 MONITORING AND REPORTING PROGRAM (MRP)

INTRODUCTION

Clear Lake lies in a broad basin of the Coast Ranges of Northern California. With a large watershed, relatively shallow depth, and Mediterranean climate, the lake is a naturally eutrophic, warm water fishery.

Increased human activity in the Clear Lake watershed in the 20th Century led to erosion and a consequent increase in the nutrients entering the Lake. These nutrients (primarily phosphorus) fueled the lake's productivity; and while fish and wildlife thrived, waters became less clear with the growth of green algae and cyanobacteria. Given the shallow nature of Clear Lake, it is this algae and planktonic growth that prevented penetration of sunlight into the littoral zone, and thus precluded growth of rooted water plants for as long as anyone could remember.

Depending on the water temperature and available nutrients, the abundance of cyanobacteria in the lake can vary greatly. Before the 1990's cyanobacteria blooms were not uncommon in the spring and late summer. Historical records indicate there has always been an abundance of cyanobacteria in Clear Lake, however development in the watershed caused cyanobacteria and green algae populations to increase significantly beginning in the 1930's, reducing the clarity of the water.

Since 1992, reduced green algae growth has resulted in a substantial increase in the clarity of Clear Lake. Penetration of sunlight into the water column has led to an increase in growth of submerged aquatic plants. These plants are now growing further out into the lake and at a greater density. While water weeds can be a nuisance to navigation and recreation, they are nevertheless a valuable element of a healthy ecosystem providing habitat for fish and other wildlife. Still, some people become understandably frustrated by dense vegetation which denies them access to the lake. Some lakeshore property owners have sought professional services to control weed growth around boat docks and swimming beaches.

Aquatic herbicides and algaecides are used in the waters of Clear Lake by commercial applicators hired by individuals or by the County for the purposes of controlling aquatic plants or cyanobacteria in order to provide access to public waters for beneficial uses. The specific existing and potential beneficial uses of Clear Lake are identified by the Water Quality Control Plan for the Sacramento River and San Joaquin River Basins as amended for a Program of Implementation for Clear Lake Nutrients and Control of Mercury. Those uses are: municipal and domestic supply; agricultural irrigation and stock watering; contact and non-contact recreation; navigation; both cold and warm freshwater habitat; warm water spawning; wildlife habitat; sport fishing; and preservation of threatened or endangered species.

Over the years, noxious invasive aquatic plants have been introduced to the Lake by unknowing humans transporting these plants to Clear Lake. Examples are hydrilla, *Hydrilla verticillata*, and Eurasian water milfoil, *Myriophyllum spicatum*, probably dumped from aquariums; and creeping water primrose, *Ludwigia peploides*, brought here because it has a pretty yellow flower. These noxious plants are harmful to the lake's ecosystem wherever they grow. In 1994, the discovery of *Hydrilla verticillata*, triggered a statutorily mandated eradication program managed by CDFA. While the necessity of this program to the well-being of Clear Lake and to the waters of the Central Valley is understood, it has, nevertheless, complicated efforts to control the non-hydrilla vegetation in the lake. While mechanical harvesting is an environmentally acceptable alternative to the use of aquatic herbicides for controlling weeds, it results in the inadvertent spread of hydrilla, because many of the harvest fragments are not removed from the water. CDFA has prohibited its practice on some areas of the lake. This action leaves some people with no alternative to the application of aquatic herbicides for control of nuisance vegetation.

Commercial applicators have been performing aquatic weed control on Clear Lake since the increase of rooted macrophytes made it an issue. They have adhered to federal Environmental Protection Agency (EPA) regulations including the Federal Insecticide, Fungicide, and Rodenticide Act, FIFRA label instructions, state laws, and to the County Agricultural Commissioner's requirements. The federal courts have ruled that regulation of pesticides by the EPA under FIFRA does not exempt a user of *aquatic* pesticides from compliance with the Clean Water Act , CWA. Thus, the California Water Resources Control Board has issued a National Pollution Discharge Elimination System (NPDES) permit, General Permit No. CAG990005, SWRCB Order # 2013-0002-DWQ, which is the mechanism for compliance with the CWA.

Lake County Department of Water Resources, as holder of the NPDES permit, assumes the responsibility of compliance with the permit's terms and conditions. Compliance will be demonstrated by following this Monitoring and Reporting Program (MRP) that will answer the following two questions.
Question No. 1: Does the residual algaecides and aquatic herbicides cause an exceedance of receiving water limitations?
Question No. 2: Does the discharge of residual algaecides and aquatic herbicides, including active ingredients, inert ingredients, and degradation byproducts, in any combination cause or contribute to an exceedance of the "no toxics in toxic amount" narrative toxicity objective.

This MRP is a part of the Clear Lake Integrated Aquatic Plant Management Program (CLIAPMP) and has been adapted to the 2013 NPDES permit. The CLIAPMP underwent a CEQA Environmental Impact Report that was certified in 2006, and provides a permitting process that establishes minimum, legal standards for integrated aquatic plant management activities in Clear Lake.

OBJECTIVES

Through this MRP, the County of Lake will achieve the following goals:

1 Document compliance with the requirements of the NPDES, General Permit, No. CAG990005, SWRCB Order # 2013-0002-DWQ.

2 Demonstrate the full restoration of water quality and protection of beneficial uses of the receiving waters following completion of the aquatic plant management program for the season by answering the questions posed in the Introduction.

3 Assure that the Plan provides for monitoring of treatments that are representative of all aquatic herbicides and cyanobactericides used and of all of the application methods used by the commercial applicators on Clear Lake that season.

SECTION 2 MONITORING PROGRAM

CHARACTERIZATION of TREATMENTS

Over the past twenty years the clarity of Clear Lake water has improved allowing aquatic macrophytes to dominate. Since 2009, cyanobacteria blooms have become a lakewide, regular event on Clear Lake. Thus aquatic herbicides and cyanobactericides will be applied to the near-shore waters (littoral zone) of the lake, where human use is greatest, in order to control submerged aquatic vegetation, floating vegetation, emerged vegetation, and cyanobacteria.

Chemical applications shall be cumulatively restricted to an area of no more than 30% of any individual parcel or ownership as measured between extensions of the parcel's lot lines lakeward from the shoreline for 300 feet.

The applications will coincide with the season of aquatic plant growth, generally June through September, though applications in April, May or October may occur when conditions are appropriate for aquatic plant growth in that year. The California Department of Fish and Wildlife will be asked for their support of any herbicide application on the lake before June 1st to protect fish spawning activity.

