APPLICATION OF COPPER TO THE STATE WATER PROJECT TO CONTROL AQUATIC WEEDS AND ALGAL BLOOMS

INITIAL STUDY/

FINAL MITIGATED NEGATIVE DECLARATION

MAY 2014

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May 2014

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SECTION 1: PROJECT DESCRIPTION

INTRODUCTION AND LOCATION

The Department of Water Resources (DWR) has applied for a State Water Resources Control Board (SWRCB) permit for application of aquatic herbicides to State Water Project (SWP) facilities to control aquatic weeds and algal blooms, in order to protect drinking water quality from diminishing through elevated tastes and odors, production of algal toxins, and to avoid aquatic plant buildup that can clog SWP filters and reduce water flows. This Initial Study (IS) evaluates the potential environmental impacts of applying aquatic herbicides on SWP facilities. The IS was prepared by DWR, for public circulation, to comply with California Environmental Quality Act (CEQA) prior to adopting a Mitigated Negative Declaration (MND). After public review and comment, DWR anticipates certifying a MND, shown in Appendix A, that will include the adoption of mitigation measures to reduce potentially significant impacts of the project to less than significant levels.

DWR has applied for a statewide General National Pollutant Discharge Elimination System (NPDES) Permit from the SWRCB to apply aquatic herbicides, when necessary, to SWP forebays and reservoirs listed in Table 1 and shown in project area maps, Figures 1-4. O'Neill Forebay lies at the foot of the Diablo Mountain Range, on the west side of the San Joaquin Valley in Merced County. Quail Lake is located in Los Angeles County within the transition zone between the Mojave Desert and mountains of the Los Padres and Angeles National Forests. Pyramid Lake is situated between the Los Padres and Angeles National Forests, about 16 miles north of Castaic in Los Angeles County. Silverwood Lake is situated at an elevation of 3,350 feet in the San Bernardino Forest within San Bernardino County.

DWR plans to apply copper complexes including copper sulfate, chelated copper compounds (Komeen® and Nautique®), and EarthTec® on an as-needed basis to control aquatic weeds and algal blooms so that the blooms do not degrade drinking water through elevated tastes and odors, production of algal toxins, clogging of filters, and reduction in water flows. Applications of copper for resource management are authorized under the General NPDES Permit No. 2013-0002-DWQ which has an effective date of December 1, 2013.

General NPDES Permit No. 2013-0002-DWQ requires strict compliance with California Toxics Rule (CTR) criteria. The SWRCB implements CTR criteria with their Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California, also known as the State Implementation Plan (SIP), and applicable Basin Plans. Thus, any aquatic pesticide that contains a priority pollutant such as copper would be prohibited from being applied in concentrations that would exceed applicable water quality criteria outside an established mixing zone.

Section 5.3 of the SIP provides a categorical exception from the toxics standards where the discharge is necessary to implement control measures: 1) for resource or pest management or 2) to meet statutory requirements under the federal Safe Drinking Water Act or California Health and Safety Code, and for certain maintenance and cleaning activities. DWR's primary purpose in periodically applying aquatic herbicides to its reservoirs is: 1) to control algal blooms, and in turn, achieve secondary drinking water

standards for taste and odor and 2) to control aquatic weeds that impact the beneficial uses and conveyance of water supplies for municipal, irrigation, and industrial purposes.

Therefore, such discharges qualify for a categorical exception to the toxics standards. Accordingly, DWR plans to apply for coverage under the SWRCB's new general permit for aquatic pesticides and, as part of that application, seek a categorical exception for its use of copper in the SWP facilities shown in Table 1. If granted, DWR would comply with all terms and conditions of the general permit.

Table 1. SWP Facilities and Aquatic Weed and Algal Management

	Region	Counties	Problem Biota	Associated Problems	Aquatic Herbicide
RESERVOIRS					
O'Neill Forebay	5	Merced	aquatic weeds and cyanobacteria	reduced water flows	copper-based
Quail Lake	4	Los Angeles	aquatic weeds and cyanobacteria	taste and odor and toxins	copper-based
Pyramid Lake	4	Los Angeles	aquatic weeds and cyanobacteria	taste and odor and toxins	copper-based
Silverwood Lake	6	San Bernardino	aquatic weeds and cyanobacteria	taste and odor and toxins	copper-based

The proposed project would involve the continued applications of copper to control aquatic weeds and algal blooms at SWP reservoirs. Figures 1 – 4 provide area maps for each of the reservoirs of this project. The facilities are located within the boundaries of three Regional Water Quality Control Boards (Regions 4, 5, and 6). Table 2 summarizes general characteristics of each reservoir.

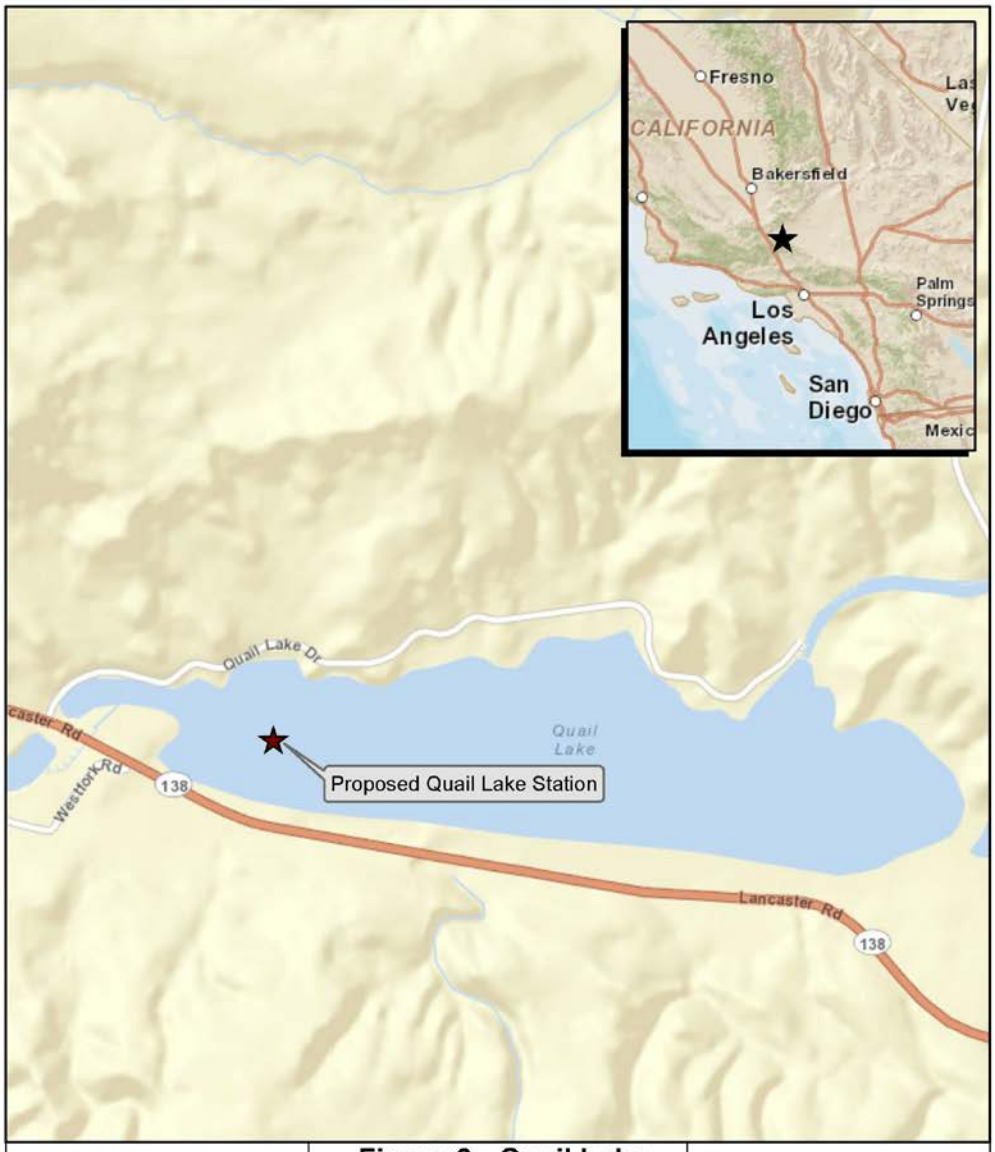
Table 2. SWP Reservoir Characteristics

Reservoirs	Maximum Volume (af)	Surface Area at Maximum Volume (ac)
O'Neill Forebay	56,400	2,700
Quail Lake	7,600	290
Pyramid Lake	171,200	1,300
Silverwood Lake	75,000	980

Total SWP reservoir storage volume is 5.8 million af.

Source: DWR, Data Handbook State Water Project, 2009


Santa Rosa
Sacramento
Oakland
Francisco
Modesto
San Jose
Oneill Forebay
Check 13 (KA007089)
San Luis Res. I/O Tower (SL001000)
Proposed O'Neill Station
Gianelli Water Quality Station (ON003050)
152
33
N
0.7
Miles
Map Citations:
Main: ESRI Street Map
Inset: ESRI Street Map
Figure 1 - O'Neill Forebay Overview Map
Application of Copper to the State Water Project to Control Aquatic Weeds and Algal Blooms
Merced County, CA
121°2'53.37"W
37°4'46.103"N
Legend
Sampling Sites
Station Name
(Station Number)



N

0.3

Miles

Map Citations:
Main: ESRI Street Map
Inset: ESRI Street Map

Figure 2 - Quail Lake Overview Map

Application of Copper to the State Water Project to Control Aquatic Weeds and Algal Blooms
Los Angeles County, CA
118°44'49.629"W
34°46'18.156"N

Legend
★ Sampling Sites


Fresno
CALIFORNIA
Bakersfield
Palm Springs
Los Angeles
San Diego
Project Inlet (PY003000)
5
Pyramid Lake
Chumash Island
Tunnel Inlet (PY001000)
Los Padres National Forest
N
0.5
Miles
Map Citations:
Main: ESRI Street Map
Inset: ESRI Street Map
Figure 3 - Pyramid Lake Overview Map
Application of Copper to the State Water Project to Control Aquatic Weeds and Algal Blooms
Los Angeles County, CA
118°46'19.483"W
34°39'14.054"N
Legend
Sampling Sites
Station Name
(Station Number)


Fresno
CALIFORNIA
Bakersfield
Palm Springs
Los Angeles
San Diego
Mexic
Los Flores Rd
CA-138
Silverwood Lake
Silverwood Lake State Rec Area
San Bernardino Tunnel (SI002000)
Canyon Rd
138
CA-138
Dart Canyon Rd
N
0.5
Miles
Map Citations:
Main: ESRI Street Map
Inset: ESRI Street Map
Figure 4 - Silverwood Lake Overview Map
Application of Copper to the State Water Project to Control Aquatic Weeds and Algal Blooms
San Bernardino County, CA
117°19'29.851"W
34°17'30.214"N
Legend
Sampling Sites
Station Name
(Station Number)

PROJECT BACKGROUND

DWR operates and manages the SWP, the largest state-built, multipurpose water project in the United States. The SWP depends on a complex system of dams, reservoirs, power plants, pumping plants, canals, and aqueducts to deliver water. The SWP provides drinking water to more than 23 million California residents and SWP water is used to irrigate about 600,000 acres of farmland, mainly in the south San Joaquin Valley. Also, the SWP was designed and built to control floods, generate power, provide recreational facilities, and enhance habitats for fish and wildlife.

DWRs mission is:

> ”To *manage the water resources of California in cooperation with other agencies, to benefit the state’s people, and to protect, restore, and enhance the natural and human environments.*”

To carry out this mission, DWR routinely monitors and tests water samples from its reservoirs, canals, aqueducts, and other water supply facilities to assure compliance with state and federal requirements for safe drinking water quality.

DWR has more than 40 monitoring stations through the SWP, and water quality monitoring provides detailed information on concentrations and distribution of chemical, physical, and biological properties at SWP facilities. . Objectives of monitoring are to:

- Assess the influence of hydrological conditions and project operations on water quality.
- Document long-term changes in SWP water quality.
- Provide water quality data to assess water treatment plant operational needs.
- Identify, monitor, and respond to water quality emergencies and determine impacts to the SWP.
- Provide data needed to determine if State Water Contractors Article 19 and California Department of Public Health Drinking water Standards are being met.
- Assess issues of concern through special studies.

DWR applies copper for two main purposes: 1) to control cyanobacteria (bluegreen algae) that can produce taste and odor compounds and 2) control aquatic weeds and attached algae that can negatively impact conveyance of water supplies for municipal, irrigation and industrial purposes.

DWR routinely monitors the taste and odor compounds produced by algae. These compounds in water are often associated with earthy, musty smelling or tasting water include geosmin and 2-methylisoborneol (MIB), which are produced in natural and manmade lakes by certain types of algae. Geosmin and MIB are natural byproducts of algal chlorophyll production, although not all algae produce them in the same amounts, so the presence of algae alone is not a good indicator of taste and odor problems.

DWR’s evaluation of taste and odor is based upon microscopic examination of samples, flavor profile analysis, and most importantly, the chemical analysis of MIB and geosmin. When sampling results indicate that concentrations of geosmin or MIB in reservoir waters are increasing within the 1 to 10 nanograms per liter (ng/L) range (1 ng/L is one part per trillion), DWR water quality staff respond by searching for the location of the source of the geosmin and/or MIB. To do this, water quality samples are collected and analyzed, and field staff ascertains possible algae sources. If an algae source is identified, DWR staff then develops a copper application plan to control the specific algae associated with the elevated geosmin and/or MIB concentrations.

Prior to application of copper-based compounds, DWR evaluates potential operational strategies to avoid introducing the taste and odor compounds into the distribution system. These modifications may include

withdrawing water from varying depths on the intake towers, blending, or utilizing other sources of water until the taste and odor compounds naturally disperse. If application of copper-based compounds is deemed necessary, this early warning monitoring provides detailed information on the location of the source blooms, allowing for spot applications.

Aquatic weeds and attached algae can restrict the conveyance of water in the SWP. Aquatic weed accumulation may be so severe that pumping plants experience outages thereby negatively impacting water deliveries. In O'Neill Forebay nuisance aquatic weeds include narrow-leaf pondweeds (*Potamogeton* sp.), broad pondweed (*Stuckenia striata*), and sago pondweed (*Potamogeton pectinatus L.*). Aquatic weed problems associated with the forebay include clogged trash racks and reduction of water flow into San Luis Reservoir.

To minimize the impact of aquatic weeds and algae, DWR plans to apply copper on an as-needed basis throughout the growing season at O'Neill Forebay, Quail Lake, Pyramid Lake, and Silverwood Lake. The typical growing season is from April – October, but in any given year, the growing season may extend beyond that period. DWR regularly applies copper at several other SWP facilities under a categorical exception obtained in 2004 and achieves control of aquatic weeds and algae without degrading water quality. The facilities included under the previously approved categorical exception are the South Bay Aqueduct, Clifton Court Forebay, Coastal Branch Aqueduct, the East Branch of the California Aqueduct, Tehachapi Afterbays, Castaic Lake, and Lake Perris.

PROJECT DESCRIPTION

DWR proposes to apply copper to O'Neill Forebay, Quail Lake, Pyramid Lake, and Silverwood Lake to control aquatic weeds and algal blooms under the new statewide NPDES permit Water Quality Order No. 2013-0002-DWQ (NPDES permit). DWR's *Aquatic Pesticides Application Plan (APAP), 2013* was prepared to control aquatic weed and taste and odor problems while minimizing the use of copper (DWR's APAP is in Appendix B). Receiving water monitoring procedures will adhere to the Monitoring and Reporting Program described in Attachment C of the NPDES permit. The monitoring would support DWR's treatment of reservoirs and forebays with copper sulfate crystals, chelated copper products, and EarthTec® to control aquatic weeds and algal blooms.

Treatment of reservoirs and forebays with copper sulfate crystals to control algal blooms

Applications of solid copper sulfate (in crystalline form) would be made to SWP reservoirs using agricultural spreaders suspended from helicopters. The spreaders would be operated over areas identified for treatment. Heliports or landing pads with loading areas located at Quail Lake, Pyramid Lake, Silverwood Lake, and O'Neill Forebay would continue to be used for the project. Quail Lake and O'Neill Forebay would also be treated nearshore by boat to control aquatic weeds. Application areas would vary in size, but would not exceed 145 acres at Quail Lake, 650 acres at Pyramid Lake, 490 acres at Silverwood Lake, or 1,350 acres at O'Neill Forebay. The applicator would be properly licensed for application of pesticides, and ground crews would wear appropriate personal protective equipment to reduce exposure to copper-based herbicides. During application, Quail Lake, Pyramid Lake and Silverwood Lake would be closed for recreational use. Access to recreational areas would be restricted at O'Neill Forebay.