VISUAL, PHYSICAL and CHEMICAL ASSESSMENT of TREATMENTS

Responsible use of aquatic herbicides requires a visual, physical and chemical assessment of existing or potential adverse impacts on beneficial uses caused by their application.
A visual assessment (on site observation) identifies the following parameters:

- Turbidity,
- Slick, sheen, foam or scum on the water surface,
- Unpleasant or unexpected odors,
- Unexpected color of the water,
- Weather conditions,
- Aquatic plant identification and percentage of plant population

Physical and chemical assessments shall be made using analytical meters that have been calibrated within the month of use. It is necessary for commercial applicators to measure dissolved oxygen and temperature prior to each treatment at each location. This requirement is a condition of the Clear Lake Aquatic Plant Management permit. Application of aquatic herbicides is not allowed if dissolved oxygen is ≤ 5 ppm or water temperature is ≥ 80ºF.
Visual, physical and chemical assessments shall be recorded by the commercial applicator and/or water quality sampler, see Table 1.

Sample frequency

Water quality samples shall be collected from a minimum of six treatment events for each active ingredient per year , except glyphosate. If there are less than six treatment events a year, each treatment shall be sampled. If the results from six consecutive sampling events show concentrations that are less than the receiving water limitation/trigger for an active ingredient, sampling shall be reduced to one treatment event per year for that active ingredient. If the yearly sampling event shows exceedance in the receiving water limitation/trigger for an active ingredient, then sampling shall return to six treatment events for that active ingredient.

For glyphosate only one treatment shall be sampled per year.

WATER QUALITY ANALYSIS

Active Ingredients: All aquatic herbicides and algaecides to be utilized for the aquatic plant management season will be identified prior to the start of the season. Table 2 is a list of those products and active ingredients that could be anticipated to be used in Clear Lake.

It is usual for one treatment of an area to be effective at providing season-long control. In a few instances it may be necessary to treat an area a second time. This second treatment of the same site is considered as another treatment for the purposes of water sampling.

It is usual for a commercial applicator to apply more than one active ingredient per treatment either as a tank mix or as separate applications, one followed directly by the other. In both cases both active ingredients will be sampled and treated as a separate treatment for the purposes of water sampling.

Lake-Wide Sampling: For each active ingredient in the products named in Table 2, and those anticipated to be used that program year, water sampling and analysis will be performed at the beginning and a month after the end of the aquatic plant treatment season at two locations in Clear Lake. Samples will be taken at Rodman Slough, the lake inlet, at the west side of the Lucerne Cutoff Over-crossing; and at Cache Creek, the lake outlet, at the Hwy. 53 Over-crossing. In a year when endothall, copper, diquat and triclopyr are used, for example, 16 lake-wide samples will be generated that program year. Lake-wide sampling shall be performed by Lake County Water Resources personnel.

> **Note: California Department of Food and Agriculture, Hydrilla Eradication Program, is usually the exclusive applicator of Sonar SRP and Sonar A.S. and also uses Komeen or Harpoon . CDFA has their own NPDES permit independent of Lake County. CDFA will contribute their Lake-Wide sampling water quality analyses for fluridone to the County when fluridone is used under the CLIAPMP.**

Table 1 Visual, physical and chemical assessments

Sample type	***Parameter***	***Units***	***Sample method***	***Sample type***	***Sample frequency***	***Test method***
Visual	Floating suspended matter	N/A	Visual observation	Background	[1]	N/A
	Discoloration					
	Visible film					
	Nuisance conditions					
	Plant ID, %					
	Weather [7]					
Physical	Temperature	ºF	Grab	Background Post-event	[1]	40 CFR part 136
	pH	No.		Background Event Post-event	[6]	
	Turbidity	NTU				
	Electrical Conductivity	µmhos/cm				
	Secchi depth	ft	In-situ	Site	[1]	N/A
Chemical	Active Ingredient [5]	µg/L	Grab	Background Event Post-event	[6]	40 CFR part 136
	Nonylphenol[8]	µg/L				
	Hardness	mg/L				
	Dissolved Oxygen	mg/L		Background Post-event	[1]	

[1] All applications at all sites.

[2] Field testing.

[3] Samples shall be collected at three feet below the surface of the water body.

[4] Herbicide active ingredients shall be analyzed using methods in 40 CFR part 136.

[5] 2,4-D, copper, diquat, endothall, fluridone, glyphosate, imazamox, imazapyr, penoxsulam, and triclopyr.

[6] Samples shall be collected from a minimum of six treatment events for each active ingredient per year , except glyphosate. If there are less than six treatment events a year, each treatment shall be sampled. If the results from six consecutive sampling events show concentrations that are less than the receiving water limitation/trigger for an active ingredient, sampling shall be reduced to one treatment event per year for that active ingredient. If the yearly sampling event shows exceedance in the receiving water limitation/trigger for an active ingredient, then sampling shall return to six treatment events for that active ingredient.
For glyphosate only one treatment shall be sampled per year.

[7] Sun, fog, rain, wind.

[8] Nonylphenol is not present in the adjuvant, Cygnet Plus, used currently in Clear Lake. If it is used then it will be tested. See Brewer International letter for Cygnet Plus confirming that it is unrelated to nonylphenol.

Spot Treatment Sampling: For each active ingredient used in that program year, a spot treatment dissipation study will be performed according to the frequency described in Table 1, above. All applications of aquatic herbicides and cyanobactericides in this program are considered spot treatments including a second application at a later time in the same location.
Sampling will occur according to the following schedule:

1. **Background Monitoring**, within ¼ hour of application in the treatment area – **PRE** sample
2. **Event Monitoring**, during the application in the treatment area – **DUR** sample
3. **Post-Event Monitoring**, approximately 1 week after application in the treatment area – **POST** sample.

Spot-treatment sampling shall be performed by Lake County Water Resources personnel.

Laboratory analysis of lake-wide and spot-treatment samples generated by the Lake County Water Resources Department will be analyzed by Alpha Labs, 860 Waugh Lane, Ukiah, CA 95482, 707-468-0401. Alpha Labs is certified by the California Department of Public Health in accordance with California Water Code Section 13176, certification no. 1551.