Implementation of APAP

State water quality regulators require persons using aquatic pesticides to apply for coverage under the general NPDES permit, No. 2013-0002-DWQ. To obtain coverage under this permit, applicants are required to demonstrate either that its discharges comply with the water quality criteria for priority pollutants under the CTR and National Toxics Rule (NTR) or that it qualifies for an exception from compliance with such criteria, pursuant to section 5.3 of the SWRCB's SIP. Furthermore, the permit requires applicants to develop and submit an APAP describing their pesticide applications, including best management practices (BMPs), and water quality monitoring programs.

DWR has developed an APAP (Appendix B) for copper applications that includes comprehensive BMPs to avoid and minimize the potential for copper toxicities to sensitive biological resources and a monitoring program intended to detect copper concentrations in water and any potential effects to wildlife, including fish.

The following BMPs are included in DWR's APAP for copper applications:

- **Application:** Copper sulfate is applied under the supervision of a certified pesticide applicator. Delta Field Division has one licensed Pest Control Advisor (PCA) who also works in the San Luis Field Division and a total of seven Certified Qualified Applicators (QAC). Southern Field Division has two licensed PCAs and six to eight certified QACs. These individuals are trained to ensure that algaecides and aquatic herbicides are applied at rates consistent with label requirements and in a manner that avoids potential adverse effects including, but not limited to, fish kills. Copper sulfate has been used since the early 1970s to control filter clogging algae and taste and odor producing cyanobacteria.

- **Notification:** State Water Contractors, who also provide treated municipal water to customers, are notified by email at least 48 hours prior to a treatment. The notification includes date, start and end time of the treatment, and travel time of copper sulfate by milepost. Additionally, a PCA will submit a written recommendation for the use of aquatic herbicides to the County Agricultural Commissioner.

- **Treatment:** The copper is applied during daylight hours of maximum photosynthetic activity to optimize copper uptake by the algal community.

- **Spill Prevention and Cleanup:** Staff will apply copper sulfate according to label instructions in order to prevent spills. In the event of a spill, staff will follow the field division's established emergency response procedures and refer to the applicable material safety data sheet (MSDS) for instructions on containing and cleaning up the spill. Emergency response and MSDS procedures will be reviewed regularly. A copy of the emergency response procedures and MSDSs will be available during each treatment. Cleanup equipment will be kept in good working order and will be readily available at each application site.

- **Monitoring:** Water quality is monitored before, during, and after treatments. Parameters measured are water temperature, turbidity, pH, specific conductance, active ingredient (copper), dissolved oxygen (DO), and hardness as required by the NPDES general permit and stated in the APAP (Appendix B).

- **Access:** Depending on the facility, public access is temporarily closed or restricted in order to avoid exposure.

- **Post-Treatment:** The efficacy of the treatment is evaluated at about one week after the application. Algae are surveyed to determine the effectiveness of the treatment at reducing biomass, and taste and odor compounds are monitored weekly throughout the year.

Monitoring data collected as part of the APAP are used to:

- identify water quality improvements or degradation;
- detect fish (and other wildlife) kills through visual fish and wildlife monitoring;
- recommend improvements to the APAP; and
- compare monitoring data to water quality standards.

PROJECT SCHEDULE

Application of copper to the lakes and forebay would be carried out only as needed, that is, when other control options have been exhausted.

REQUIRED APPROVALS

Application of copper would require obtaining a permit from the SWRCB.

SECTION 2: Environmental Checklist Form

1. **Project title:** Application of Copper to the State Water Project to Control Aquatic Weeds and Algal Blooms

2. **Lead agency name and address:**

   Department of Water Resources
   1416 Ninth Street, Room 620
   Sacramento, CA 95814

3. **Contact person and phone number:** Diane Shimizu, (916) 653-1154

4. **Project location:** O'Neill Forebay, Quail Lake, Pyramid Lake, and Silverwood Lake California

5. **Project sponsor's name and address:**

   Department of Water Resources
   1416 Ninth Street, Room 620
   Sacramento, CA 95814

6. **General plan designation:** Reservoirs 7. **Zoning:** Public Facilities

8. **Description of project:** See Project Description in Section 1 of the IS/Mitigated Negative Declaration

9. **Surrounding land uses and setting:** See Project Description in Section 1 of the IS/Mitigated Negative Declaration

10. **Other public agencies whose approval is required (e.g., permits, financing approval, or participation agreement.):** State Water Resources Control Board

ENVIRONMENTAL FACTORS POTENTIALLY AFFECTED:

The environmental factors checked below would be potentially affected by this project, involving at least one impact that is a "Potentially Significant Impact" as indicated by the checklist on the following pages.

☐ Aesthetics	☐ Agriculture and Forestry Resources	☐ Air Quality
☑ Biological Resources	☐ Cultural Resources	☐ Geology/Soils
☐ Greenhouse Gas Emissions	☐ Hazards & Hazardous Materials	☑ Hydrology/Water Quality
☐ Land Use/Planning	☐ Mineral Resources	☐ Noise
☐ Population/Housing	☐ Public Services	☐ Recreation
☐ Transportation/Traffic	☐ Utilities/Service Systems	☐ Mandatory Findings of Significance

DETERMINATION:

On the basis of this initial evaluation:

☐ I find that the proposed project COULD NOT have a significant effect on the environment, and a NEGATIVE DECLARATION will be prepared.

☑ I find that although the proposed project could have a significant effect on the environment, there will not be a significant effect in this case because revisions in the project have been made by or agreed to by the project proponent. A MITIGATED NEGATIVE DECLARATION will be prepared.

☐ I find that the proposed project MAY have a significant effect on the environment, and an ENVIRONMENTAL IMPACT REPORT is required.

☐ I find that the proposed project MAY have a "potentially significant impact" or "potentially significant unless mitigated" impact on the environment, but at least one effect 1) has been adequately analyzed in an earlier document pursuant to applicable legal standards, and 2) has been addressed by mitigation measures based on the earlier analysis as described on attached sheets. An ENVIRONMENTAL IMPACT REPORT is required, but it must analyze only the effects that remain to be addressed.

☐ I find that although the proposed project could have a significant effect on the environment, because all potentially significant effects (a) have been analyzed adequately in an earlier EIR or NEGATIVE DECLARATION pursuant to applicable standards, and (b) have been avoided or mitigated pursuant to that earlier EIR or NEGATIVE DECLARATION, including revisions or mitigation measures that are imposed upon the proposed project, nothing further is required.

_____ _____

Signature Date

_____ _____

Signature Date

SECTION 3: EVALUATION OF ENVIRONMENTAL IMPACTS

I. AESTHETICS -- Would the project:	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
a) Have a substantial adverse effect on a scenic vista?	☐	☐	☑	☐
b) Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway?	☐	☐	☐	☑
c) Substantially degrade the existing visual character or quality of the site and its surroundings?	☐	☐	☑	☐
d) Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area?	☐	☐	☐	☑

Discussion

a, b, & c. This project involves the periodic application of copper sulfate to several reservoirs. All project work is short-term, with each treatment occurring during a single day, and will not have a presence beyond work windows. Each reservoir would be treated a maximum of five times per year. While Silverwood Lake has designated scenic viewpoints and Highway 152, adjacent to O'Neill Forebay, is a designated state scenic highway, the work will be temporary near these areas. In addition, the only on ground footprint during application periods will be the small staging areas. Since the staging areas will be located in previously developed areas, no alterations to the land will be necessary. Due to the short work windows and lack of permanent structures or alterations to the environment, this project will have less than significant impact on the aesthetics of the regions in question.

d. The proposed project will not result in any new sources of light or glare and any activities during work windows will be limited in time and scope. Therefore, this project will have no adverse impact on day or nighttime views.

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
II. AGRICULTURAL AND FOREST RESOURCES: In determining whether impacts to agricultural resources are significant environmental effects, lead agencies may refer to the California Agricultural Land Evaluation and Site Assessment Model (1997) prepared by the California Dept. of Conservation as an optional model to use in assessing impacts on agriculture and farmland. In determining whether impacts to forest resources, including timberland, are significant environmental effects, lead agencies may refer to information compiled by the California Department of Forestry and Fire Protection regarding the state's inventory of forest land, including the Forest and Range Assessment Project and the Forest Legacy Assessment project; and forest carbon measurement methodology provided in Forest Protocols adopted by the California Air Resources Board. -- Would the project:				
a) Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non- agricultural use?	☐	☐	☐	☑
b) Conflict with existing zoning for agricultural use, or a Williamson Act contract?	☐	☐	☐	☑

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
c) Conflict with existing zoning for, or cause rezoning of, forest land (as defined in Public Resources Code section 12220(g)), timberland (as defined by Public Resources Code section 4526), or timberland zoned Timberland Production (as defined by Government Code section 51104(g))?	☐	☐	☐	☑
d) Result in the loss of forest land or conversion of forest land to non-forest use?	☐	☐	☐	☑
e) Involve other changes in the existing environment which, due to their location or nature, could result in conversion of Farmland, to non-agricultural use or conversion of forest land to non-forest use?	☐	☐	☐	☑

Discussion

a, b, c, d, & e. All project locations will be located within DWR owned and operated lands. There are no current agriculture or forest resources located at any of the staging areas, and there is no conflict with existing zoning or Williamson Act lands. Furthermore, since work site footprints will be located on developed land, no land use conversions will occur as a result of this project. Therefore, this project poses no impact to agricultural or forest resources.

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
III. AIR QUALITY -- Where available, the significance criteria established by the applicable air quality management or air pollution control district may be relied upon to make the following determinations. Would the project:				
a) Conflict with or obstruct implementation of the applicable air quality plan?	☐	☐	☑	☐
b) Violate any air quality standard or contribute substantially to an existing or projected air quality violation?	☐	☐	☑	☐
c) Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard (including releasing emissions which exceed quantitative thresholds for ozone precursors)?	☐	☐	☑	☐
d) Expose sensitive receptors to substantial pollutant concentrations?	☐	☐	☑	☐
e) Create objectionable odors affecting a substantial number of people?	☐	☐	☐	☑

Discussion

a, b, & c. The reservoirs covered by this project are located within two separate air quality districts. The southern reservoirs (Quail Lake, Pyramid Lake, and Silverwood Lake) are under the jurisdiction of the South Coast Air Quality Management District (SCAQMD), while O'Neill Forebay is under the jurisdiction of the San Joaquin Valley Air Pollution Control District (SJVAPCD). Each of these districts has the authority and responsibility to regulate air quality within their respective administrative areas. Regulation by either agency occurs through the implementation and enforcement of appropriate air quality management plans (AQMP). All projects occurring within the jurisdiction of each district must

identify and mitigate any contribution to adverse air quality deemed significant based on thresholds in the applicable AQMP.

In order to identify any contributions to adverse air quality produced by the proposed project, the major emissions sources related to the project were evaluated for their impacts to regional air quality. The activities included in this analysis include those associated with emissions from vehicle trips and emissions from spraying operations. The air quality analysis was performed using several emissions factors and models, based on known and assumed procedures.

The mobile emissions, those from staff vehicles and the truck transporting the application material, were calculated using the most recent emissions factors used by the California Air Resources Board's (CARB's) EMFAC2011 emissions model for both air districts. The air pollutant constituents provided by this model include reactive organic gasses (ROG), total organic gasses (TOG), carbon monoxide (CO), oxides of nitrogen (NOx) and sulfur (SOx), and both inhalable coarse particulate matter less than 10 microns in diameter (PM10), and fine particles less than 2.5 microns in diameter (PM2.5). For the EMFAC model, ROG is the same as VOC (volatile organic compounds). The parameters used for calculating the total automobile source emissions derived from the vehicle type and usage for similar projects at other locations. For this project it was assumed there would be no more than five pickup trucks (EMFAC2011 vehicle classification LDT2), a hopper truck (T7 Ag), a water truck (T6 instate small), and a flatbed trailer (T7 tractor), each averaging 75 miles per day. The total emissions from each vehicle class for each district are shown in Tables 3(a) & (b). Detailed information about each calculation, as well as the specific emissions factors used, is located in Appendix C.

In addition to the automobile source emissions, mobile source emissions for the helicopter used during this project were also calculated. The emissions factors used for this calculation are for a Bell 206b and were taken from the Swiss Confederation, Federal Office of Civil Aviation's (FOCA) report "Guidance on the Determination of Helicopter Emissions". Aircraft emissions calculations require separate emissions factors for both the landing and take-off cycle (LTO) and hourly sustained flight; both emission factors are calculated in Appendix C. The specific pollutants addressed for the helicopter emissions include CO, NOx, and PM2.5, as well as total hydrocarbons (THC). In most cases, THC is analogous to TOG (EPA, 2010), meaning they can be combined for the comparison portion of this analysis. In addition to the EMFAC emissions results, Tables 3(a) & (b) show the total helicopter emissions calculated for this project and total pounds per day for each air district.

Table 3(a) – San Joaquin Project Emissions Results

Pollutant	LDT2 Emissions (lbs/day)	T7 Ag Emissions (lbs/day)	T6 instate small Emissions (lbs/day)	T7 tractor Emissions (lbs/day)	Helicopter Emissions (lbs/day)	Total Emissions (lbs/day)
ROG	0.194	0.107	0.057	0.070	-	0.428
TOG	0.214	0.122	0.065	0.080	-	0.481
THC	-	-	-	-	25.85	25.85
CO	2.079	0.500	0.187	0.327	33.12	36.213
NOX	0.252	2.318	0.953	1.860	10.23	15.613
PM10	0.039	0.086	0.058	0.052	-	0.235
PM2.5	0.017	0.070	0.042	0.039	0.34	0.508
SOX	0.004	0.003	0.002	0.003	-	0.012

Source: CARB EMFAC2011 & FOCA

Table 3(b) – South Coast Project Emissions Results

Pollutant	LDT2 Emissions (lbs/day)	T7 Ag Emissions (lbs/day)	T6 instate small Emissions (lbs/day)	T7 tractor Emissions (lbs/day)	Helicopter Emissions (lbs/day)	Total Emissions (lbs/day)
ROG	0.167	0.100	0.035	0.067	-	0.369
TOG	0.186	0.114	0.040	0.076	-	0.416
THC	-	-	-	-	25.86	25.86
CO	1.857	0.450	0.143		33.12	35.895
NOX	0.215	2.289	0.743	1.868	10.23	15.345
PM10	0.039	0.092	0.051	0.056	-	0.238
PM2.5	0.017	0.075	0.035	0.043	0.34	0.51
SOX	0.004	0.003	0.002	0.003	-	0.012

Source: CARB EMFAC2011 & FOCA

SCAQMD is a non-attainment region for State and Federal levels of ozone, PM2.5, and PM10. SJVAPCD is an attainment region for PM10 at the Federal level but non-attainment at the State level. In addition, SJVAPCD is non-attainment for State and Federal levels of ozone and PM2.5. Both air districts have prepared AQMPs to reach attainment for these pollutants in their respective air basins. The AQMPs contain project-level thresholds that must not be exceeded in order for each district to reach attainment. Projects that increase pollutant levels of the criteria pollutants beyond approved thresholds may have a potentially significant affect on the environment. Since each district is individual in their approach to determining significance, separate analysis was required for each project region.

SCAQMD Analysis

The SCAQMD uses two significance threshold tables for determining project effects on air quality. These thresholds, localized and regional significance thresholds, each have their own requirements and are utilized separately. The regional significance thresholds are the overarching set of values used to determine the project's effects on air quality. The regional significance thresholds for the SCAQMD are shown in Table 4. When these values are compared to the calculated project emissions, it is clear that this project is far below the significance thresholds determined by the SCAQMD.