Table 2 Products and active ingredients that may be used in Clear Lake

Product name and manufacturer	Active ingredient
DMA 4 IVM (DowAgroSciences)	2,4-D
Navigate (Applied Biochemists)	2,4-D
Weedar 64 (Nufarm)	2,4-D
Aquacide (Aquacide Co.)	2,4-D
Sculpin (SePRO)	2,4-D
Nautique (SePRO)	Copper
Captain (SePRO)	Copper
Captain XTR (SePRO)	Copper
Harpoon (Applied Biochemists)	Copper
Cutrine-Plus (Applied Biochemists)	Copper
Cutrine-Ultra (Applied Biochemists)	Copper
Komeen (SePRO)	Copper
Algimycin-PWF (Applied Biochemists)	Copper
Aquathol K (UPI)	Endothall
Aquathol Super K (UPI)	Endothall
Navitrol DPF (Applid Biochemists)	Triclopyr
Triclopyr 3 (Alligare)	Triclopyr
Ecotriclopyr 3 SL (Vegetation Mngmt)	Triclopyr
Renovate 3 (SePRO)	Triclopyr
Renovate OTF (SePRO)	Triclopyr
Renovate MAX G (SePRO)	Triclopyr, 2,4-D
Renovate LZR (SePRO)	Triclopyr
Kraken (Phoenix)	Triclopyr
Reward (Syngenta)	Diquat
Sonar A.S. (SePRO)	Fluridone
SonarOne (SePRO)	Fluridone
Sonar SRP (SePRO)	Fluridone
Roundup Custom (Monsanto)	Glyphosate
Aquastar (Agri Star)	Glyphosate
AquaPro (SePRO)	Glyphosate
Rodeo (Dow AgroSciences)	Glyphosate
Accord Concentrate (Dow AgroScience)	Glyphosate
Touchdown Pro (Syngenta)	Glyphosate
Galleon SC (SePRO)	Penoxsulam
Phycomycin (Applied Biochemists)	Sodium carbonate peroxyhydrate
Green Clean (BioSafe Systems)	Sodium carbonate peroxyhydrate
Green Clean PRO (BioSafe Systems)	Sodium carbonate peroxyhydrate
PAK 27 (Solvay Chemicals)	Sodium carbonate peroxyhydrate
Clearcast (SePRO)	Imazamox
Cygnet Plus (Brewer International)	Spray Adjuvent with no nonylphenol

SECTION 3

QUALITY ASSURANCE PROGRAM PLAN

(QAPP)

For the Clear Lake Integrated Aquatic Plant Management Plan

Monitoring 2,4-D, copper, diquat, endothall, fluridone, glyphosate, imazamox penoxsulam, sodium carbonate peroxyhydrate, and triclopyr

August 2013

Prepared by Lake County Water Resources
255 North Forbes Street, Room 309
Lakeport, California 95453

TABLE OF CONTENTS

DISTRIBUTION LIST

Philip Isorena, SWRCB
Scott De Leon, Water Resources Director
Mike Meske, CDFA
Pat Akers, CDFA
David Kratville, CDFA
Steven Hajik, County Agricultural Commissioner

PROGRAM ORGANIZATION

Participants and Contacts

Alpha Analytical Laboratories, Inc.
CAC Agricultural Biologist
CDFA Hydrilla Eradication Team
Lake County Water Resources
SWRCB

Key Individuals Responsible for QA/QC

Mike Meske, CDFA Hydrilla Eradication Sampling Team
Katherine Blyleven, County Agricultural Commissioner's Office
Sheri Speaks, Alpha Labs

Program Manager

Carolyn Ruttan, Invasive Species Program Coordinator

I. PROGRAM DEFINITION AND BACKGROUND

Concern about environmental impacts of aquatic herbicides and cyanobactericides focuses on human toxicology with drinking water, and toxicology as it relates to the fishery and the food chain. While this concern is understandable, the potential for adverse impacts has been extensively evaluated by the EPA and the California Department of Pesticide Regulation, DPR, through the product registration process. The pesticidal active ingredients that the Monitoring and Reporting Program of the Clear Lake Integrated Aquatic Plant Management Program proposes to monitor (2,4-D, copper, diquat, endothall, fluridone, glyphosate, imazamox, penoxsulam, sodium carbonate peroxyhydrate, and triclopyr) are approved for use in waters used for drinking water, recreation, agricultural irrigation, and fisheries when applied according to the label restrictions in the state of California.

This QAPP is a part of the Clear Lake Integrated Aquatic Plant Management Program (CLIAPMP) and has been adapted to the 2013 NPDES permit. The CLIAPMP underwent a CEQA Environmental Impact Report that was certified in 2006, and provides a permitting process that establishes minimum, legal standards for integrated aquatic plant management activities in Clear Lake.

II. DATA QUALITY OBJECTIVES AND DATA USE PLANNING

Data Quality Objectives specify the underlying reason for collection of data, data type, quality, quantity, and uses of data collection. For the CLIAPMP, lake-wide water sampling for all active ingredients used that season, and spot-treatment water sampling of at least one representative treatment per active ingredient used that season, is needed to demonstrate the full restoration of water quality and protection of beneficial uses of the waters of Clear Lake following completion of aquatic plant management activities.

Data to be Collected

The principle data required by this project are concentrations (ppm or ppb) of the herbicidal active ingredient in lake water at a specified time in relation to the treatment.

Intended Uses of Data

These data will be used to evaluate the duration, area, and magnitude of impacts to beneficial uses of the waters of Clear Lake. The specific existing and potential beneficial uses of Clear Lake are identified by the Central Valley Regional Water Quality Control Board Basin

Management Plan as municipal and domestic supply; agricultural irrigation and stock watering; contact and other non-contact recreation; both cold and warm freshwater habitat; warm water spawning; and wildlife habitat.

The concentration restrictions for the aquatic herbicide active ingredients are found in product label instructions, regulations of the California Department of Pesticide Regulation, US EPA guidelines, and the NPDES permit CAG990005, SWRCB Order # 2013-0002-DWQ, and are summarized in Table 3.

Table 3 Summary of Receiving Water Limitations and Receiving Water Triggers

	Beneficial Use[1]				
Active Ingredient	***MUN µg/L***	***WARM or COLD µg/L***	***Other than MUN, WARM or COLD, µg/L***	***All Designations µg/L***	***Basis***
2,4-D	70				US EPA MCL[3]
Copper (hardness = 113 mg/L)				10.36[5]	CA Toxics Rule
Diquat dibromide	20				US EPA MCL[3]
Endothall	100				US EPA MCL[3]
Fluridone	560				US EPA IRIS[4]
Glyphosate	700				US EPA MCL[3]
Imazamox				None[2]	US EPA Office of Pesticides Ecotoxicity Database
Penoxsulam				None[2]	US EPA Office of Pesticides Ecotoxicity Database
Sodium carbonate peroxyhydrate				None[2]	No toxicity data
Triclopyr				13000[2]	US EPA Office of Pesticides Ecotoxicity Database
Nonylphenol				6.6	US EPA National Recommended Ambient Water Quality Criteria

1. Clear Lake Integrated Watershed Management Plan
2. Receiving water monitoring trigger
3. Maximum Contaminant Level
4. Integrated Risk Information System
5. Copper receiving water limitation is based on hardness of water

QA Objectives for Precision and Accuracy

Precision and accuracy is a function of receiving water limitations and triggers. Table 4 shows the precision and accuracy of Alpha Labs, the analytic laboratory used for water quality sample analysis. All reporting limits are below the receiving water limitations and triggers.

Table 4 Alpha Labs Criteria for Precision and Accuracy

Parameter	*Detection Limit (g/L)*	*Reporting Limit (mg/L)*	*Estimated Accuracy*	*Accuracy Protocol**	*Estimated Precision*	*Precision Protocol***
diquat	2	4	70-130	% Rec.	25	%RSD
copper	1	9	85-115	% Rec.	20	%RSD
glyphosate	3	25	66-126	% Rec.	30	%RSD
2,4-D	0.8	1	48-124	% Rec.	50	%RSD
Endothall	2	45	80-120	% Rec.	30	%RSD
Triclopyr	0.5	0.5	54-134	% Rec.	50	%RSD

*Accuracy Protocol Formula - %Recovery is the protocol used:

$$\%R = \frac{S - u}{C_{sa}} \times 100$$

Where S is the measured concentration in the spiked aliquot, u is the measured concentration in the unspiked aliquot, and C_{sa} is the actual concentration of the spike added.

**Precision Protocol Formula – % Relative Standard Deviation

Special Training Requirements/Certification

Analytic laboratory: The laboratory will be certified as an environmental testing laboratory pursuant to the provisions of the California Environmental Laboratory Improvement Act of 1988 (Health and Safety Code (HSC), Division 101, Part 1, Chapter 4, Section 100825, et seq.). Alpha Labs ELAP Certificate Numbers 1551 and 2728.

Field personnel: At least two years education related to environmental water analysis. At least one year experience in environmental soil and water sampling and analysis. No certification is required.

Project Manager: At least a Bachelor's degree in biology, limnology, or other environmental science from an accredited four-year college.

Documentation and Records

Data to be reported to the State Water Resources Control Board will be transcribed directly from laboratory reports, expressed in units of mg/L (ppm) or µg/L (ppb) whichever is appropriate.

III. DATA ACQUISITION

Sampling Process Design and Rationale

Lake-wide sampling will occur at the inflow to the lake, Rodman Slough, and at the outflow of the lake, Cache Creek. Sampling will occur from the bridge over Rodman Slough on the Nice-Lucerne Cutoff, Upper Lake, and at the bridge over Cache Creek on Lake Street, Lower Lake. Samples will be taken from a centerpoint on the bridge and at one foot below the water surface. At the beginning of the season herbicide applicators will be asked which aquatic plant management products will be used on Clear Lake that season. Sampling will be based on this limited number of active ingredients of these products. For each active ingredient to be used that season, one sample will be taken at the beginning of the aquatic plant management season, prior to any program herbicides being applied to the lake, and another sample, one month after the last herbicide application to the lake.

Spot treatment sampling will consist of three water samples taken within the treatment area for each active ingredient used for that treatment.

Samples will be taken in a time sequence according to the schedule below:

PRE sample: Background monitoring taken within ¼ hour of the treatment.
DUR sample: Event monitoring taken as the treatment is proceeding.
POST sample: Post-event monitoring approximately one week after treatment.

Sampling Materials

- Grab sample bottle: as designated by analytical lab, see Table 5
- Plastic insulated cooler,
- Neoprene or thin nitrile gloves (not latex),
- Subsurface grab sampler (i.e., Van Dorn or Kemmerer),
- Depth finder or marked pole,
- 3 Ring binder and data sheets on waterproof paper, clipboard,
- Disposable paper towels,
- Adhesive labels,
- Clean boat,
- Clean vehicle.

Materials will be visually inspected by the field technicians prior to use to assure that materials are new, not visibly contaminated, and free of defect. Unacceptable materials will be discarded and replaced by acceptable materials, or steps will be taken to assure acceptability (such as a thorough washing of the project boat).

Table 5 Alpha Labs required containers for herbicide water sampling

Herbicide Active Ingredient	*No. of containers*	*Container*	*Sample Preservation*	*Sample Storage*	*Holding Time*
copper	1	Clear poly, 500 ml	HNO_3	**Refrigeration**	6 months
diquat	1	Brown poly, 1L	none	**Refrigeration**	7 days
glyphosate	1	Amber glass, 125 ml	none	**Refrigeration**	14 days
endothall	1	Amber glass, 1L	none	**Refrigeration**	7 days
triclopyr	2	Amber glass, 1L	none	**Refrigeration**	7 days
2,4-D	2	Amber glass, 1L	none	**Refrigeration**	7 days
fluridone	1	Amber glass, 1L	none	**Refrigeration**	14 days

Sample Handling and Custody Procedures

Water samples will be drawn according to SOP from Sampling Manual for Environmental Measurement Projects (The Resources Agency, State of California, Department of Water Resources 1994). Preservation of samples, sample storage and hold times shall be followed according to Table 5.

- Take PRE sample FIRST. Store PRE samples in a separate cooler from treated samples.
- Take care not to stir up sediments as the sample site is approached.
- For all samples except copper, leave the bottle's cap in place till the bottle is at the appropriate depth, one foot below the water surface, remove the cap, and fill the bottle. Fill only sterilized bottles from the lab. Avoid disturbing sediments.
- For copper samples, the lab supplies containers with a liquid preservative, nitric acid. That sample container is filled with lake water from a sterilized amber glass bottle filled in the same manner as above. The preservative is caustic so appropriate precautions must be in place.
- Dry the bottle with disposable paper towels and affix a completed adhesive label.
- Place the bottle into a cooler (separate from PRE samples) packed with clean ice or blue ice packs, each placed inside a sealed, disposable plastic bag.
- Transport, store, and transfer samples to the analytic lab according to procedures set forth in this plan. All water samples may be handled only by the sampling technician(s) during field procedures.

All sample containers will be labeled with the date, time, sampling technician, and sample location. Samples will be transferred from the field cooler directly to a refrigerator. All samples will be stored in a refrigerator at 4ºC until transferred to the analytic laboratory. This refrigerator is in the office area of the secure local government facility at 255 North Forbes Street, Room 309, Lakeport, CA 95453.

Within the time ranges specified in Table 5, the samples will be picked up by a courier of the analytic lab and delivered to that laboratory. Alpha Labs is able to pickup with one day's notice.

Chain of Custody (COC) forms, see attached, will be filled out and signed at each transfer of custody. The total number of containers will be verified at each transfer by both parties. When the samples are delivered to the lab, the delivering person will have the receiving person sign the COC form and make a copy before turning over the samples.

Analytic Methods

The following analytic methods are used by Alpha Labs.

Sample Parameter	***Matrix***	***Analytic Method Reference***
copper	Water	EPA 200.7
diquat	Water	EPA 549.2
glyphosate	Water	EPA 547
endothall	Water	EPA 548
triclopyr	Water	EPA 515.1
2,4-D	Water	EPA 515.4
fluridone	Water	EPA 8321

Quality Control Checks

Field duplicates: These are used to assess precision associated with the laboratory and the field collection process. A field duplicate will be taken for every fifteen samples taken.

Lab QC Checks: The Analytic Laboratory's SOP's and QA manual procedures will be followed with regard to QC samples.

Corrective Action: In the event a field error is revealed, repeat of field procedures may be necessary, or the data point may be left blank due to the time sensitive nature of the samples.