Table 4 – SCAQMD Mass Daily Thresholds Comparison (lbs/day)

Pollutant	Mass Daily Threshold (Construction)	Calculated Emissions from Table 3(b)
NOX	100	15.345
VOC	75	0.369
PM10	150	0.238
PM2.5	55	0.51
SOX	150	0.012
CO	550	35.895

Source: SCAQMD Air Quality Significance Thresholds

The second set of significance thresholds are the localized significance thresholds. The specific values used for determining a project's localized impacts are based, in part, on the distance from the nearest sensitive receptors. The furthest distance used by the localized significance thresholds is 500 meters. While the classification of sensitive receptors differs between agencies, "for the purposes of a CEQA analysis, the SCAQMD considers a sensitive receptor to be to be a receptor such as residence, hospital, convalescent facility were [sic] it is possible that an individual could remain for 24 hours" (SCAQMD, 2008). The only project site within 500 meters of a sensitive receptor is Quail Lake; however, project operations and helicopter flyovers will not occur in those areas within 500 meters of the sensitive receptor. Since the operations at Quail Lake and at the other sites will not occur within 500 meters of any sensitive receptors, no further examination under the localized significance thresholds is necessary.

SJVAPCD Analysis

The SJVAPCD analysis method uses estimated emissions calculations, however, the classification and determination of the thresholds of significance differ from SCAQMD emission types. Project emissions for this air district were calculated using EMFAC2011 then compared to predetermined thresholds of significant impact for ROG, NOx, and CO. The thresholds for the ozone precursors (ROG and NOx) are based on annual accumulation and are determined to be 10 tons/year for each type. The carbon monoxide threshold is calculated differently and is based on the California Ambient Air Quality Standard (CAAQS) of 9 parts per million (ppm) averaged over 8 hours. Based on the calculated daily emissions in Table 3(a), this project will fall well below these standards. Thus the project's emissions are deemed to be less than significant.

In addition to the comparison of emissions to significance thresholds, the SJVAPCD has approved a series of rules to mitigate fugitive dust (PM10). These rules, collectively called Regulation VIII, address PM10 generated during the construction phase and provide a series of control measures that projects should implement. According to the SJVAPCD, "compliance with Regulation VIII for all sites and implementation of all other control measures indicated in Tables 6-2 and 6-3 (as appropriate, depending on the size and location of the project site) will constitute sufficient mitigation to reduce PM-10 impacts to a level considered less than- significant" (SJVAPCD, 2002). The other control measures indicated in Table 6-3 in the Guide for Assessing and Mitigating Air Quality Impacts refer to projects larger than the project proposed here. The control measures shown on Table 6-2 of the GAMAQI are meant for projects

of this size and include the Regulation VIII control measures necessary for this project. The applicable control measures from Table 6-2 of the GAMAQI are listed below.

Regulation VIII Control Measures Applicable to this Project:

- All on-site unpaved roads and off-site unpaved access roads shall be effectively stabilized of dust emissions using water or chemical stabilizer/suppressant.
- When materials are transported off-site, all material shall be covered, or effectively wetted to limit visible dust emissions, and at least six inches of freeboard space from the top of the container shall be maintained.
- All operations shall limit or expeditiously remove the accumulation of mud or dirt from adjacent public streets at the end of each workday. (The use of dry rotary brushes is expressly prohibited except where preceded or accompanied by sufficient wetting to limit the visible dust emissions.) (Use of blower devices is expressly forbidden.)

This project will implement these applicable Regulation VIII control measures thereby ensuring that this project's PM10 emissions are at a level deemed less than significant.

One area in which these two air districts are similar is the treatment of hazardous air pollutants. Both districts have set thresholds of significance for carcinogenic and non-carcinogenic exposure due to project activities. The application materials used during this project are not known carcinogens nor are they listed as hazardous air pollutants. Therefore, this project will not contribute to an increase in the probability of nearby individuals contracting cancer nor will it increase concentrations of toxic air contaminants.

Due to this project's compliance with each district's thresholds of significance, the lack of carcinogenic and hazardous air pollutants, and the use of recommended control measures for PM10 it has been determined that this project has a less than significant impact on the implementation of any AQMP and will not violate air quality standards or contribute to a significant increase in pollutants classified as non-attainment.

d. Since the project distance from sensitive receptors is unique for each reservoir, it was determined using aerial photography for each reservoir individually. In the case of this project, the distance to sensitive receptors was measured from the edge of the expected application areas to the nearest sensitive receptor. This was done to ensure that the effects on sensitive receptors from emissions by vehicles used for the application (either boats or helicopters) are included in the analysis. The standard operating procedure for this type of pesticide application requires closing the water body to all recreational uses for the duration of the project, meaning the nearest receptors would all be on land. All four reservoirs involved in this project have publicly accessible recreation facilities along the shore. In order to minimize exposure to these receptors, all project staging areas will be located away from recreational facilities or on those facilities that will be closed to the public during the application period.

In addition, both Silverwood Lake and O'Neill Forebay have State Parks campgrounds located adjacent to the waterline, which will not be closed during application periods. While the emissions from the helicopters have been found to be negligible and the application material being used is not a known hazardous air pollutant, steps will be taken to limit public concerns surrounding the aerial spraying. The purpose of this is to limit concerns over potential overspray into areas near the public access points. These steps include ceasing aerial spraying in high winds and the use of boats for all applications within 500

meters of sensitive receptors. Following these procedures, as well as typical operating procedures for these types of projects, there will be a less than significant impact on nearby sensitive receptors.

e. A further analysis requirement for each district is for odor affects. Since the copper compounds applied during this project are odorless, there will be no impacts due to odors from the project.

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
IV. BIOLOGICAL RESOURCES -- Would the project:				
a) Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Wildlife or U.S. Fish and Wildlife Service?	☐	☑	☐	☐
b) Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations or by the California Department of Fish and Wildlife or US Fish and Wildlife Service?	☐	☐	☑	☐
c) Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the CWA (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means?	☐	☐	☑	☐

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
d) Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites?	☐	☑	☐	☐
e) Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?	☐	☐	☐	☑
f) Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan?	☐	☐	☐	☑

Discussion

DWR contracted with ESA consultants to conduct a biological survey to evaluate potential impacts to biological resources resulting from the project. Their technical report is included as Appendix D of this document. The *Impact Analysis* of the ESA report is incorporated in the biological resources section of this IS.

a. This section describes the potential impacts to special-status species that may occur within or along the shoreline of each water body. No critical habitat, as designated by USFWS, occurs in the project area. The staging areas for the herbicide application are developed to accommodate SWP operational activities and do not contain special-status plant or animal species.

Special-Status Plants

This section describes the potential impact to special-status plant species that may occur along the shore of each water body.

The following seven special-status plants have the potential to occur along the shoreline of Pyramid Lake:

- Horn's milkvetch (*Astragalus hornii* ssp. *hornii*)
- Monkey-flower savory (*Clinopodium mimuloides*)

- Mojave tarplant (*Deinandra mohavensis*)
- Los Angeles sunflower (*Helianthus nuttallii* ssp. *parishii)*
- California satintail (*Imperata brevifolia*)
- Ocellated Humboldt lily (*Lilium humboldtii* ssp. *ocellatum*)
- San Bernardino aster (*Symphyotrichum defoliatum*)

The following three special-status plants have the potential to occur along the shoreline of Silverwood Lake:

- Palmer's mariposa-lily (*Calochortus palmeri*)
- San Bernardino aster
- Black bogrush (*Schoenus nigricans*)

The following three special-status plants have the potential to occur along the shoreline of Quail Lake:

- Late-flowered mariposa-lily (*Calochortus fimbriata*)
- Palmer's mariposa-lily
- San Bernardino aster

The following two special-status plants have the potential to occur along the shoreline of O'Neill Forebay:

- Hispid birds-beak (*Chloropyron molle* ssp. *hispidum*)
- Sanford's arrowhead (*Sagittaria sanfordii*)

Plants Potentially Occurring in Upland Areas

The copper sulfate would be applied using a helicopter that would depart from previously developed areas, away from native habitats where special-status plants potentially occurring in upland areas (i.e., Horn's milkvetch, monkey-flower savory, Mojave tarplant, Los Angeles sunflower, California satintail, ocellated Humboldt lily, San Bernardino aster, Palmer's mariposa-lily, late-flowered mariposa-lily, and hispid birds-beak) could be present. Project activities would include unloading pallets of copper sulfate from a truck to the helicopter pad area, loading the copper sulfate into bins and depositing the material into the reservoir using a helicopter or boat. No copper sulfate would be dispersed within upland habitat areas where these plants could be present, and the helicopter pad areas are generally devoid of vegetation. As a result, potential impacts to special-status plants potentially occurring in upland areas (i.e., Horn's milkvetch, monkey-flower savory, Mojave tarplant, Los Angeles sunflower, California satintail, ocellated Humboldt lily, San Bernardino aster, Palmer's mariposa-lily, late-flowered mariposa-lily, and hispid birds-beak) would be less than significant.

Plants Potentially Occurring in Open Water Areas

The copper sulfate would be applied to control planktonic algae by helicopter and/or boat to open water areas of the lake away from the immediate shoreline. Applications would be dispersed on the lake using a boat targeting nuisance algal blooms and submerged aquatic weeds. No special-status plant species would be present within the open water areas of the lake/forebay where applications would be primarily

targeted, and therefore, there would be no special-status plants impacted directly or indirectly during the applications in open water areas.

Plants Potentially Occurring in Shoreline Areas

There is potential for two special-status plants to occur within the shoreline areas of the reservoirs where copper sulfate applications would be conducted to reduce nuisance algae. Special-status species with the potential to occur in shoreline areas of the reservoirs are wetland plants and include black bogrush and Sanford's arrowhead. Black bullrush and Sanford's arrowhead, if present, would occur in seasonally or perennially saturated areas along the shorelines of Silverwood Lake (black bogrush) and O'Neill Forebay (Sanford's arrowhead). Sanford's arrowhead also has the potential to occur in inundated areas at O'Neill Forebay.

The use of copper sulfate for weed and algae management is limited to aquatic environments and affected vegetation generally includes algae and submerged and floating broadleaf plants (DiTomaso, 2012). The US Environmental Protection Agency ascertains that their assessment of the ecological effects of copper sulfate "does not indicate a risk of concern to freshwater vascular plants or estuarine/marine plants" (United States Environmental Protection Agency [USEPA], 2008).

Only plant tissues present in water would potentially come in contact with copper sulfate. Wetland habitats with saturated soils but no standing water are considered to be outside of the area where applications would be targeted and these are the areas most likely to support black bogrush. Copper sulfate is not likely to be taken up through roots in soil substrate. Copper is generally considered to be biologically inactive in sediments (Gettys, Haller, and Bellaud, 2009) because it becomes strongly adsorbed to the soil (DiTomaso et al 2013). Therefore, even in inundated areas, plants rooted in soil are unlikely to take up toxic levels of copper via the root system.

Black bogrush and Sanford's arrowhead, if present, are unlikely to be negatively affected by the application of copper sulfate because the majority of the above-ground tissue is typically present outside of the water column and limited plant tissue would come in contact with copper sulfate resulting in limited exposure. Black bogrush and Sanford's arrowhead would be unlikely to accumulate enough copper sulfate to result in toxicity. As a result, potential impacts to special-status plants potentially occurring in shoreline areas would be less than significant.

Special-Status Wildlife

Several special-status species have the potential to occur within the reservoirs or along the immediate shoreline areas and a list of special-status species by reservoir is provided below. A discussion of potential impacts to these species is also provided below. The discussion is organized into two sections based on habitat types used by the different species – impacts to aquatic habitat and impacts to upland habitat.

The following eight special-status wildlife species have the potential to occur within Pyramid Lake or along the immediate shoreline:

- Western pond turtle (*Emys marmorata*)
- Arroyo toad (*Anaxyrus californicus*)

- Foothill yellow-legged frog (*Rana boylii*)
- Western spadefoot (*Spea hammondii*)
- Two-striped garter snake (*Thamnophis hammondii*)
- Tricolored blackbird (*Agelaius tricolor*)
- Northern harrier (*Circus cyaneus*)
- Bald eagle (Haliaeetus *leucocephalus*)

The following seven special- status wildlife species have the potential to occur within Silverwood Lake or along the immediate shoreline:

- Arroyo toad
- California red-legged frog (*Rana draytonii*)
- San Bernardino ring-necked snake (*Diadophis punctatus* ssp. *modestus*)
- Southern mountain yellow-legged frog (*Rana muscosa*)
- Two-striped garter snake
- Western pond turtle
- Bald eagle

The following four special- status wildlife species have the potential to occur within Quail Lake or along the immediate shoreline:

- Northern harrier
- Foothill yellow-legged frog
- Western pond turtle
- Bald eagle

The following ~~nine~~thirteen special- status wildlife species have the potential to occur within O'Neill Forebay or along the immediate shoreline:

- California tiger salamander (*Ambystoma californiense*)
- Cackling goose (*Branta hutchinsii* ssp. *leucopareia*)
- Northern harrier
- Western pond turtle
- California red-legged frog
- Western spadefoot
- Giant garter snake (*Thamnophis gigas*)
- Tricolored blackbird
- Yellow warbler (*Dendroica petechia brewsteri*)
- Bald eagle
- Golden eagle (*Aquila chrysaetos*)
- Swainson's hawk (*Buteo swainsoni*)
- White-tailed kite (*Elanus leucurus*)

Impacts to Aquatic Habitat

Impacts to aquatic habitat could occur through immediate exposure and toxicity, long-term exposure and bioaccumulation, and through post-application decreases in dissolved oxygen. Each of these impact mechanisms is described below.

Immediate Exposure and Toxicity

Wildlife species that utilize aquatic habitats associated with the lakes, including fish, amphibians, reptiles, and birds, could be exposed to copper sulfate, the active ingredient in aquatic herbicides being used, if they are present in the application areas during periods when applications are taking place. Studies have shown that the application of copper sulfate to surface waters for nuisance algae control in reservoirs have no apparent negative effects for most adult game fish (Anderson et al., 2001). However, copper sulfate has been shown to be toxic to larval fish and aquatic invertebrates (Diamond, et al., 1997; TOXNET, 1975-1986.). CDFW laboratory tests have shown that concentrations of 1,000 parts per billion (ppb) are many times below the toxicity values for delta smelt (California Department of Boating and Waterways [DBW], 2001). Salmonids tend to be more sensitive to copper sulfate than other fish species but tests for rainbow trout have also shown toxicity values many times higher than the application concentrations that would occur with this project (DBW, 2001). Copper concentrations would be applied according to the label to achieve a maximum concentration of 1,000 ppb, well below any known concentrations that may be toxic to fish in the project area.

Copper sulfate exposure poses less of a threat to birds than to other animals, with the lowest lethal dose for this material in pigeons and ducks being 1,000 parts per million (ppm) (Tucker and Crabtree, 1970).This toxicity value is many times higher than the application concentrations that would occur for this project.

The potential for special-status amphibians to be exposed to copper applications is low because habitat within the reservoirs is generally not suitable and these species would not be expected to occur where applications would be targeted. Arroyo toad inhabits washes, arroyos, sandy riverbanks, and riparian areas. Southern mountain yellow-legged frog and foothill yellow-legged frog also inhabit small streams with sandy banks and would not be expected to occur within the reservoirs. California red-legged frog is principally a pond frog that can be found in quiet permanent waters of ponds, pools, streams, springs, and marshes. Similarly, California tiger salamander are typically found occupying habitat in small stock ponds and would not be expected to occur in any of the reservoirs.

The potential for two-striped garter snakes to be exposed to copper applications is also low because this species is generally found around pools, creeks, cattle tanks, and other water sources, often in rocky areas, in oak woodland, chaparral, brushland, and coniferous forest. The potential for giant garter snakes to be exposed to applications is also low because this species generally inhabits freshwater marshes and swamps of the Central Valley. Western pond turtles are typically found in ponds, lakes, rivers, streams, creeks, marshes, and irrigation ditches, with abundant vegetation, and either rocky or muddy bottoms, in woodland, forest, and grasslands. While it is possible that they could be present in areas exposed to applications of copper sulfate, it is unlikely. If they are present in areas where copper applications would be conducted, the effects would be expected to be negligible due to the small amount of copper that would be applied. Lastly, with implementation of the Aquatic Pesticides Application Plan (see Appendix

B), fish (and other wildlife) distress and/or kills would be detected through visual fish and wildlife monitoring during and after applications. If distressed turtles are observed during monitoring, these results would be reported and application procedures would be refined in order to avoid any potential harm.