Quality Assurance Audits

Third party validation of the procedures of Lake County Water Resources, Clear Lake Integrated Aquatic Plant Management Monitoring Program will be provided by a Quality Assurance Officer provided by the Central Valley Regional Water Quality Control Board. The QA Officer is encouraged to inspect and validate any phase of the sample retrieval, storage, recording and shipping for any herbicide and site.

SECTION 4 REPORTING PROGRAM

I. Monthly Reporting Program

A. Copies of the Supplemental Monthly Pesticide Use Reports and the Aquatic Plant Identification and % Density Reports written by each commercial applicator will be sent electronically to Lake County Water Resources. Blank copies of the report forms are attached.

II. Annual Reporting Program

Annually, by the 31st of January, Lake County Water Resources will prepare a summary report including the following elements:

A. Objectives of the Monitoring Program
B. Results
C. Interpretation of data in relation to frequency, duration and magnitude of impacts to beneficial uses.

Program Records and Reports

Records for each treatment site on Clear Lake will include the following on the Clear Lake Aquatic Plant Management Permit:

- Name and license number of the applicator,
- The location of the treatment area by parcel number and owner name,
- The water surface area treated,
- Purpose of treatment,
- Herbicide(s) to be used,
- Aquatic weeds to be controlled,
- ArcView map of accessor parcels overlayed on an aerial photo with herbicide-treated, lakeshore parcels selected,
- ArcView map of accessor parcels overlayed on an aerial photo with GIS Polygons of County treated areas identified as recreation areas, boat lanes and shoreline lanes.

A log of every permit application shall be maintained as an Access database file by Lake County Water Resources 255 N. Forbes Street, Lakeport, CA.

Copies of each Clear Lake Aquatic Plant Management Permit Application will be maintained at Lake County Water Resources, 255 N. Forbes Street, Lakeport, CA and the CDFA Hydrilla team at 833 Lakeport Blvd., Lakeport, CA .

Records of each herbicide/cyanobactericide treatment will include:

- Date, and start- and end-time, of treatment
- Secchi depth
- Weather conditions
- Temperature during and one week after treatment
- Dissolved oxygen during and one week after treatment
- Total area treated
- Quantity of herbicide/cyanobactericide used
- Aquatic plant identification and % density

The above records in the form of the Supplemental Monthly Pesticide Use Report and the Aquatic Plant ID and Density Record are submitted by the commercial aquatic pesticide applicator. These reports shall be submitted by the 20th day of the following month to Lake County Water Resources.
These records will be maintained at Lake County Water Resources, 255 N. Forbes Street, Lakeport, CA.

Records of the water quality sampling activities will include:

- Name of the person(s) performing the sampling procedure,
- Date and time the sample is collected,
- The location of the sample acquisition,
- Purpose of sampling (spot-treatment or lake-wide monitoring),
- Active ingredient to be analyzed,
- Weather conditions
- Secchi depth
- Temperature
- pH
- Turbidity
- Electrical conductivity
- Dissolved oxygen
- Hardness

An Alpha Labs Chain of Custody Record shall be kept for all water sample analyses. Analytical reports shall be sent to Lake County Water Resources.

These records will be maintained at Lake County Water Resources, 255 N. Forbes Street, Lakeport, CA.

Annually, a project summary report will be submitted to the State Water Resources Control Board and to the Executive Officer of the Central Valley Regional Water Quality Control Board . The Annual Report will contain tabular summaries and all forms and reports of the herbicide monitoring data obtained during the previous year. The Annual Report will include the objectives of the monitoring program; results; and interpretation of the data in relation to the BMPs that are ensuring compliance with the Clean Water Act by maintaining the beneficial uses of the lake.

SECTION 5 PROGRAM FORMS

Clear Lake Aquatic Plant Management Permit Application
The application form is filled out for every aquatic plant management activity on Clear Lake for County funded projects and for private property owners' projects. It is usual for the commercial applicator to apply for the permit. The permit is sent to the Agricultural Center to be vetted by the CDFA Hydrilla team supervisor and the Agricultural Commissioner. They will usually return permits the day of receipt.

Permit Log Database
On receipt of a completed Clear Lake Aquatic Plant Management Permit Application, a unique permit number is assigned to that permit and entered into an access database file containing records as far back as 2006. The database allows staff to track the progress of the permit application through to its issue as a permit.

Monthly Supplemental Pesticide Use Report
This report is a requirement of the Clear Lake Integrated Aquatic Plant Management Program. It is the means of monitoring every herbicide and cyanobactericide application made to the Lake by the unique permit number. This report is completed in the field as it involves entering analytical meter readings from the water taken at the site of each treatment. The commercial applicator is required to submit this report to Lake County Water Resources by the 20th day of the following month.

Monthly Aquatic Plant Identification and Percentage Density Report
Another requirement of the Clear Lake Integrated Aquatic Plant Management Program. is the Aquatic Plant ID and % Density report. This report is also completed in the field at each treatment site by throwing hooks in the water and identifying the eight most common aquatic plants and their percentage abundance in the treatment area. The commercial applicator is required to submit this report to Lake County Water Resources by the 20th day of the following month.

Spot Treatment Water Quality Sample Monitoring
This report is required by the NPDES permit and is the data that is assessed to determine compliance with toxicity limitations and triggers at the treatment site.

Lake-Wide Water Quality Sample Monitoring
Also required by the NPDES permit, the lake-wide sampling is the data that is assessed to demonstrate that water quality of the receiving waters following completion of the aquatic plant management season is equivalent to pre-application conditions.

Alpha Labs Chain of Custody
The means by which water quality samples are traced from the time of collection through laboratory courier pickup to delivery to the analytic lab.

SECTION 6 AQUATIC PESTICIDE SPECIMEN LABELS AND RESTRICTIONS

Specimen labels are obtained from the manufacturer's website. Labels are not attached to this document since they are frequently changed. Restrictions for use of chemicals used in surface water are specific to the active ingredient of each product and are found on the product label. Table 6 summarizes the restrictions taken from product labels in use in California in 2013.