Because the potential for special-status species exposure to copper sulfate applications is low and because targeted application concentrations of copper sulfate are substantially lower than toxicity thresholds for sensitive fish and wildlife, impacts associated with immediate exposure and toxicity would be less than significant.

Long-term Exposure and Bioaccumulation

Although copper sulfate is highly water soluble; that is, it dissolves very easily in water, the copper ions are strongly adsorbed by soil (lake-bottom sediment) particles when it is applied (TOXNET, 1975-1986). Copper compounds, or precipitates, also settle out of solution, in a process called precipitation. Copper that is absorbed by sediments and copper precipitates are biologically inactive, meaning that they do not undergo further biological changes (Gangstad, 1986). Additionally, copper that is not in a soluble form (i.e., absorbed by sediment or copper precipitate) is less available for uptake into the food web and less toxic (Moffett et al., 1998). Because copper sulfate applications are expected to be rapidly absorbed by lake sediments (TOXNET, 1975-1986) and/or form precipitates and fall out of solution, and these forms are much less bio-available and toxic, impacts associated with long-term exposure and bioaccumulation of copper are less than significant.

Post-application Decreases in Dissolved Oxygen

While not associated with direct copper toxicity, aquatic herbicides, including copper sulfate have the potential to result in temporary decreases in dissolved oxygen (DO) concentrations in water if large blooms of algae are treated at one time or through frequent treatments that occur over a relatively short duration. Low DO concentrations (< 5 to 6 mg/L) can occur when the decomposition of organic matter (dead algal matter) results in high biological oxygen demand (BOD). Sudden increases in BOD and associated decreases in DO (below 5 to 6 mg/L for warmwater fish and below 6 to 8 mg/L for coldwater fish, including salmonids) can result in conditions that are unsuitable for fish and lead to fish kills (State Water Resources Control Board [SWRCB], 2004). Substantial decreases in DO are not expected to result from copper sulfate applications because DWR has developed and implements an APAP describing their copper sulfate applications, including best management practices (BMPs), and water quality monitoring programs. Therefore, with the implementation of the APAP, this impact is less than significant.

Additionally, at O'Neill Forebay, water would not be released from the forebay into the adjacent O'Neill Forebay Wildlife Area during copper sulfate application.

Based on a review of past monitoring reports (DWR, 2011, 2012, and 2013b), there have been no reported periods of prolonged water quality degradation, distressed fish, or fish kills associated with these past copper sulfate applications.

In summary, based on a review of copper concentration toxicities to fish and birds, the concentrations of copper that would be achieved with applications of copper, and bioavailability of copper in lake sediments, impacts resulting from copper sulfate exposure would be **less than significant**. DWR's

adherence to the APAP would further ensure that water quality and sensitive biological resources within the lakes would not be impacted by the application of copper sulfate. Additionally, copper sulfate applications may reduce the potential for fish kills, and reduce risks to other animals, by killing algal biomass which can produce toxins that are toxic to all animals.

Impacts to Upland Habitats

As discussed above for special- status plants, the proposed project would not affect upland native habitat areas and, as a result, would not be anticipated to affect any terrestrial wildlife species utilizing those habitats, including special- status species such as western spadefoot. However, there are a number of resident and seasonally present bird species that have the potential to nest and/or forage in the vicinity of the proposed project site in trees and adjacent vegetation along the shoreline. These species include tricolored blackbird, northern harrier, bald eagle, cackling goose, and yellow warbler. Depending on the timing of application, repeated noise and wind disturbance from helicopters and drift of copper sulfate during aerial applications could affect habitats close to the shoreline where birds may nest. Repeated noise and wind disturbance from helicopters and copper sulfate drift could also cause a nesting bird to abandon a nest resulting in loss of eggs or chicks, or affect the nest directly is eggs or chicks are present. Such impacts to active nests would be a violation of the MBTA and Fish and Game Code (see Section 3.2.1 above). Implementation of the mitigation measure recommended below would reduce the potential for injury or mortality of nesting birds during helicopter applications through application timing, pre-application nesting bird surveys, and establishment of nesting buffers.

Mitigation Measure BIO-1: Impact Avoidance to Nesting Birds

The following mitigation measures are recommended to reduce potential impacts to nesting birds during application of copper sulfate by helicopters:

- If a copper sulfate application is scheduled to occur during the breeding season (February 1– ~~August 31~~September 15), it is recommended that a qualified biologist conduct pre-application surveys of all potential nesting habitats within 500 feet of proposed helicopter application activities. Surveys at O'Neill Forebay will follow the survey methodology of the Swainson's Hawk Technical Advisory Committee (SWHA TAC, 2000) and the Bald Eagle Breeding Survey Instructions (California Department of Fish and Game (CDFG), 2010). At least one survey should be conducted no more than three days prior to these activities. If the application is scheduled to occur during the non-nesting season (September ~~1~~ 16 through January 31) at Quail Lake, Pyramid Lake, or Silverwood Lake, a pre-application survey is not necessary and no additional measures are recommended. At O'Neill Forebay, surveys for burrowing owl nests will be conducted using the survey methodology described in "Staff Report on Burrowing Owl Mitigation dated March 7, 2012 (CDFG, 2012) any time of year that an application by helicopter is planned.

- If active nests are found at Quail Lake, Pyramid Lake, or Silverwood Lake, no-disturbance buffers shall be implemented around each nest based on the species and location of the nest as determined by a qualified biologist, or the nest should be closely monitored during applications to ensure that helicopter does not create physical disturbance and copper sulfate does not inadvertently drift into the nest. If a buffer is preferred, a general buffer distance typically includes 500 feet around any confirmed active raptor nest or a 300-foot buffer around nests of passerine bird species protected in accordance with the MBTA and/or Fish and Game Code. Additionally, helicopters shall not fly vertically over trees with active nests

unless an adequate elevation can be achieved to ensure that downward wind generated by the propulsion would not physically disturb the tree. However, buffer distances can be determined by the biologist based on location, vegetation cover, species, and other factors. The buffers should be implemented until it is determined by a qualified wildlife biologist that young have fledged and the nest is determined to be inactive.

- If active nests are found at O'Neill Forebay, identified nests of special status species will be continuously surveyed for 24 hours prior to any activities related to helicopter applications in order to establish a behavioral baseline. During the application, the nests will be continuously monitored to detect any behavioral changes. No-disturbance buffers of 500 feet shall be implemented around each nest for non-listed bird species, while buffers of 0.5 miles will be implemented for nests of all raptors. Additionally, helicopters shall not fly vertically over trees with active nests unless an adequate elevation can be achieved to ensure that downward wind generated by the propulsion would not physically disturb the tree. The buffers should be implemented until it is determined by a qualified wildlife biologist that young have fledged and the nest is determined to be inactive. If burrowing owl nests are identified, impacts to occupied burrows will be avoided by implementing no-disturbance buffers in accordance with the table below unless a qualified biologist determines either: 1) the birds have not begun egg-laying and incubation or 2) juveniles from the occupied burrows are foraging independently and are capable of survival.

Location	Time of Year	Level of Disturbance		
		Low	Med.	High
Nesting sites	April 1-Aug 15	200 m*	500 m	500 m
Nesting sites	Aug 16-Oct 15	200 m	200 m	500 m
Nesting sites	Oct 16-Mar 31	50 m	100 m	500 m

*meters (m)

Mitigation Measure BIO-2: Focused Biological Surveys

Prior to a copper application by helicopter, a qualified wildlife biologist will conduct a survey of the project area to determine if special status species could be impacted. Survey results will be used to identify any mitigation minimization and avoidance measures that may be needed to reduce potential impacts to special status wildlife species to a less than significant level.

Mitigation Measure BIO-3: Special Status Plant Surveys at O'Neill Forebay

Prior to a copper application by helicopter at O'Neill Forebay, a qualified botanist will survey the land adjacent to the application area for special status species plants. The botanist will follow the *Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities (November 24, 2009).* If special status species are found, DWR will monitor wind speed and wind direction to avoid potential impacts to the species from a helicopter application.

With implementation of the proposed mitigation measures, impacts to uplands habitat and terrestrial species, including nesting birds, would be **less than significant**.

b & c. All four water bodies contain wetland features that may be considered jurisdictional by the USACE under Section 404 of the Clean Water Act, by the RWQCB under Section 401 of the Clean Water Act, and by CDFW under the Fish and Game Code (including riparian habitat, and/or other vegetation communities considered sensitive by CDFW).

Potential wetlands and/or sensitive communities within Pyramid Lake include cattail marsh and riparian forest (which in some locations is classified as Southern Cottonwood Willow Riparian Forest and Southern Willow Scrub, two sensitive natural communities defined by CDFW). Potential wetlands and/or sensitive communities within Silverwood Lake include cattail marsh and riparian forest (which in some locations is classified as Southern Sycamore Alder Riparian Woodland, Southern Cottonwood Riparian Forest or Southern Willow Scrub; all of which are sensitive natural communities defined by CDFW). Potential wetlands and/or sensitive communities within Quail Lake include cattail marsh and riparian forest/scrub (which in some locations is classified as Southern Willow Scrub, a sensitive natural community defined by CDFW). Potential wetlands and/or sensitive communities within O'Neill Forebay include freshwater marsh, riparian forest (which in some locations is classified as Great Valley Cottonwood Riparian Forest), and Southern Riparian Scrub.

No loss of wetland features that may be considered jurisdictional by the USACE, RWQCB, or CDFW; nor the loss of riparian habitat, or other communities considered sensitive by CDFW, would occur as a result of the proposed project. The project does not propose to remove, fill, or alter the existing wetland or riparian features within any of the water bodies. Therefore, it is not anticipated that a permit would be required from the USACE, RWQCB, or CDFW for impacts to wetlands or riparian habitat as a result of the proposed project.

The helicopter and/or boat used for copper sulfate application at all four water bodies would be staged at existing developed areas. Copper sulfate application to control planktonic algae would be limited to open water areas away from the shoreline and would not impact wetlands, riparian habitats, or other sensitive natural communities. The helicopter would be staged at existing developed areas as shown in Figures 2, 4, 6, and 8 of Appendix D for Pyramid Lake, Silverwood Lake, Quail Lake, and O'Neill Forebay, respectively.

d. All four water bodies are situated within relatively undisturbed habitat and provide habitat for migratory species. All four sites are located within the Pacific Flyway and provide a stopover for a variety of migratory birds, notably waterfowl. Pyramid Lake is situated between the Los Padres and Angeles National Forests and provides linkage for terrestrial wildlife between the two natural areas. Piru Creek and other drainages that flow into Pyramid Lake provide movement for both aquatic and terrestrial species. Silverwood Lake is located along the Mojave River, which provides access to other undisturbed areas of the San Bernardino Mountains and access to the Mojave Desert. Quail Lake is located within the transition zone between the Mojave Desert and mountains of the Los Padres and Angeles National Forests. O'Neill Forebay is located within the base of the Diablo Mountain Range and provides habitat for wildlife migrating north-south through central California.

The project would not affect movement of wildlife species. The project would not remove any existing habitat nor would it add any fill or structures that would impede wildlife movement. The helicopter and/or boat applying the copper sulfate would be operated for only a short duration in areas away from native terrestrial habitats. Migrating waterfowl or other avian species utilizing the water bodies would be able to utilize other areas of the water body located away from the noise of the helicopter and/or boat.

Implementation of DWR's APAP (Appendix B) will ensure impacts to migratory corridors are **less than significant** level.

e. The Project would consist of applying copper sulfate to the water of existing reservoirs and would not conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance. **No impact** would occur.

f. Select upland areas around Pyramid Lake, Silverwood Lake, Quail Lake, and O'Neill Forebay are designated as reserves and managed under various conservation and/or resource management plans. The proposed project would be conducted entirely within the existing reservoir open water areas, outside of upland habitat, and would not affect any Multiple Species Habitat Conservation Plan, or Natural Community Conservation Plan or other Conservation Plan. Therefore, the proposed project would not conflict with any provisions of such adopted plans, or other approved local, regional, or state habitat conservation plan. **No impact** would occur.

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
V. CULTURAL RESOURCES -- Would the project:				
a) Cause a substantial adverse change in the significance of a historical resource as defined in § 15064.5?	☐	☐	☐	☑
b) Cause a substantial adverse change in the significance of an archaeological resource pursuant to § 15064.5?	☐	☐	☐	☑
c) Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?	☐	☐	☐	☑
d) Disturb any human remains, including those interred outside of formal cemeteries?	☐	☐	☐	☑

Discussion

a & b. The proposed project would be implemented entirely within the open water of existing State Water Project reservoirs. Treatments would be made by helicopter (at all four reservoirs) or by boat (O'Neill Forebay and Quail Lake) utilizing existing staging areas. The project would not include any elements that would alter or otherwise disturb any known historical or archaeological resources. Therefore, no impact to historical or archaeological resources would occur.

c & d. As this project would only involve water treatment with copper-based aquatic pesticides with no ground disturbances, there would be no impact to paleontological resources or sites or to unique geological features. Further, application of aquatic pesticides would not cause any disturbance of human remains. The project, as outlined in the project description, would cause no impact to cultural resources.

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
VI. GEOLOGY AND SOILS -- Would the project:				
a) Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:				
i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault? Refer to Division of Mines and Geology Special Publication 42.	☐	☐	☐	☑
ii) Strong seismic ground shaking?	☐	☐	☐	☑
iii) Seismic-related ground failure, including liquefaction?	☐	☐	☐	☑
iv) Landslides?	☐	☐	☐	☑
b) Result in substantial soil erosion or the loss of topsoil?	☐	☐	☐	☑
c) Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse?	☐	☐	☐	☑

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
d) Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property?	☐	☐	☐	☑
e) Have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water?	☐	☐	☐	☑

Discussion

a (i). The Division of Mines and Geology Special Publication 42 (2007) shows that O'Neill Forebay and Quail Lake are located in earthquake fault zones, within the San Luis Dam and La Liebre Ranch Quadrangles, respectively. The Ortigalita Fault is located to the west of O'Neill Forebay, and according to Figure 1 in Special Publication 42 (Bryant, et al., 2007), it is not identified as a fault with historic surface rupture. Quail Lake was originally a pond created by a cataclysmic movement of the San Andreas Fault ages ago. Before it became part of the SWP, Quail Lake was enlarged to move water safely across the fault. The proposed project would consist of applying aquatic herbicides to four existing reservoirs of the SWP. The project does not involve the construction of any new structures that would be subject to the Alquist-Priolo Earthquake Fault Zoning Act. Therefore, no impacts relating to rupture of a known fault would occur.

a (ii, iii, iv). Several active and/or potentially active faults in the region, such as the Ortigalita and San Andreas Faults discussed in section a (i) above, could produce ground shaking at the site. Although it is possible that ground shaking could occur at the project site, secondary effects such as liquefaction would not increase with implementation of the project. Further, the project would not include building any structures or increasing the population on or near the project site. The project would not have the potential to increase the risk of landslides in the area, since it would not involve building structures and would not affect any existing slopes. Therefore, no impacts associated with liquefaction and other seismic-related ground failure would occur.

b, c, d, & e. This project consists of the application of aquatic herbicides to four reservoirs of the SWP and does not involve any digging or other physical disturbance that would result in soil erosion or loss of topsoil. The project would not result in on- or off-site landslides, lateral spreading, subsidence, liquefaction, or collapse. Additionally, the proposed project does not entail the construction of any building and has no effect on expansive soil. The proposed application of aquatic herbicides would not require a septic or other wastewater system as workers would use existing facilities in the operation areas of the reservoirs. Therefore, the project would have no impact.

VII. GREENHOUSE GAS EMISSIONS -- Would the project:	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
a) Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment?	☐	☐	☑	☐
b) Conflict with an applicable plan, policy or regulation adopted for the purpose of reducing the emissions of greenhouse gases?	☐	☐	☑	☐

Discussion

a & b.

GHG Emissions Analysis

In May 2012, DWR adopted the DWR Climate Action Plan-Phase I: Greenhouse Gas Emissions Reduction Plan (GGERP), which details DWR's efforts to reduce its greenhouse gas (GHG) emissions consistent with Executive Order S-3-05 and the Global Warming Solutions Act of 2006 (Assembly Bill (AB) 32). DWR also adopted the Initial Study/Negative Declaration prepared for the GGERP in accordance with the CEQA Guidelines review and public process. Both the GGERP and Initial Study/Negative Declaration are incorporated herein by reference and are available at: http://www.water.ca.gov/climatechange/CAP.cfm. The GGERP provides estimates of historical (back to 1990), current, and future GHG emissions related to operations, construction, maintenance, and business practices (e.g. building-related energy use). The GGERP specifies aggressive 2020 and 2050 emission reduction goals and identifies a list of GHG emissions reduction measures to achieve these goals.

DWR specifically prepared its GGERP as a "Plan for the Reduction of Greenhouse Gas Emissions" for purposes of CEQA Guidelines section 15183.5. That section provides that such a document, which must meet certain specified requirements, "may be used in the cumulative impacts analysis of later projects." Because global climate change, by its very nature, is a global cumulative impact, an individual project's compliance with a qualifying GHG Reduction Plan may suffice to mitigate the project's incremental contribution to that cumulative impact to a level that is not "cumulatively considerable." (CEQA Guidelines, § 15064, subd. (h)(3).)

More specifically, "[l]ater project-specific environmental documents may tier from and/or incorporate by reference" the "programmatic review" conducted for the GHG emissions reduction plan. "An environmental document that relies on a greenhouse gas reduction plan for a cumulative impacts analysis must identify those requirements specified in the plan that apply to the project, and, if those requirements are not otherwise binding and enforceable, incorporate those requirements as mitigation measures applicable to the project." (CEQA Guidelines § 15183.5, subd. (b)(2).)

Section 12 of the GGERP outlines the steps that each DWR project will take to demonstrate consistency with the GGERP. These steps include: 1) analysis of GHG emissions from construction of the proposed project , 2) determination that the construction emissions from the project do not exceed the levels of construction emissions analyzed in the GGERP, 3) incorporation into the design of the project DWR's project level GHG emissions reduction strategies, 4) determination that the project does not conflict with DWR's ability to implement any of the "Specific Action" GHG emissions reduction measures identified in the GGERP, and 5) determination that the project would not add electricity demands to the SWP system that could alter DWR's emissions reduction trajectory in such a way as to impede its ability to meet its emissions reduction goals.

Consistent with these requirements, a GGERP Consistency Determination Checklist is attached, Appendix K, documenting that the project has met each of the required elements.

Based on the analysis provided in the GGERP and the demonstration that the proposed project is consistent with the GGERP (as shown in the attached Consistency Determination Checklist), DWR as the lead agency has determined that the proposed project's incremental contribution to the cumulative impact of increasing atmospheric levels of GHGs is less than cumulatively considerable and, therefore, less than significant.

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
VIII. HAZARDS AND HAZARDOUS MATERIALS -- Would the project:				
a) Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?	☐	☐	☑	☐
b) Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment?	☐	☐	☑	☐

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
c) Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?	☐	☐	☐	☑
d) Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would it create a significant hazard to the public or the environment?	☐	☐	☐	☑
e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project result in a safety hazard for people residing or working in the project area?	☐	☐	☑	☐
f) For a project within the vicinity of a private airstrip, would the project result in a safety hazard for people residing or working in the project area?	☐	☐	☐	☑
g) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?	☐	☐	☐	☑
h) Expose people or structures to a significant risk of loss, injury or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands?	☐	☐	☐	☑

Discussion

a & b. The proposed project involves the treatment of SWP reservoirs with copper-based pesticides. These copper compounds (copper sulfate pentahydrate, Nautique®, Komeen®, EarthTec®, & Captain® XTR) all contain components considered hazardous by the Occupational Safety and Health Administration (OSHA) Hazard Communication Standard. While the active ingredients in these compounds differ, they all pose potential health effects due to ingestion, inhalation, or contact with eyes or skin.

To minimize the risks associated with the use of hazardous compounds, this project will follow guidelines developed as part of the DWR Hazardous Waste Management Program. These guidelines include procedures for the handling, storage, disposal, transport, and source reduction of hazardous wastes. This program also has procedures for the containment and cleanup of hazardous waste spills and establishes hazardous waste contingency. Furthermore, each Field Division has contracts with private firms specializing in hazardous waste cleanup.

In addition to the procedures developed by the Hazardous Waste Management Program, all staff on site will follow procedures laid out on the respective pesticide MSDS and label. Include in these procedures is the use of personal protection equipment, consisting of disposable coveralls, gloves, boots, respirators, and protective eyewear. These measures, along with the implementation of the APAP as described in Section 1 and included as Appendix B of this IS/Draft Mitigated Negative Declaration, will limit hazards to project staff and the public to a level deemed less than significant.

c. There are no known current or proposed schools within ¼ mile of any project reservoirs or staging areas. Therefore, no impacts will occur.

d. None of the project sites are located on or near properties listed as hazardous material sites. The specific lists used for this determination include the State Water Resources Control Board's GeoTracker, the Department of Toxic Substance Control's EnviroStor list, and the EPA's CERCLIS database of Superfund sites and Cleanups in My Community (CIMC) website. Due to the lack of hazardous material sites in the vicinity of the project sites, there will be no impact to the public due to project activities.

e & f. The only airstrip within the vicinity of any project location is the private airstrip located adjacent to Quail Lake. When using helicopters for applications at Quail Lake, proper steps will be taken to ensure that there is no overlap in the operation of the airstrip and project helicopter use. This precaution and continued communication during aerial treatment periods will ensure any impacts will be less than significant. Other project locations using helicopters for applications, will limit their usage to only the areas deemed necessary to complete the application. This will limit the exposure of helicopter operations to the public, thereby limiting public impacts to less than significant.

g. This project will not block or alter any public roadways, thereby limiting their availability in the event of an emergency. Project staging areas will be located at well established locations and will have easy access to and from in the event of an emergency. This project will have no impact on emergency response or evacuation plans.

h. This project will not increase the risk for wildland fires. All project staging areas will be located at preexisting facilities and on paved or gravel lots. In addition, this project will not increase the population or change land usage within or adjacent to the project area. Therefore, this project will not impact or increase local wildland fire risk.

IX. HYDROLOGY AND WATER QUALITY -- Would the project:	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
a) Violate any water quality standards or waste discharge requirements?	☐	☑	☐	☐
b) Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre- existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted)?	☐	☐	☐	☑
c) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or off-site?	☐	☐	☐	☑
d) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site?	☐	☐	☐	☑
e) Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff?	☐	☐	☐	☑

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
f) Otherwise substantially degrade water quality?	☐	☑	☐	☐
g) Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map?	☐	☐	☐	☑
h) Place within a 100-year flood hazard area structures which would impede or redirect flood flows?	☐	☐	☐	☑
i) Expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam?	☐	☐	☐	☑
j) Inundation by seiche, tsunami, or mudflow?	☐	☐	☐	☑

Discussion

a & f. The proposed project seeks to reduce algae and aquatic weed growth in drinking water storage reservoirs. The algae and aquatic weeds targeted are of concern due to their potential to inhibit compliance with secondary drinking water standards for taste and odor or to interfere with public use and SWP operations. The project will involve the treatment of these reservoirs with one of several copper-based algaecides or herbicides. Both the U.S. EPA and the California Department of Pesticide Regulation have approved all of the proposed treatment materials for use in California. The specific pesticide type and amount used in each treatment occurrence will depend on target species' composition and concentration, as well as several limnological factors.

State water quality regulators require persons using aquatic pesticides to apply for coverage under the general NPDES permit, No. 2013-0002-DWQ. To obtain coverage under this NPDES permit, applicants are required to demonstrate either that its discharges comply with the water quality criteria for priority pollutants under the CTR and NTR or that it qualifies for an exception from compliance with such criteria, pursuant to section 5.3 of the SWRCB's SIP. Furthermore, the permit requires applicants to submit an APAP describing their pesticide application and water quality monitoring programs.

The application of copper-based compounds to DWR reservoirs could raise dissolved copper levels above approved receiving water limitations. To comply with water quality regulations, DWR is pursuing a categorical exception for use of copper under section 5.3 of the SIP and will submit a notice of intent and an APAP for the copper applications, as required by the NPDES permit.

Past copper treatments in similar water bodies have shown the dissolved copper concentration to fall soon after application and remain below the CTR human health criteria for copper of 1.3 mg/L. Therefore, with the implementation of the following mitigation measures, this project will present a less than significant impact on water quality.

HYDRO-1: Submit the Proper Regulatory Documents (NPDES Permit and APAP)

- Develop and follow the monitoring requirements associated with the NPDES permit and APAP.
- To the extent feasible, take full advantage of operational options (e.g., selective water withdrawal, bypass and blending) to avoid or minimize the use of copper compounds.
- To the extent feasible, treat algal blooms prior to their exponential growth phase to minimize the amount of aquatic pesticides used.

b. Since this project is limited to the application of copper compounds to surface water reservoirs, there will not be an increase in groundwater use or a decrease in groundwater recharge. The project does not include any new developments or facilitate an increase in population, so there will not be any long-term or future impacts to groundwater supplies due to this project.

c, d, & e. The proposed project will not include any ground moving activities nor will it alter any pre-existing drainages. In addition, there will not be an increase in the amount of water present at the project locations since the treatment is based on reservoir volume at that time. Therefore, this project will not impact the amount or flow of surface water on site.

g, h, & i. The project will not involve the construction of any new structures or result in an increase in surface water at the project locations. The project would not place any housing or other structures in danger of flood damage due to increased or redirected flow. This project will only involve application of copper compounds to retained water at pre-existing reservoirs. No alterations to dams or levees will occur, therefore, there will not be an increased exposure to flooding risks due to their failure.

j. Staging areas for each project reservoir will be located at pre-existing facilities normally open to the public. These areas are high enough above the reservoir water level to avoid seiche waves and far enough from the ocean to avoid tsunamis. In addition, these sites are not located in potential mudslide areas.

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
X. LAND USE AND PLANNING -- Would the project:				
a) Physically divide an established community?	☐	☐	☐	☑

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
b) Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project (including, but not limited to the general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect?	☐	☐	☐	☑
c) Conflict with any applicable habitat conservation plan or natural community conservation plan?	☐	☐	☐	☑

Discussion

a. The footprint of this project will be existing reservoirs and staging areas. There will not be any new development or disturbance to communities caused by any project activities. This project will not impact the continuity of established communities.

b & c. The proposed plan is limited to the treatment of reservoirs with copper-based herbicides. These reservoirs are located on DWR land and this project is consistent with standard operating procedures for treatment of aquatic vegetation in DWR waters. In addition, this project will not require physical changes to the landscape or require a change in existing land use and adopted land use classifications. Furthermore, the locations covered by this project aren't located in areas covered by existing habitat or natural community conservation plans. Therefore, this project will not have an impact on land use planning or policies.

XI. MINERAL RESOURCES -- Would the project:	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
a) Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state?	☐	☐	☐	☑

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
b) Result in the loss of availability of a locally- important mineral resource recovery site delineated on a local general plan, specific plan or other land use plan?	☐	☐	☐	☑

Discussion

a & b. The proposed project will be limited to the treatment of existing reservoirs with copper-based herbicides. All project staging areas will be located at pre-existing facilities and there will be no further disturbance from this project. As such, there will be no impact to mineral resources due to project activities.

XII. NOISE -- Would the project:	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
a) Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?	☐	☐	☑	☐
b) Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels?	☐	☐	☐	☑
c) A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project?	☐	☐	☐	☑
d) A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project?	☐	☐	☑	☐

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?	☐	☐	☐	☑
f) For a project within the vicinity of a private airstrip, would the project expose people residing or working in the project area to excessive noise levels?	☐	☐	☑	☐

Discussion

a, b, c, & d. The proposed project will include several noise generating activities, namely the hauling and dispersal of application material using trucks and a helicopter or boat, which would increase noise levels above ambient levels. These activities however occur during daytime hours, in areas closed to public use. Therefore, they would not expose nearby persons to significant levels of noise or groundborne vibration. Likewise, since there is no permanent footprint to this project there will not be a permanent increase in noise above ambient levels.

e & f. The only project site located within two miles of any airstrip is Quail Lake, which is adjacent to the Quail Lake Sky Park, a private, single runway airstrip. While the airstrip is located close to the southeast shore of the lake, the staging area will be located at the western or northern shore, one mile and half a mile respectively from the airstrip. This distance will limit the exposure of project staff to airstrip noise to a level less than significant.

XIII.POPULATION AND HOUSING -- Would the project:	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
a) Induce substantial population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through extension of roads or other infrastructure)?	☐	☐	☐	☑
b) Displace substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere?	☐	☐	☐	☑
c) Displace substantial numbers of people, necessitating the construction of replacement housing elsewhere?	☐	☐	☐	☑

Discussion

a, b, &c. This project will be confined to preexisting reservoirs and staging areas. No aspect of this project will include the construction, alteration, or demolition of any homes or other buildings. Therefore, this project will not increase population growth in the area or the need for replacement housing elsewhere. While, this project will improve water quality there will be no increase in water quantity, meaning there will not be an increase in water supply which might indirectly increase population growth. Also, due to the short-term nature of the treatment periods, there will be no need for employees working on the project to relocate closer to the worksites nor would nearby residents need to relocate away from the worksites. For these reasons it has been determined that this project will have no impact on population and housing.

XIV. PUBLIC SERVICES	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
a) Would the project result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times or other performance objectives for any of the public services:				
Fire protection?	☐	☐	☐	☑
Police protection?	☐	☐	☐	☑
Schools?	☐	☐	☐	☑
Parks?	☐	☐	☐	☑
Other public facilities?	☐	☐	☐	☑

Discussion

a. This project is limited to the treatment of existing reservoirs and does not require any new construction. In turn there will be no increase in demand or changes to existing public services. Likewise, the short-term nature of each treatment periods means there will be no impact on the existing demand for police and fire protection.

XV. RECREATION --	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
a) Would the project increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?	☐	☐	☑	☐
b) Does the project include recreational facilities or require the construction or expansion of recreational facilities which might have an adverse physical effect on the environment?	☐	☐	☐	☑

Discussion

a & b. This project involves the infrequent treatment of SWP reservoirs with copper compounds and will not result in an increase of usage for recreational facilities. In addition, the project will not require the construction or expansion of recreational facilities. A less than significant increase in use of other local recreational facilities may occur as a result of the DWR facilities being closed or with limited access. However, the closures are short-term (generally one day) and would be reopened to public use as soon as feasible.

XVI. TRANSPORTATION/TRAFFIC -- Would the project:	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
a) Conflict with an applicable plan, ordinance or policy establishing measures of effectiveness for the performance of the circulation system, taking into account all modes of transportation including mass transit and non-motorized travel and relevant components of the circulation system, including but not limited to intersections, streets, highways and freeways, pedestrian and bicycle paths, and mass transit?	☐	☐	☐	☑

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
b) Conflict with an applicable congestion management program, including, but not limited to level of service standards and travel demand measures, or other standards established by the county congestion management agency for designated roads or highways?	☐	☐	☐	☑
c) Result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks?	☐	☐	☐	☑
d) Substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?	☐	☐	☐	☑
e) Result in inadequate emergency access?	☐	☐	☐	☑
f) Conflict with adopted policies, plans, or programs regarding public transit, bicycle, or pedestrian facilities, or otherwise decrease the performance or safety of such facilities?	☐	☐	☑	☐

Discussion

a & b. The necessary number of people and vehicles required for this project is negligible in size compared to normal transportation volumes. It is estimated that five to ten passenger vehicles will be required along with one or two material transport trucks. Due to the small volume of vehicle traffic associated with this project, no impacts will occur to any plans, ordinances, or policies concerning traffic circulation or congestion management.

c. A portion of this project will require the localized use of helicopters over the reservoirs mentioned in this document. All appropriate regulations and procedures will be followed in the use of these helicopters, including but not limited to the filing of flight plans for each treatment period. Due to the small size and infrequency of treatments (a yearly maximum of five treatments per reservoir), the use of helicopters for this project will not impact existing air traffic patterns.

d. The activities in this project will be contained to the boundaries of existing reservoirs and parking lots. There are no planned alterations or incompatible uses from this project; therefore it will have no impact on an increase in road hazards.

e. Vehicles parking at SWP facilities and staging areas are routine and will occur in designated areas so there will be no impact on emergency access or evacuation.

f. The project will not add any facilities that would impact existing policies, plans, or programs associated with public transit. The project will not impact, close, impede, or restrict use of existing transit facilities. Temporary closures of existing bicycle or pedestrian access at some SWP facilities may occur, but given their short duration these impacts will be less than significant.