Aquacide (Aquacide Co.)
DMA 4 IVM (Dow AgroSciences)
Navigate (Applied Biochemists)
Sculpin (SePRO)
Weedar 64 (Nufarm)

Algimycin-PWF (Applied Biochemists)
Captain (SePRO)
Captain XTR (SePRO)
Cutrine-Plus (Applied Biochemists)
Cutrine-Ultra (Applied Biochemists)
Harpoon (Applied Biochemists)
Komeen (SePRO)
Nautique (SePRO)

Aquathol K (UPI)
Aquathol Super K (UPI)

Ecotriclopyr 3 SL (Vegetation Mgmt)
Kraken (Phoenix)
Navitrol DPF (Applid Biochemists)
Renovate 3 (SePRO)
Renovate OTF (SePRO)
Renovate MAX G (SePRO)
Renovate LZR (SePRO)
Triclopyr 3 (Alligare)

Reward (Syngenta)

Sonar A.S. (SePRO)
SonarOne (SePRO)
Sonar SRP (SePRO)

Accord Concentrate (Dow AgroSci)
Aquastar (Agri Star)
AquaPro (SePRO)
Rodeo (Dow AgroSciences)
Roundup Custom (Monsanto)
Touchdown Pro (Syngenta)

Galleon SC (SePRO)

Phycomycin (Applied Biochemists)
Grean Clean (BioSafe Systems)
Green Clean PRO (BioSafe Systems)
PAK 27 (Solvay Chemicals)

Cygnet Plus (Brewer International)

Table 6 Label Restrictions

Active Ingredient	*Potable Water Restrictions*	*Water Use Restrictions for Drinking, Fishing, Swimming, Livestock/Pet Consumption*	*Water Use Restrictions for Plants*
2,4-D	≤ 0.07 ppm	600 ft setback from potable water intake if application rate < 1 ppm	600 ft setback from water inlet if application rate < 1 ppm, or 21 day waiting period, or assay ≤ 100 ppb
Copper	Not > 1 ppm		Hold water for 3 hrs before irrigation use
Diquat dibromide	Not > 0.02 ppm	1-3 days	1-5 days
Endothall	Not > 0.1 ppm	7 – 25 days, or 600 ft setback from potable water intake, or assay < 0.1 ppm	Hold water for 7 days before irrigating annual nursery, greenhouse, hydroponics, newly seeded or transplanted annuals ornamentals or turf
Fluridone		Apply at 0.25 mile from potable water intake if application rate > 20 ppb	7-14 days, or assay ≤ 5 or 10 ppb
Glyphosate	< 0.7 ppm	0.5 mile from potable water intake, or 48 hour waiting period, or 0.7 ppm by lab assay	None
Imazamox	Not > 50 ppb, or apply at ≥ ¼ mile from potable water intake	None	Greenhouse, nurseries hydroponics ≤ 1 ppb. Other irrigation ≤ 50 ppb, or wait 24 hrs if > 25% surface has been treated or application made <100 ft from irrigation intake.
Penoxsulam	None	None	Not for greenhouse, hydroponic or nursery use. Other irrigation ≤ 1 ppb, except rice and turf ≤ 30 ppb
Sodium carbonate peroxyhydrate	None	None	None
Triclopyr	None	None	None

2014
Clear Lake Aquatic Plant Management Permit Application

Permit No. ________________, Hydrilla Management Area (1-80, C1-5)_____________,   Mechanical ☐ or Chemical ☐

Attach a copy of the map, highlighting areas of aquatic weed control   **Application received by:____ Date:_____/2014**

Assessor's Parcel Number (APN)	Purpose of Weed Mgmt*	Area of Weed Management (square feet)				Weed Survey		Method of Weed Management			
		Boat dock access	Swim area	Other	Total Area			Herbicide		Mech **
APN _____________							Sago PW		Copper	
							Coontail		Glyphosate	
Owner (Last Name):							Milfoil		Diquat	
							IL PW		Endothall	
________________							Curly PW		Triclopyr	
							Primrose		Fluridone	
							Azolla		2,4-D	

* **1**. Public Facility Safety, **2**.Private Resort Safety, **3**. Private Residence Safety, **4**. Other (specify) _________

Mechanical

****** **a**. Boat-Mounted Harvester **b**. Hand Pulling and Bagging **c**. Manual Cutter **d**. Other (explain):________________

- Disposal Location ____
- Owner ____Telephone:__________________ Fax:_____________________
- Contractor ____Telephone:__________________ Fax:____________________

I certify that I am the owner or have permission from owner to engage in weed control activity from the owner of the parcel(s) named on this application. I am familiar with the Clear Lake hitch status as a potentially endangered species and will, prior to harvesting, disturb the water such that fish will vacate the treatment area.

Owner: ____ Date: __________/__________/2014

Signature: or

Agent of Owner(s): ______________________________________ Date: __________/__________/2014

Herbicide

Applicator ______________________________Telephone: ___________________ Fax: __________________

Pest Control Operator's Bus. License #_______________________Applicator's Q.A.L. #______________________

All Clear Lake herbicide applications will be made by a Qualified Licensed Applicator under the written recommendations of a licensed Pest Control Advisor, and must comply with all applicable pesticide laws and regulations for California. I certify that I have obtained permission to engage in weed control activity from the owner of the parcel named on this application. I hereby certify that I will visit the site declared on this application to verify the need for treatment and the suitability of the site for treatment. I agree to use only appropriate herbicides from the approved list according to label specifications. I will notify nearby users of lake water, for drinking and irrigation uses, according to label directions.

Signature: ____Date: _________/_________/2014

Clear Lake Aquatic Plant
Management Permit Application

Permit No. ___________________

ENDORSEMENTS

California Dept. Food and Agriculture Hydrilla Program **Mechanical** **Chemical:**

_______________________________________, ____/____/2014 Approved___ Denied ___ Approved___ Denied ___
Signature: Date
Management Area _____________ **Active Hydrilla Treatment Area** Y / N

County Agricultural Commissioner's Office **Mechanical:** **Chemical:**

_______________________________________, ____/____/2014 Approved___ Denied ___ Approved___ Denied ___
Signature: Date

CONDITIONS OF PERMIT

In order to keep invasive species out of Clear Lake:
Watercraft returning here from out-of-county **shall be screened for invasive mussels prior to each launch** in Clear Lake or any other water body in Lake County. They shall be issued with resident or visitor stickers, whichever is appropriate.

Mechanical	Herbicide
1. Collection of fragmented material is required. **2.** Disposal of plants shall be landward of high water. **3.** Fragments must be prevented from re-entry into any water body.	**1.** Only approved herbicides are to be applied in accordance with NPDES Permit. Approved herbicides use 2,4-D, copper, diquat, endothall, fluridone, glyphosate, penoxsulam, sodium carbonate peroxyhydrate, triclopyr and imazamox. **2.** Submit a completed Supplemental Pesticide Use Report for each application on each parcel. **3.** Application is permitted only when: • D.O. is greater than 5 ppm. (Must apply for exception) • Water temperature is lower than 80°F • Water is judged clear with low turbidity • Weather is calm (wind speed less than 10 mph) • No rain predicted. 4. Applicator will provide work schedule 1 week prior to treatment.

HOLD HARMLESS: Except with respect to active negligence of a party indemnified herein, to the fullest extent permitted by law, the permittee shall indemnify and hold harmless the COUNTY and its agents, officers and employees against and from any and all claims, lawsuits, actions, liabilities, losses, damages, and expenses and costs (including but not limited to attorney's fees) brought for, or on account of, injuries to or death of any person or persons, including employees of permittee, or injuries to or destruction of property, including the loss of use thereof, arising out of, or alleged to arise out of, or resulting from, the performance of the work permitted herein, provided that any such claim, lawsuit, action, liability, damage, loss, expense, or cost is caused in whole or in part by any negligent or intentional act or omission of permittee, or anyone directly or indirectly employed by permittee, or anyone for whose acts permittee may be liable, regardless of whether or not it is caused by the passive negligence of a party indemnified hereunder.