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
XVII. UTILITIES AND SERVICE SYSTEMS -- Would the project:				
a) Exceed wastewater treatment requirements of the applicable Regional Water Quality Control Board?	☐	☐	☐	☑
b) Require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	☐	☐	☐	☑
c) Require or result in the construction of new storm water drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	☐	☐	☐	☑
d) Have sufficient water supplies available to serve the project from existing entitlements and resources, or are new or expanded entitlements needed?	☐	☐	☐	☑

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
e) Result in a determination by the wastewater treatment provider which serves or may serve the project that it has adequate capacity to serve the project's projected demand in addition to the provider's existing commitments?	☐	☐	☐	☑
f) Be served by a landfill with sufficient permitted capacity to accommodate the project's solid waste disposal needs?	☐	☐	☑	☐
g) Comply with federal, state and local statutes and regulations related to solid waste?	☐	☐	☐	☑

Discussion

a, b, c, d, & e. The proposed project involves the application of copper-based algaecide to several existing water storage reservoirs and will not involve the construction of new facilities, a change in water supply, or a change in water demand. There will be no discharges of wastewater or increased demand placed on existing water, wastewater, or storm water systems. There will be no impact on, or need for new or expanded facilities, or entitlements. Likewise, there would be no conflict with local wastewater treatment providers' capacity.

f & g. This project may generate a minor amount of solid waste during each application. These applications would be infrequent (a maximum of five treatments per reservoir per year) and would produce a negligible amount solid waste (e.g., empty herbicide containers) after the application period is over. Therefore, any solid waste from this project would be negligible and would not place a strain on landfill capacities. In addition, any solid waste from this project will be taken to appropriate disposal or recycling facilities in coordination with federal, state, and local regulations.

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
XVIII. -- MANDATORY FINDINGS OF SIGNIFICANCE --				
a) Does the project have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of a rare or endangered plant or animal or eliminate important examples of the major periods of California history or prehistory?	☐	☑	☐	☐
b) Does the project have impacts that are individually limited, but cumulatively considerable? ("Cumulatively considerable" means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects.)	☐	☐	☐	☑
c) Does the project have environmental effects which will cause substantial adverse effects on human beings, either directly or indirectly?	☐	☐	☑	☐

Discussion

a. The proposed project would involve the periodic application of copper-based herbicides to existing State Water Project water storage reservoirs: O'Neill Forebay, Quail Lake, Pyramid Lake, and Silverwood Lake by the Department of Water Resources. Application of these aquatic herbicides would occur on an as-needed basis, to control algal blooms and aquatic weeds so that such blooms do not degrade drinking water quality through elevated taste and odor problems, production of algal toxins, and/or through filter clogging. The project would not require any physical alteration or construction of any facilities at the project sites, nor would the project result in any ground disturbance or tree or vegetation removal, with exception of the algae and aquatic weeds. Implementation of the project may temporarily impact aquatic species present in the reservoirs and their associated habitats during pesticide applications. However, these impacts would be reduced to a less than significant level by the

implementation of mitigation factors identified in this MND. Several species of rare or endangered animals are known to exist in the terrestrial areas adjacent to the project sites. However, none of these species would be impacted by the project. Likewise the project would not eliminate any important examples of California history. Therefore, implementation of the proposed project, in conjunction with the proposed mitigation measures would reduce potentially significant impacts, to less than significant levels.

b. The project sites are each located within properties owned and operated by DWR. The project consists of a routine maintenance activity to maintain existing infrastructure and maintain water quality for DWR customers. No foreseeable cumulative impacts in conjunction with potential local or regional projects would occur. Application events would typically be conducted only a maximum of five times per year per reservoir on an as-needed basis. Therefore, the impacts of the project application in the area would not be cumulatively considerable and would have no cumulative impact.

c. The proposed project would have a less than significant impact to human beings with the implementation of the APAP and its BMPs, described in Section 1. The proposed project may cause limited and temporary noise intrusions during project applications, which would be less than significant. Hence, the proposed project would result in less than significant effects on human beings.

SECTION 4: LIST OF MITIGATION MEASURES

BIOLOGICAL RESOURCES

BIO-1: Impact Avoidance to Nesting Birds

The following mitigation measure is recommended to reduce potential impacts to nesting birds during application of copper sulfate by helicopters:

- If a copper sulfate application is scheduled to occur during the breeding season (February 1~~ August 31~~September 15), it is recommended that a qualified biologist conduct pre-application surveys of all potential nesting habitats within 500 feet of proposed helicopter application activities. Surveys at O'Neill Forebay will follow the survey methodology of the Swainson's Hawk Technical Advisory Committee (SWHA TAC, 2000) and the Bald Eagle Breeding Survey Instructions (California Department of Fish and Game (CDFG), 2010). At least one survey should be conducted no more than three days prior to these activities. If the application is scheduled to occur during the non-nesting season (September ~~1~~16 through January 31) at Quail Lake, Pyramid Lake, or Silverwood Lake, a pre-application survey is not necessary and no additional measures are recommended. At O'Neill Forebay, surveys for burrowing owl nests will be conducted using the survey methodology described in "Staff Report on Burrowing Owl Mitigation dated March 7, 2012 (CDFG, 2012) any time of year that an application by helicopter is planned.

- If active nests are found at Quail Lake, Pyramid Lake, or Silverwood Lake, no-disturbance buffers shall be implemented around each nest based on the species and location of the nest as determined by a qualified biologist, or the nest should be closely monitored during applications to ensure that helicopter does not create physical disturbance and copper sulfate does not inadvertently drift into the nest. If a buffer is preferred, a general buffer distance typically includes 500 feet around any confirmed active raptor nest or a 300-foot buffer around nests of passerine bird species protected in accordance with the MBTA and/or Fish and Game Code. Additionally, helicopters shall not fly vertically over trees with active nests unless an adequate elevation can be achieved to ensure that downward wind generated by the propulsion would not physically disturb the tree. However, buffer distances can be determined by the biologist based on location, vegetation cover, species, and other factors. The buffers should be implemented until it is determined by a qualified wildlife biologist that young have fledged and the nest is determined to be inactive.

- If active nests are found at O'Neill Forebay, identified nests of special status species will be continuously surveyed for 24 hours prior to any activities related to helicopter applications in order to establish a behavioral baseline. During the application, the nests will be continuously monitored to detect any behavioral changes. No-disturbance buffers of 500 feet shall be implemented around each nest for non-listed bird species, while buffers of 0.5 miles will be implemented for nests of all raptors. Additionally, helicopters shall not fly vertically over trees with active nests unless an adequate elevation can be achieved to ensure that downward wind generated by the propulsion would not physically disturb the tree. The buffers should be implemented until it is determined by a qualified wildlife biologist that young have fledged and the nest is determined to be inactive. If burrowing owl nests are identified, impacts to occupied burrows will be avoided by implementing no-disturbance buffers in accordance with the table below unless a qualified biologist determines either: 1) the birds have not begun egg-laying and incubation or 2) juveniles from the occupied burrows are foraging independently and are capable of survival.

Location	Time of Year	Level of Disturbance		
		Low	Med.	High
Nesting sites	April 1-Aug 15	200 m*	500 m	500 m
Nesting sites	Aug 16-Oct 15	200 m	200 m	500 m
Nesting sites	Oct 16-Mar 31	50 m	100 m	500 m

*meters (m)

Mitigation Measure BIO-2: Focused Biological Surveys

Prior to a copper application by helicopter, a qualified wildlife biologist will conduct a survey of the project area to determine if special status species could be impacted. Survey results will be used to identify any mitigation minimization and avoidance measures that may be needed to reduce potential impacts to special status wildlife species to a less than significant level.

Mitigation Measure BIO-3: Special Status Plant Surveys at O'Neill Forebay

Prior to a copper application by helicopter at O'Neill Forebay, a qualified botanist will survey the land adjacent to the application area for special status species plants. The botanist will follow the *Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities (November 24, 2009).* If special status species are found, DWR will monitor wind speed and wind direction to avoid potential impacts to the species from a helicopter application.

HYDROLOGY AND WATER QUALITY

HYDRO-1: Submit the Proper Regulatory Documents (NPDES Permit and APAP)

- Develop and follow the monitoring requirements associated with the NPDES permit and APAP.
- To the extent feasible, take full advantage of operational options (e.g., selective water withdrawal, bypass and blending) to avoid or minimize the use of copper compounds.
- To the extent feasible, treat algal blooms prior to their exponential growth phase to minimize the amount of aquatic pesticides used.

SECTION 5: REFERENCES

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SECTION 6: AGENCIES CONTACTED

1. State Water Resources Control Board

SECTION 7: LIST OF PREPARERS

1. Department of Water Resources:

- Jeff Janik, Program Manager
- Diane Shimizu, Senior Environmental Scientist (Specialist)
- Daniel Wisheropp, Environmental Scientist

APPLICATION OF COPPER TO THE STATE WATER PROJECT TO CONTROL AQUATIC WEEDS AND ALGAL BLOOMS

RESPONSE TO COMMENTS ON THE DRAFT MITIGATED NEGATIVE DECLARATION

MAY 2014

For additional information

regarding this document contact:

Department of Water Resources

Environmental Assessment Branch

1416 Ninth Street

Sacramento, California 95814

Jeff Janik

Water Quality Section Chief

(916) 653-5688

1. Introduction

Purpose of the Final Initial Study/Mitigated Negative Declaration (IS/MND)

This document has been prepared to accompany the Initial Study/Draft Mitigated Negative Declaration for the Department of Water Resources' (DWR) project *Application of Copper to the State Water Project to Control Aquatic Weeds and Algal Blooms*. The IS/Draft MND (SCH# 2014032086) identified the potential environmental impacts of the proposed project and recommended mitigation measures to reduce potentially significant impacts. This document responds to the comments received on the draft IS/MND and makes revisions in response to the comments. The Response to Comments document together with the IS/ Draft MND constitute the Final IS/MND. A Mitigation Monitoring and Reporting Program (MMRP) has been prepared for the project and is included as Appendix A of this document.

The Final IS/MND consists of the following:

a. The IS/Draft MND (March 2014),
b. Response to Comments on the Draft Mitigated Negative Declaration document containing:
    - Comments received on the IS/Draft MND,
    - DWR's responses to the comments,
    - Staff initiated changes to the IS/Draft MND, and
    - Changes made to the IS/Draft MND in response to comments received.

Environmental Review

DWR has applied for a State Water Resources Control Board (SWRCB) permit for application of aquatic herbicides to State Water Project (SWP) facilities to control aquatic weeds and algal blooms, in order to protect drinking water quality from diminishing through elevated tastes and odors, production of algal toxins, and to avoid aquatic plant buildup that can clog SWP filters and reduce water flows. General NPDES Permit No. 2013-0002-DWQ requires strict compliance with California Toxics Rule (CTR) criteria. The SWRCB implements CTR criteria with their Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California, also known as the State Implementation Plan (SIP), and applicable Basin Plans. Thus, any aquatic pesticide that contains a priority pollutant such as copper would be prohibited from being applied in concentrations that would exceed applicable water quality criteria outside an established mixing zone.

Section 5.3 of the SIP provides a categorical exception from the toxics standards where the discharge is necessary to implement control measures: 1) for resource or pest management or 2) to meet statutory requirements under the federal Safe Drinking Water Act or California Health and Safety Code, and for certain maintenance and cleaning activities. To obtain a SIP exception from SWRCB, DWR is required to prepare and submit a California Environmental Quality Act (CEQA) document evaluating the project-specific impacts of the project.

DWR prepared an IS/Draft MND for the project (SCH#2014032086). The public review and comment period began on March 28, 2014 and ended April 28, 2014.

DWR plans to adopt the Final IS/MND. Upon adoption of the Final IS/MND, DWR will submit the necessary documentation, including the Final MND, to the SWRCB to request a section 5.3 SIP exception SIP for the project.

2. Comments and Responses

DWR received one comment letter during the March 28-April 28, 2014 review period. A copy of the comment letter from the California Department of Fish and Wildlife (CDFW) Central Region, dated April 28, 2014 and DWR's responses follow.

The comments in CDFW's letter are underlined and numbered. DWR's responses to each numbered comment in the CDFW letter begin on page 10.

State of California – Natural Resources Agency
DEPARTMENT OF FISH AND WILDLIFE
Central Region
1234 East Shaw Avenue
Fresno, California 93710
(559) 243-4005
www.wildlife.ca.gov

EDMUND G. BROWN JR., Governor
CHARLTON H. BONHAM, Director

April 28, 2014

Jeff Janik
Department of Water Resources
1416 Ninth Street
Sacramento, California 95814

Subject: Mitigated Negative Declaration
Application of Copper to the State Water Project to Control Aquatic Weeds and Algal Blooms
SCH#: 2014032086

Dear Mr. Janik:

The California Department of Fish and Wildlife (Department) has reviewed the Mitigated Negative Declaration by the Department of Water Resources (DWR) for Application of Copper to the State Water Project to Control Aquatic Weeds and Algal Blooms (Project) submitted. DWR proposes to apply copper sulfate to O'Neill Forebay, Quail Lake, Pyramid Lake, and Silverwood Lake to control aquatic weeds and algal blooms under the new statewide National Pollutant Discharge Elimination System (NPDES) permit, Water Quality Order No. 2013-0002-DWQ (NPDES permit). Application of the herbicide will involve use of helicopters and boats that would be staged and departed from previously developed areas. The copper application sites are located within 3 counties: Merced County (O'Neill Forebay), Los Angeles County (Pyramid Lake and Quail Lake), and San Bernardino County (Silverwood Lake).

The Project proposes to use copper sulfate for aquatic weed control. Although effective on aquatic weeds, copper sulfate is known to impact wildlife resources. Copper is very toxic to fish and aquatic invertebrates, and may accumulate in the sediment further impacting sediment aquatic life. Indirect fish kills may result from anaerobic water conditions due to the mass overload of decaying aquatic vegetation. Wildlife that depend on fish and/or insect diets have the potential to be impacted. The Project's use of helicopters also has the potential to impact nesting birds and State-listed species. 1

Special status species such as the State threatened Swainson's hawk (*Buteo swainsoni*), the State fully protected white-tailed kite (*Elanus leucurus*) and golden eagle (*Aquila chrysaetos*), the State endangered and fully protected bald eagle (*Haliaeetus leucocephalus*), and the State Species of Special Concern burrowing owl (*Athene cunicularia*), western pond turtle (*Actinemys marmorata*), and tricolored blackbird (*Agelaius tricolor*) may occur adjacent to the Project area. Due to the potential impacts to fish and wildlife resources within or adjacent to the Project site, appropriate mitigation 2

measures may be needed. The Department recommends that focused biological surveys be conducted by qualified wildlife biologists during the appropriate survey period(s) to determine if special status species could be impacted prior to Project-related activities. Survey results can then be used to identify any mitigation, minimization, and avoidance measures necessary to reduce potential impacts to special status biological resources to less than significant. The Department advises these be included as enforceable measures in the Mitigated Negative Declaration prepared for this Project so as to inform any potential permitting needs. Also, because these large water bodies provide habitat for a variety of wildlife resources, including State-listed species, and are often used by anglers and recreationalists, the California Environmental Quality Act (CEQA) document prepared for the Project may need to address the above impacts, including nutrient loading, and the cumulative impacts. Our comments, with respect to copper sulfate application within O'Neill Forebay (Merced County), follow. 2 contd.

Department Jurisdiction

Trustee Agency Authority: The Department is a Trustee Agency with responsibility under CEQA for commenting on projects that could impact plant and wildlife resources. Pursuant to Fish and Game Code Section 1802, the Department has jurisdiction over the conservation, protection, and management of fish, wildlife, native plants, and the habitat necessary for biologically sustainable populations of those species. As a Trustee Agency for fish and wildlife resources, the Department is responsible for providing, as available, biological expertise to review and comment upon environmental documents and impacts arising from project activities, as those terms are used under CEQA (Division 13 [commencing with Section 21000] of the Public Resources Code). 3

Responsible Agency Authority: The Department has regulatory authority over projects that could result in the "take" of any species listed by the State as threatened or endangered, pursuant to Fish and Game Code Section 2081. If the Project could result in the take of any species listed as threatened or endangered under the California Endangered Species Act (CESA), the Department may need to issue an Incidental Take Permit (ITP) for the Project. CEQA requires a Mandatory Finding of Significance if a project is likely to substantially impact threatened or endangered species (sections 21001{c}, 21083, Guidelines sections 15380, 15064, 15065). Impacts must be avoided or mitigated to less than significant levels unless the CEQA Lead Agency makes and supports Statement of Overriding Consideration (SOC). The CEQA Lead Agency's SOC does not eliminate the Project proponent's obligation to comply with Fish and Game Code Section 2080. The Project has the potential to impact endangered, rare, or threatened species (as defined in Section 15380 of CEQA). 4

Bird Protection: The Department has jurisdiction over actions which may result in the disturbance or destruction of active nest sites or the unauthorized take of birds. Fish and Game Code sections that protect birds, their eggs and nests include, sections 3503 5

(regarding unlawful take, possession or needless destruction of the nest or eggs of any bird), 3503.5 (regarding the take, possession or destruction of any birds-of-prey or their nests or eggs), and 3513 (regarding unlawful take of any migratory nongame bird). 5 contd.

Fully Protected Species: The Department has jurisdiction over fully protected species of birds, mammals, amphibians and reptiles, and fish, pursuant to Fish and Game Code sections 3511, 4700, 5050, and 5515. Take of any fully protected species is prohibited and the Department cannot authorize their take. The fully protected white-tailed kite, bald eagle, and golden eagle has the potential to occur adjacent to the Project area. 6

Water Pollution: The Project states that a permit would not be required from the United States Army Corps of Engineers (USACE), Regional Water Quality Control Board (RWQCB), or the Department for impacts to wetlands or riparian habitat as a result of the proposed Project. Although the Project does not propose to remove, fill, or alter the existing wetland or riparian features within any of the water bodies, there is the potential for water pollution. Pursuant to Fish and Game Code Section 5650, it is unlawful to deposit in, permit to pass into, or place where it can pass into the "Waters of the State" any substance or material deleterious to fish, plant life, or bird life, including non-native species. It is possible that application of copper sulfate could result in pollution of a "Waters of the State", impacting fish and wildlife resources. The Regional Water Quality Control Board also has jurisdiction regarding discharge and pollution to "Waters of the State". Consultation with the USACE is also advised. 7

Potential Project Impacts and Recommendations

Listed Plant Species: Although the California Natural Diversity Database indicates that there no special status plant species adjacent to the O'Neill Forebay Project site, it is important to understand that the database consists of a compilation of submitted survey reports. Absence of special status plant species in the database does not indicate species absence. Prior to initiating any ground-disturbing activities on the site, the Department recommends the land adjacent to the Project site be surveyed for special status plants by a qualified botanist following the Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities (November 24, 2009). 8a This protocol, which is intended to maximize detectability, includes the identification of reference populations to facilitate the likelihood of field investigations occurring during the appropriate floristic period. The Department recommends the CEQA document describe all avoidance and minimization measures that would be employed in the event that special status plant species are found on the Project site. 8b If special status plant species are found, the Department advises that wind speed and wind direction during herbicide application are taken into account so as not to impact them. The Department also recommends using a dyed copper sulfate as well as applying the herbicide when wind speeds are less than 3 miles per hour. 8c

Nesting Birds: The trees, shrubs, and grasses within and in the vicinity of the Project site likely provide nesting habitat for songbirds and raptors. The Department encourages Project implementation to occur during the non-nesting bird season. However, if ground-disturbing activities must occur during the breeding season (February through mid-September), the Project applicant is responsible for ensuring that implementation of the Project does not result in any violation of the Migratory Bird Treaty Act or relevant Fish and Game Codes as referenced above. 9a

Prior to work commencing, the Department recommends surveys for active nests be conducted by a qualified wildlife biologist no more than 10 days prior to the start of the of the Project and that the surveys be conducted in a sufficient area around the application sites to identify any nests that are present and to determine their status. 9b

A sufficient area means any nest within an area that could potentially be affected by the Project. For this Project, nests might be affected by noise, vibration, and movement of workers or equipment. Identified nests should be continuously surveyed for the first 24 hours prior to any Project-related activities to establish a behavioral baseline. Once work commences, all nests should be continuously monitored to detect any behavioral changes as a result of the Project. If behavioral changes are observed, the activities causing that change should cease and the Department consulted for additional avoidance and minimization measures. 9c

Because the Project will involve usage of helicopter(s) for herbicide application, the buffers proposed in the MND will be insufficient. Larger buffers are needed to avoid impacts to nesting birds. The Department recommends a minimum no-disturbance buffer of 500 feet around active nests of non-listed bird species and a 0.5 mile no-disturbance buffer around the nests of all raptors until the breeding season has ended, or until a qualified biologist has determined that the birds have fledged and are no longer reliant upon the nest or parental care for survival. Variance from these no disturbance buffers may be implemented when there is compelling biological or ecological reason to do so, such as when the Project area would be concealed from a nest site by topography. Any variance from these buffers is advised to be supported by a qualified wildlife biologist and it is recommended the Department be notified in advance of implementation of a no-disturbance buffer variance. 9d

Swainson's Hawk (SWHA): SWHA are known to occur adjacent to the Project site. The trees along and adjacent to the O'Neill Forebay provide suitable nesting habitat characteristics. Therefore, this State threatened species has the potential to be present. If Project activities are to take place during the normal bird breeding season (February 1 through September 15), the Department recommends that a qualified wildlife biologist conduct surveys for nesting raptors following the survey methodology developed by the Swainson's Hawk Technical Advisory Committee (SWHA TAC, 2000) prior to Project implementation to evaluate potential Project-related impacts,. We recommend at least one surveys for active nests be conducted by a qualified biologist no more than 10 days prior to Project implementation 10a

If active nests are detected, the Department recommends a minimum no-disturbance buffer of 0.5 mile to avoid impacts to SWHA until the breeding season has ended or until a qualified biologist has determined that the birds have fledged and are no longer reliant upon the nest or parental care for survival. If implementation of the 0.5 mile no-disturbance buffer is not feasible, consultation with the Department is advised and the acquisition of an ITP pursuant to Fish and Game Code Section 2081(b) may be warranted prior to initiating any ground-disturbing activities. 10b

Fully Protected Raptors: The State fully protected white-tailed kite, golden eagle, and bald eagle are known to occur in the vicinity of the Project site. Projects within occupied territories have the potential to significantly impact the species. The Department recommends that focused surveys be conducted by experienced biologists prior to Project implementation. To avoid impact to these species, surveys following the Bald Eagle Breeding Survey Instructions (CDFG, 2010) will suffice and is advised. In the event that the species is found within 0.5 mile of the Project site, implementation of avoidance measures are warranted. The Department recommends that a qualified wildlife biologist be on-site during all Project-related activities and that a 0.5 mile no disturbance buffer be put into effect. If the 0.5 mile no disturbance buffer cannot feasibly be implemented, contacting the Department to assist with providing and implementing additional avoidance measures is essential. Fully addressing white-tailed kite, golden eagle, and bald eagle with appropriate mitigation measures in the CEQA document is advised. 11

Burrowing Owl: Burrowing owl has the potential to be present adjacent to the Project site. It is possible Project activities could impact this species. Burrowing owls have the potential to be year-round residents. This includes dispersing juveniles, migrants, transients, or new colonizers. Therefore, the Department recommends the survey methodology described in the new "Staff Report on Burrowing Owl Mitigation" dated March 7, 2012 (CDFG 2012) be followed before beginning ground-disturbing activities. In the event that burrowing owls are found, the Department's "Staff Report on Burrowing Owl Mitigation" recommends that impacts to occupied burrows be avoided in accordance with the following table unless a qualified biologist approved by the Department verifies through non-invasive methods that either: 1) the birds have not begun egg laying and incubation; or 2) that juveniles from the occupied burrows are foraging independently and are capable of independent survival. 12

Location	Time of Year	Level of Disturbance		
		Low	Med	High
Nesting sites	April 1-Aug 15	200 m*	500 m	500 m
Nesting sites	Aug 16-Oct 15	200 m	200 m	500 m
Nesting sites	Oct 16-Mar 31	50 m	100 m	500 m

* meters (m)

Failure to implement the recommended buffer zones could cause adult burrowing owls to abandon the nest, cause eggs or young to be directly impacted (crushed), and/or result in reproductive failure, in violation of Fish and Game Code and the Migratory Bird Treaty Act. 12 contd.

More information on survey and monitoring protocols for sensitive species can be found at the Department's website (www.dfg.ca.gov/wildlife/nongame/survey_monitor.html). If you have any questions on these issues, please contact Jim Vang, Environmental Scientist, at the address provided on this letterhead, by telephone at (559) 243-4014, extension 254, or by electronic mail at Jim.Vang@wildlife.ca.gov. 13

Sincerely,

Jeffrey R. Single, Ph.D.
Regional Manager

cc: Regional Water Quality Control Board
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Literature Cited

CDFG, 1994. Staff Report Regarding Mitigation for Impacts to Swainson's Hawks (*Buteo Swainsoni*) in the Central Valley of California. California Department of Fish and Game.

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SWHA TAC, 2000. Recommended Timing and Methodology for Swainson's Hawk Nesting Surveys in California's Central Valley. Swainson's Hawk Technical Advisory Committee, May 31, 2000.

Responses to Letter from California Department of Fish and Wildlife, April 28, 2014

GENERAL COMMENTS

1. As stated in the Initial Study/Draft Mitigated Negative Declaration (Draft IS/MND), the application of copper sulfate to surface waters for nuisance algae control in reservoirs have no apparent negative effects for most adult game fish (Anderson et al., 2001). However, copper sulfate has been shown to be toxic to larval fish and aquatic invertebrates (Diamond, et al., 1997; TOXNET, 1975-1986.). Copper concentrations would be applied according to the product label and under the supervision of a certified herbicide applicator to achieve a maximum concentration of 1,000 parts per billion, well below any known concentrations that may be toxic to fish in the project area. Further, the application area will be restricted to less than 50 percent of the lake surface area. O'Neill Forebay does not thermally stratify and the combination of high upstream inflows and flushing of the forebay, limited total treatment area, and lack of thermal stratification, will reduce the loss of dissolved oxygen near the sediment-water interface.

   The project's use of helicopters and the potential to impact nesting birds was addressed in the Draft IS/MND under *Mitigation Measure BIO-1: Impact Avoidance to Nesting Birds*. As recommended by CDFW, the mitigation measure has been modified to further reduce potential impacts to nesting birds, including fully protected raptors. (See response numbers 9a-12.)

   DWR is applying for coverage under the Statewide General National Pollutant Discharge Elimination System (NPDES) for Residual Aquatic Pesticide Discharges to Waters of the United States from Algae and Aquatic Weed Control Applications (No. CAG990005). To obtain coverage, DWR has submitted an Aquatic Pesticides Application Plan (APAP) identifying best management practices to be followed to avoid negative impacts such as fish kills. In addition, monitoring of physical and chemical parameters will be conducted for dissolved oxygen, copper concentrations, pH, specific conductance, and hardness, as outlined in the monitoring plan of the APAP.

2. Focused biological surveys will be conducted prior to project-related activities. The surveys will be included in the final Mitigated Negative Declaration as *Mitigation Measure BIO-2: Focused Biological Surveys*.

COMMENTS SPECIFIC TO O'NEILL FOREBAY

3. CDFW's responsibilities as a trustee agency for the project are noted.

4. CDFW's responsibilities as a responsible agency for the project are noted.

5. CDFW's jurisdiction over actions which may result in the disturbance or destruction of active nest sites or the unauthorized take of birds is noted. Response numbers 9a-12 address the protection of birds in the implementation of the project.

6. CDFW's jurisdiction over fully protected birds, mammals, amphibians, reptiles, and fish is noted. The potential for white-tailed kite, bald eagle, and golden eagle to occur adjacent to the O'Neill Forebay project area will be reflected in the biological resources discussion portion of the initial study in the Final MND. Response numbers 9a-12 address the protection of birds in

the implementation of the project. Responses 9b-12 describe the modification of *Mitigation Measure BIO-1: Impact Avoidance to Nesting Birds* of the Draft IS/MND to address potential impacts to birds and reduce the impacts to a less than significant level.

7. Application of copper-based herbicides to SWP reservoirs requires DWR to apply for coverage under the Statewide General National Pollutant Discharge Elimination System (NPDES) for Residual Aquatic Pesticide Discharges to Waters of the United States from Algae and Aquatic Weed Control Applications (No. CAG990005). To apply for coverage under the general permit, DWR submitted its Notice of Intent and APAP to the State Water Resources Control Board (SWRCB) in April 2014. Additionally, section 5.3 of the State Implementation Plan (SIP) provides a categorical exception from the toxics standards where the discharge is necessary to implement control measures: 1) for resource or pest management or 2) to meet statutory requirements under the federal Safe Drinking Water Act or California Health and Safety Code, and for certain maintenance and cleaning activities. DWR currently has a section 5.3 SIP exception for copper which covers several SWP facilities, including other reservoirs. After the adoption of the final MND, DWR will seek approval from SWRCB for a section 5.3 SIP exception for the additional SWP facilities named in this project, including O'Neill Forebay. The suggestion to consult with the United States Army Corps of Engineers is noted.

8a. Surveys for special status plants will be conducted as recommended and included in the Final MND as *Mitigation Measure BIO-3: Special Status Plant Surveys at O'Neill Forebay*. This mitigation measure specifies that land adjacent to the O'Neill project will be surveyed for special status plants by a qualified botanist following the *Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities (November 24, 2009)*, as recommended by CDFW.

8b. If special status species are found after conducting a survey, wind speed and wind direction will be taken into account before scheduling a helicopter application in order to avoid chemical drift reaching the special status plant species. Maximum allowable wind velocities for helicopter applications are also addressed in the APAP submitted to the SWRCB as part of the permitting process.

8c The recommendation to use a dyed copper sulfate is noted.

9a. When possible, DWR will treat reservoirs with copper during the non-nesting bird season. However, aquatic weed and algal growth often coincides with the bird nesting season; therefore, copper applications will sometimes be necessary during the nesting season. *Mitigation Measure BIO-1: Impact Avoidance to Nesting Birds* will be implemented to reduce this potential impact to a less than significant level.

9b. *Mitigation Measure BIO-1: Impact Avoidance to Nesting Birds* of the Draft IS/MND addressed the surveys for active nests. In the Final MND, this mitigation measure will be modified to address methodologies recommended by CDFW (See also response numbers 10a, 11, and 12).

9c *Mitigation Measure BIO-1: Impact Avoidance to Nesting Birds* will be modified to reflect the recommendation that nests identified at O'Neill Forebay be continuously surveyed for 24 hours prior to any activities related to helicopter applications in order to establish a behavioral baseline. During the application, the nests will be continuously monitored to detect any behavioral changes.

9d *Mitigation Measure BIO-1: Impact Avoidance to Nesting Birds* will be modified to change the no-disturbance buffers according to CDFW's recommendations.

10a. DWR will update the biological resources discussion portion of the initial study in the Final MND to identify the potential for Swainson's hawks to appear in the vicinity of the project area. Further, *Mitigation Measure BIO-1: Impact Avoidance to Nesting Birds* will be modified to include the use of the survey methodology developed by the Swainson's Hawk Technical Advisory Committee in 2000.

10b. *Mitigation Measure BIO-1: Impact Avoidance to Nesting Birds* was modified to change the no-disturbance buffers according to CDFW's recommendations to protect Swainson's hawks.

11. DWR will update the biological resources discussion portion of the initial study in the Final MND to identify the potential for white-tailed kites, golden eagles, and bald eagles to appear in the vicinity of the project area. Further, *Mitigation Measure BIO-1: Impact Avoidance to Nesting Birds* will be modified to indicate that surveys will follow the Bald Eagle Breeding Survey Instructions (CDFG, 2010). As indicated in response 9d, *Mitigation Measure BIO-1* was modified to change the no-disturbance buffers according to CDFW's recommendations.

12. *Mitigation Measure BIO-1: Impact Avoidance to Nesting Birds* will be modified to require surveys to determine the presence of burrowing owl using the methodology described in the "Staff Report on Burrowing Owl Mitigation" dated March 7, 2012. If burrowing owl nests are identified, impacts to occupied burrows will be avoided by adhering to no-disturbance buffers in accordance with the table provided by CDFW unless a qualified biologist determines either: 1) the birds have not begun egg-laying and incubation or 2) juveniles from the occupied burrows are foraging independently and are capable of survival.