Applicant's acceptance:____ Date:__________/__________/___________

Application Final Approval

Fee Paid Total Fees Paid __________ Check Number _________ Date: _____/_____/2014

- ❑ Lakebed/GIS Map Attached
- ❑ Treatment Area Highlighted

$100 Herbicide, $27 Mechanical/Physical

County of Lake Dept. of Water Resources Signature: ___________________________________ Date: _____/_____/2014

COMPANY NAME___________________________ AQUATIC PLANT ID and % DENSITY 2014 MONTH____________________

Permit Number	Name Property Owner	% abundance Sago PW	% abundance Curly-leaf PW	% abundance Chara	% abundance Water milfoil	% abundance Coontail	% abundance Illinois PW	% abundance Water primrose	% abundance Azolla
.									

Alpha Analytical Laboratories Inc.
e-mail: clientservices@alpha-labs.com

Laboratory & Corporate: *208 Mason Street, Ukiah, CA 95482*
707-468-0401 • Fax: 707-468-5267

Service Center & Micro Lab: *6398 Dougherty Road, Suite 35, Dublin, CA 94568*
925-828-6226 • Fax: 925-828-6309

Chain of Custody Record

Reports and Invoices will be delivered by e-mail in .pdf format.

Lab No.__________ Page____ of____

Report to:	Invoice to (if different):	Project Info for Report:
Company:	Company:	Project Name:
Attn:	Attn:	
Address:	Address:	Project No:
Phone/Fax:	Phone/Fax:	PO/Reference:
E-mail Address:	E-mail Address:	

Samplers Signature:

Print:

Signature below authorizes work under terms stated on reverse side.

TAT

10 days ○

Rush:

5 days ○

48 hours ○

Other: ____ days ○

Lab Approval Required For Rush TATs

Sample Notes (lab use only)

Temperature: ______ deg. C

Shipment Method:

Custody Seals: ○ Y / N ○

Sample Identification	Sampled: Date	Time	Container: 40ml VOA	Poly	Amber	Sleeve	Other	Preservative: HCL	HNO3	H2SO4	Other	None	Matrix: Water	Soil	Other	Total Number of Containers	Analyses Requested											Sample Notes or CDPH Source Numbers:

Relinquished by:	Received by:	Date:	Time:

CDPH Write On EDT Report? ○ Yes ○ No

State System Number:__________

If "Y" please enter the Source Number(s) in the column above.

CA Geotracker EDF Report? ○ Yes ○ No

Global ID: Sampling Company Log Code:

EDF to (Email Address):

Travel and Site Time:	Mileage:	Misc. Supplies:

BREWER International

September 24, 2013

Carolyn Ruttan
Invasive Species Program Coordinator
Lake County Water Resources Department
255 North Forbes Street
Lakeport, CA 95453

Carolyn Ruttan:

RE: Cygnet Plus

Cygnet Plus, CA-1051114-50001, is approved for aquatic use and water applications. Cygnet Plus uses Alcohol Ethoxylates and its formulation does not contain Nonylphenol Ethoxylate or create Nonylphenol Ethoxylate when used.

Sincerely,

Stephen P. Brewer
steve@brewerint.com
President

Receiving water sample location	Date	VISUAL CONDITIONS OF RECEIVING WATER							Endothall	Copper	Triclopyr	2,4-D	Diquat	Imazamox	Fluridone	Penoxsulam	Glyphosate
		Floating/suspended matter	Discloration	Bottom deposits	Aquatic life	Visible films	Fungi, slimes growth	Nuisance conditions	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
Rodman Slough																	
Cache Creek																	
.																	

Supplemental Monthly Pesticide Use Report: 2014 Aquatic Plant Management Clear Lake

Month: ______________

** Note: Use separate line for each treatment for a given permit*

Name Property Owner	Permit #	Visual		Pre Treatment		Date Herbicide Applied*	Start Time	End Time	Total Area Treated, square feet	COMMERCIAL NAME OF HERBICIDE AND UNITS, be consistent					Post Monitoring		
		Secchi depth, ft	Weather Conditions	Temp °F	D.O. ppm										Date(s)	D.O. (ppm)	Temp. °F

I certify that I have followed the
Clear Lake Aquatic Plant Management Permit Conditions

____
Print Name

____
Signature Date

Supplemental Monthly Pesticide Use Report: 2014 Aquatic Plant Management Clear Lake

Month: ______________

** Note: Use separate line for each treatment for a given permit*

										COMMERCIAL NAME OF HERBICIDE AND UNITS, be consistent					**Post Monitoring**		
Name Property Owner	**Permit #**	**Visual**		**Pre Treatment**		**Date Herbicide Applied***	**Start Time**	**End Time**	**Total Area Treated, square feet**						**Date(s)**	**D.O. (ppm)**	**Temp. °F**
		Secchi depth, ft	Weather Conditions	Temp °F	D.O. ppm												

I certify that I have followed the
Clear Lake Aquatic Plant Management Permit Conditions

______________________________ Print Name

______________________________ Signature Date

Supplemental Monthly Pesticide Use Report: 2014 Aquatic Plant Management Clear Lake

Month: ______________

** Note: Use separate line for each treatment for a given permit*										**COMMERCIAL NAME OF HERBICIDE AND UNITS, be consistent**					**Post Monitoring**		
Name Property Owner	**Permit #**	**Visual**		**Pre Treatment**		**Date Herbicide Applied***	**Start Time**	**End Time**	**Total Area Treated, square feet**						**Date(s)**	**D.O. (ppm)**	**Temp. °F**
		Secchi depth, ft	Weather Conditions	Temp °F	D.O. ppm												

I certify that I have followed the
Clear Lake Aquatic Plant Management Permit Conditions

______________________________ Print Name

______________________________ Signature Date

Supplemental Monthly Pesticide Use Report: 2014 Aquatic Plant Management Clear Lake

Month: ______________

* Note: Use separate line for each treatment for a given permit										COMMERCIAL NAME OF HERBICIDE AND UNITS, be consistent					Post Monitoring		
Name Property Owner	Permit #	Visual		Pre Treatment		Date Herbicide Applied*	Start Time	End Time	Total Area Treated, square feet						Date(s)	D.O. (ppm)	Temp. °F
		Secchi depth, ft	Weather Conditions	Temp °F	D.O. ppm												

I certify that I have followed the
Clear Lake Aquatic Plant Management Permit Conditions

____
Print Name

____
Signature   Date

Supplemental Monthly Pesticide Use Report: 2014 Aquatic Plant Management Clear Lake

Month: ______________

** Note: Use separate line for each treatment for a given permit*

Name Property Owner	Permit #	Visual		Pre Treatment		Date Herbicide Applied*	Start Time	End Time	Total Area Treated, square feet	COMMERCIAL NAME OF HERBICIDE AND UNITS, be consistent					Post Monitoring		
		Secchi depth, ft	Weather Conditions	Temp °F	D.O. ppm										Date(s)	D.O. (ppm)	Temp. °F

I certify that I have followed the
Clear Lake Aquatic Plant Management Permit Conditions

____
Print Name

____
Signature Date

Supplemental Monthly Pesticide Use Report: 2014 Aquatic Plant Management Clear Lake

Month: ________________

** Note: Use separate line for each treatment for a given permit*

Name Property Owner	Permit #	Visual		Pre Treatment		Date Herbicide Applied*	Start Time	End Time	Total Area Treated, square feet	COMMERCIAL NAME OF HERBICIDE AND UNITS, be consistent					Post Monitoring		
		Secchi depth, ft	Weather Conditions	Temp °F	D.O. ppm										Date(s)	D.O. (ppm)	Temp. °F
																	AVG.

I certify that I have followed the
Clear Lake Aquatic Plant Management Permit Conditions

________________________ Print Name

________________________ Signature Date

PERMITID	APM	Date	Owner	Contractor	Hydrilla Unit	APN	Ag/Hydrilla	RCVD	Method	Denied?
805	13-001	1/15/2013	Clearlake Keys	Self (Mechanical)	40		1/15/2013	1/18/2013	Mechanical	☐
807	13-002	1/15/2013	Clearlake Keys	Self (Mechanical)	40		1/15/2013	1/18/2013	Mechanical	☐
808	13-003	1/15/2013	Clearlake Keys	Self (Mechanical)	40		1/15/2013	1/18/2013	Mechanical	☐
809	13-004	1/15/2013	Clearlake Keys	Self (Mechanical)	40		1/15/2013	1/18/2013	Mechanical	☐
810	13-005	4/25/2013	Lands End Channel	Self (Mechanical)	4	044-521-09	4/25/2013	4/25/2013	Mechanical	☐
818	13-006	4/26/2013	Biagi, Fred	Pestmaster Services	15	028-041-38	4/28/2013	5/3/2013	Herbicide	☐
819	13-007	4/26/2013	Hale, Shirley	Pestmaster Services	64	044-193-13	4/28/2013	5/23/2013	Herbicide	☐
820	13-008	4/26/2013	Jewett, B	Pestmaster Services	64	044-193-11	4/28/2013	5/3/2013	Herbicide	☐
821	13-009	4/26/2013	Konocti Estates	Pestmaster Services	62	009-013-16	4/28/2013	5/3/2013	Herbicide	☐
822	13-010	4/26/2013	Lehman, Barbara	Pestmaster Services	66	044-501-14	4/28/2013	5/3/2013	Herbicide	☐
823	13-011	4/26/2013	Bella Lago	Pestmaster Services	62	009-013-18	4/28/2013	5/3/2013	Herbicide	☐
824	13-012	4/26/2013	Hennesey, Neil	Pestmaster Services	13	028-102-05	4/28/2013	5/3/2013	Herbicide	☐
825	13-013	4/26/2013	White, Arlene	Pestmaster Services	47	036-263-33	4/28/2013	5/3/2013	Herbicide	☐
826	13-014	4/26/2013	Willow Point	Pestmaster Services	9	025-331-28	4/28/2013	5/3/2013	Herbicide	☐
827	13-015	4/26/2013	Stitt, Jim	Pestmaster Services	40	060-342-03	4/28/2013	5/3/2013	Herbicide	☐
828	13-016	4/26/2013	Guartaroli	Pestmaster Services	64	044-193-19	4/28/2013	5/3/2013	Herbicide	☐
811	13-017	5/14/2013	Vartabedian, Paul	Pestmaster Services	63	440-042-01	5/15/2013	5/16/2013	Herbicide	☐
812	13-018	5/14/2013	Paradise Cove	Pestmaster Services	40	060-323-01	5/15/2013	5/16/2013	Herbicide	☐
813	13-019	5/14/2013	Bruns, Buzz	Pestmaster Services	11	026-312-28	5/15/2013	5/16/2013	Herbicide	☐
814	13-020	5/14/2013	Jonas, Jim	Pestmaster Services	42	035-240-13	5/15/2013	5/16/2013	Herbicide	☐
815	13-021	5/14/2013	Schepper, Carol	Pestmaster Services	40	060-311-05	5/15/2013	5/16/2013	Herbicide	☐
816	13-022	5/14/2013	Bruzzone, John	Pestmaster Services	63	044-262-16	5/15/2013	5/16/2013	Herbicide	☐
817	13-023	5/14/2013	Kono Tayee	Pestmaster Services	40	060-022-27	5/15/2013	5/16/2013	Herbicide	☐
829	13-024	5/16/2013	Lands End	Clean Lakes, Inc.	4	044-511-17	5/20/2013	5/20/2013	Herbicide	☐
830	13-025	5/16/2013	Rizzio	Clean Lakes, Inc.	16	029-242-10	5/20/2013	5/20/2013	Herbicide	☐
831	13-026	5/16/2013	Detweiler	Clean Lakes, Inc.	64	044-193-01	5/20/2013	5/20/2013	Herbicide	☐
832	13-027	5/16/2013	Richards, Kiaski	Clean Lakes, Inc.	40	060-332-22	5/20/2013	5/20/2013	Herbicide	☐
833	13-028	5/16/2013	Northport Trailer Park	Clean Lakes, Inc.	19	029-301-19	5/20/2013	5/20/2013	Herbicide	☐
834	13-029	5/16/2013	Walker	Clean Lakes, Inc.	15	028-041-10	5/20/2013	5/20/2013	Herbicide	☐
835	13-030	5/16/2013	Lindsay	Clean Lakes, Inc.	64	044-193-05	5/20/2013	5/20/2013	Herbicide	☐
836	13-031	5/16/2013	Taylor, Aitchison	Clean Lakes, Inc.	64	044-193-16	5/20/2013	5/20/2013	Herbicide	☐
837	13-032	5/16/2013	Clarke, Colvis	Clean Lakes, Inc.	66	044-501-22	5/20/2013	5/20/2013	Herbicide	☐
838	13-033	5/16/2013	Bellig	Clean Lakes, Inc.	65	044-182-08	5/20/2013	5/20/2013	Herbicide	☐

MONITORING PARAMETERS

SPOT TREATMENT WATER QUALITY SAMPLES

9/24/2013

Permit No., Client name County Area	Date	Sample timing relation to treatment	Secchi ft	Weather	Temp °F	pH	Turbidity NTU	Conductivity μmhos/cm	D.O. mg/L	Hardness mg/L	Endothall μg/L	Copper μg/L	Triclopyr μg/L	2,4-D μg/L	Diquat μg/L	Imazamox μg/L	Fluridone μg/L	Penoxsulam μg/L	Glyphosate μg/L
.										.									