13. The website information on survey and monitoring protocols for sensitive species, as well as the staff contact information are noted.

3. Changes to the IS/MND

Staff-Initiated Changes

1. DWR staff identified several areas of the Biological Resources section of the draft IS/Draft MND that require punctuation corrections. The term "special status" was incorrectly written as a single hyphenated word "special-status" throughout the Biological Resources section, beginning on page 22.
2. In addition, the first paragraph of page 39, incorrectly refers to "mitigation measures" when there is only one mitigation measure addressing Hydrology and Water Quality impacts. The changed text reads:

   Past copper treatments in similar water bodies have shown the dissolved copper concentration to fall soon after application and remain below the CTR human health criteria for copper of 1.3 mg/L. Therefore, with the implementation of the following mitigation measure~~s~~, this project will present a less than significant impact on water quality.

Changes in Response to Comments

The following changes have been made in response to comments received from CDFW. The reasons for the changes are explained earlier in this document.

1. Four special status wildlife species that have the potential to occur at O'Neill Forebay were added to the nine originally listed on page 25. The change reads as follows:

   The following ~~nine~~thirteen special status wildlife species have the potential to occur within O'Neill Forebay or along the immediate shoreline:

   - California tiger salamander (*Ambystoma californiense*)
   - Cackling goose (*Branta hutchinsii* ssp. *leucopareia*)
   - Northern harrier
   - Western pond turtle
   - California red-legged frog
   - Western spadefoot
   - Giant garter snake (*Thamnophis gigas*)
   - Tricolored blackbird
   - Yellow warbler (*Dendroica petechia brewsteri*)
   - Bald eagle
   - Golden eagle (*Aquila chrysaetos*)
   - Swainson's hawk (*Buteo swainsoni*)
   - White-tailed kite (*Elanus leucurus*)

2. *Mitigation Measure BIO-1: Impact Avoidance to Nesting Birds* was amended to identify specific survey methodologies and monitoring requirements to be implemented to avoid impacts to special status birds and burrowing owls (species of special concern). The revised mitigation measure is found on pages 28 and 52 of the IS/Draft MND. The amended mitigation measure reads:

Mitigation Measure BIO-1: Impact Avoidance to Nesting Birds

The following mitigation measures are recommended to reduce potential impacts to nesting birds during application of copper sulfate by helicopters:

- If a copper sulfate application is scheduled to occur during the breeding season (February 1~~ August 31~~September 15), it is recommended that a qualified biologist conduct pre-application surveys of all potential nesting habitats within 500 feet of proposed helicopter application activities. Surveys at O'Neill Forebay will follow the survey methodology of the Swainson's Hawk Technical Advisory Committee (SWHA TAC, 2000) and the Bald Eagle Breeding Survey Instructions (California Department of Fish and Game (CDFG), 2010). At least one survey should be conducted no more than three days prior to these activities. If the application is scheduled to occur during the non-nesting season (September ~~1~~16 through January 31) at Quail Lake, Pyramid Lake, or Silverwood Lake, a pre-application survey is not necessary and no additional measures are recommended. At O'Neill Forebay, surveys for burrowing owl nests will be conducted using the survey methodology described in "Staff Report on Burrowing Owl Mitigation dated March 7, 2012 (CDFG, 2012) any time of year that an application by helicopter is planned.

- If active nests are found at Quail Lake, Pyramid Lake, or Silverwood Lake, no-disturbance buffers shall be implemented around each nest based on the species and location of the nest as determined by a qualified biologist, or the nest should be closely monitored during applications to ensure that helicopter does not create physical disturbance and copper sulfate does not inadvertently drift into the nest. If a buffer is preferred, a general buffer distance typically includes 500 feet around any confirmed active raptor nest or a 300-foot buffer around nests of passerine bird species protected in accordance with the MBTA and/or Fish and Game Code. Additionally, helicopters shall not fly vertically over trees with active nests unless an adequate elevation can be achieved to ensure that downward wind generated by the propulsion would not physically disturb the tree. However, buffer distances can be determined by the biologist based on location, vegetation cover, species, and other factors. The buffers should be implemented until it is determined by a qualified wildlife biologist that young have fledged and the nest is determined to be inactive.

- If active nests are found at O'Neill Forebay, identified nests of special status species will be continuously surveyed for 24 hours prior to any activities related to helicopter applications in order to establish a behavioral baseline. During the application, the nests will be continuously monitored to detect any behavioral changes. No-disturbance buffers of 500 feet shall be implemented around each nest for non-listed bird species, while buffers of 0.5 miles will be implemented for nests of all raptors. Additionally, helicopters shall not fly vertically over trees with active nests unless an adequate elevation can be achieved to ensure that downward wind generated by the propulsion would not physically disturb the tree. The buffers should be implemented until it is determined by a qualified wildlife biologist that young have fledged and the nest is determined to be inactive. If burrowing owl nests are identified, impacts to occupied burrows will be avoided by implementing no-disturbance buffers in accordance with the table below unless a qualified biologist determines either: 1) the birds have not begun egg-laying and incubation or 2) juveniles from the occupied burrows are foraging independently and are capable of survival.

Location	Time of Year	Level of Disturbance		
		Low	Med.	High
Nesting sites	April 1-Aug 15	200 m*	500 m	500 m
Nesting sites	Aug 16-Oct 15	200 m	200 m	500 m
Nesting sites	Oct 16-Mar 31	50 m	100 m	500 m

*meters (m)

3. Two additional biological resources mitigation measure were added after *Mitigation Measure BIO-1*. The first new mitigation measure calls for focused biological surveys prior to a helicopter application. The second new measure concerns special status plant surveys at O'Neill Forebay. The added mitigation measures read:

   Mitigation Measure BIO-2: Focused Biological Surveys

   Prior to a copper application by helicopter, a qualified wildlife biologist will conduct a survey of the project area to determine if special status species could be impacted. Survey results will be used to identify any mitigation minimization and avoidance measures that may be needed to reduce potential impacts to special status wildlife species to a less than significant level.

   Mitigation Measure BIO-3: Special Status Plant Surveys at O'Neill Forebay

   Prior to a copper application by helicopter at O'Neill Forebay, a qualified botanist will survey the land adjacent to the application area for special status species plants. The botanist will follow the *Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities (November 24, 2009).* If special status species are found, DWR will monitor wind speed and wind direction to avoid potential impacts to the species from a helicopter application.

4. A reference to mitigation measures in the Biological Resources section on page 29 was updated to reflect the inclusion of the additional mitigation measures discussed in item 3 above. The changed sentence reads:

   With implementation of the proposed mitigation measures, impacts to uplands habitat and terrestrial species, including nesting birds, would be **less than significant**.

4. References

California Department of Fish and Game (CDFG). 2010. *Bald Eagle Breeding Survey Instructions*.

CDFG. 2009. *Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities*.

CDFG. 2012. *Staff Report on Burrowing Owl Mitigation*.

Swainson's Hawk Technical Advisory Committee, 2000. *Recommended Timing and Methodology for Swainson's Hawk Nesting Surveys in California's Central Valley.*

Appendix A
Mitigation Monitoring and Reporting Program

Department of Water Resources

Application of Copper to the State Water Project to Control Aquatic Weeds and Algal Blooms Project

Mitigated Negative Declaration

SCH# 2014032086

Mitigation Monitoring and Reporting Program

MAY 2014

This Mitigation Monitoring and Reporting Program (MMRP) document summarizes the mitigation measures identified for the project *Application of Copper to the State Water Project to Control Aquatic Weeds and Algal Blooms*. The four mitigation measures are integrated into the project to reduce potentially significant environmental impacts to a less than significant level.

Each mitigation measure of the Final IS/MND is followed by a table that describes how the measure will be implemented. Each table consists of four column headings which are defined:

1. **Implementation Procedure:** This column provides information on how the mitigation measure will be implemented.
2. **Monitoring and Reporting Actions:** This column identifies the steps necessary to verify compliance with the mitigation measure.
3. **Monitoring Responsibility:** This column identifies the party responsible for carrying out the monitoring and reporting tasks.
4. **Monitoring Schedule:** This column contains the timing and frequency of the action.

BIOLOGICAL RESOURCES

Mitigation Measure BIO-1: Impact Avoidance to Nesting Birds

The following mitigation measures are recommended to reduce potential impacts to nesting birds during application of copper sulfate by helicopters:

- If a copper sulfate application is scheduled to occur during the breeding season (February 1-September 15), it is recommended that a qualified biologist conduct pre-application surveys of all potential nesting habitats within 500 feet of proposed helicopter application activities. Surveys at O'Neill Forebay will follow the survey methodology of the Swainson's Hawk Technical Advisory Committee (SWHA TAC, 2000) and the Bald Eagle Breeding Survey Instructions (California Department of Fish and Game (CDFG), 2010). At least one survey should be conducted no more than three days prior to these activities. If the application is scheduled to occur during the non-nesting season (September 16 through January 31) at Quail Lake, Pyramid Lake, or Silverwood Lake, a pre-application survey is not necessary and no additional measures are recommended. At O'Neill Forebay, surveys for burrowing owl nests will be conducted using the survey methodology described in "Staff Report on Burrowing Owl Mitigation dated March 7, 2012 (CDFG, 2012) any time of year that an application by helicopter is planned.

- If active nests are found at Quail Lake, Pyramid Lake, or Silverwood Lake, no-disturbance buffers shall be implemented around each nest based on the species and location of the nest as determined by a qualified biologist, or the nest should be closely monitored during applications to ensure that helicopter does not create physical disturbance and copper sulfate does not inadvertently drift into the nest. If a buffer is preferred, a general buffer distance typically includes 500 feet around any confirmed active raptor nest or a 300-foot buffer around nests of passerine bird species protected in accordance with the MBTA and/or Fish and Game Code. Additionally, helicopters shall not fly vertically over trees with active nests unless an adequate elevation can be achieved to ensure that downward wind generated by the propulsion would not physically disturb the tree. However, buffer distances can be determined by the biologist based on location, vegetation cover, species, and other factors. The buffers should be implemented until it is determined by a qualified wildlife biologist that young have fledged and the nest is determined to be inactive.

- If active nests are found at O'Neill Forebay, identified nests of special status species will be continuously surveyed for 24 hours prior to any activities related to helicopter applications in order to establish a behavioral baseline. During the application, the nests will be continuously monitored to detect any behavioral changes. No-disturbance buffers of 500 feet shall be implemented around each nest for non-listed bird species, while buffers of 0.5 miles will be implemented for nests of all raptors. Additionally, helicopters shall not fly vertically over trees with active nests unless an adequate elevation can be achieved to ensure that downward wind generated by the propulsion would not physically disturb the tree. The buffers should be implemented until it is determined by a qualified wildlife biologist that young have fledged and the nest is determined to be inactive. If burrowing owl nests are identified, impacts to occupied burrows will be avoided by implementing no-disturbance buffers in accordance with the table below unless a qualified biologist determines either: 1) the birds have not begun egg-laying and incubation or 2) juveniles from the occupied burrows are foraging independently and are capable of survival.

Location	Time of Year	Level of Disturbance		
		Low	Med.	High
Nesting sites	April 1-Aug 15	200 m*	500 m	500 m
Nesting sites	Aug 16-Oct 15	200 m	200 m	500 m
Nesting sites	Oct 16-Mar 31	50 m	100 m	500 m

*meters (m)

Implementation Procedure	**Monitoring and Reporting Actions**	**Monitoring Responsibility**	**Monitoring Schedule**
<u>O'Neill Forebay, Quail Lake, Pyramid Lake, and Silverwood Lake</u> A qualified biologist (DWR staff or a consultant) conducts pre-application surveys of all potential nesting habitats within 500 feet of proposed helicopter application activities for this project. Surveys at O'Neill Forebay will follow the survey methodology of the Swainson's Hawk Technical Advisory Committee (SWHA TAC, 2000) and the Bald Eagle Breeding Survey Instructions (California Department of Fish and Game (CDFG), 2010).	DWR staff will maintain a record of the surveys conducted.	Department of Water Resources (DWR) staff	At least one survey should be conducted no more than three days prior to a copper application by helicopter during the breeding season (February 1-September 15).
<u>O'Neill Forebay</u> Surveys for burrowing owl nests by a qualified biologist (DWR staff or a consultant) will be conducted using the survey methodology described in "Staff Report on Burrowing Owl Mitigation dated March 7, 2012 (CDFG, 2012).	DWR staff will maintain a record of the burrowing owl surveys conducted at O'Neill Forebay.	DWR staff	Prior to every copper application by helicopter.

Implementation Procedure	Monitoring and Reporting Actions	Monitoring Responsibility	Monitoring Schedule
<u>Quail Lake, Pyramid Lake, and Silverwood Lake</u> If active nests are found, no-disturbance buffers will be implemented around each nest based on the species and location of the nest as determined by a qualified biologist (DWR staff or a consultant), or the nest should be closely monitored during applications to ensure that helicopter does not create physical disturbance and copper sulfate does not inadvertently drift into the nest. If buffers are implemented, the distance should be 500 feet around any confirmed active raptor nest or a 300-foot buffer around nests of passerine bird species protected in accordance with the Migratory Bird Treaty Act and/or Fish and Game Code.	DWR staff will maintain a record of no-disturbance buffers implemented or nest monitoring, as applicable.	DWR staff	Prior to and during copper applications by helicopter conducted during the breeding season (February 1-September 15).
<u>O'Neill Forebay</u> • If active nests are found at O'Neill Forebay, identified nests of **special status species** will be continuously surveyed for 24 hours prior to any activities related to helicopter applications in order to establish a behavioral baseline. During the application, the nests will be continuously monitored to detect any behavioral changes. • No-disturbance buffers of 500 feet will be implemented around each nest for **non-listed bird species**, while buffers of 0.5 miles will be implemented for nests of **all raptors**. Additionally, helicopters will not fly vertically over trees with active nests unless an adequate elevation can be achieved to ensure that downward wind generated by the propulsion would not physically disturb the tree. The buffers should be implemented until it is determined by a qualified wildlife biologist (DWR staff or a consultant) that young have fledged and the nest is determined to be inactive. • If burrowing owl nests are identified, impacts to occupied burrows will be avoided by implementing no-	DWR staff will maintain a record of no-disturbance buffers implemented as nest monitoring, as outlined in the mitigation measure.	DWR staff	Prior to and during copper applications by helicopter.

Implementation Procedure	Monitoring and Reporting Actions	Monitoring Responsibility	Monitoring Schedule
disturbance buffers in accordance with the table included as part of *Mitigation Measure BIO-1* unless a qualified biologist (DWR staff or a consultant) determines either: 1) the birds have not begun egg-laying and incubation or 2) juveniles from the occupied burrows are foraging independently and are capable of survival.			

Mitigation Measure BIO-2: Focused Biological Surveys

Prior to a copper application by helicopter, a qualified wildlife biologist will conduct a survey of the project area to determine if special status species could be impacted. Survey results will be used to identify any mitigation minimization and avoidance measures that may be needed to reduce potential impacts to special status wildlife species to a less than significant level.

Implementation Procedure	Monitoring and Reporting Actions	Monitoring Responsibility	Monitoring Schedule
<u>O'Neill Forebay, Quail Lake, Pyramid Lake, and Silverwood Lake</u> A qualified wildlife biologist (DWR staff or a consultant) will conduct a survey of the project area to determine if special status species could be impacted. Survey results will be used to identify any mitigation minimization and avoidance measures that may be needed to reduce potential impacts to special status wildlife species to a less than significant level.	DWR staff will maintain a record of the survey results as well as any mitigation and avoidance measures implemented to reduce potential impacts to special status species.	DWR staff	Prior to a copper application by helicopter.

Mitigation Measure BIO-3: Special Status Plant Surveys at O'Neill Forebay

Prior to a copper application by helicopter at O'Neill Forebay, a qualified botanist will survey the land adjacent to the application area for special status species plants. The botanist will follow the *Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities (November 24, 2009).* If special status species are found, DWR will monitor wind speed and wind direction to avoid potential impacts to the species from a helicopter application.

Implementation Procedure	Monitoring and Reporting Actions	Monitoring Responsibility	Monitoring Schedule
O'Neill Forebay A qualified botanist (DWR staff or a consultant) will conduct a survey of the land adjacent to the application area for special status plants following the *Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities (November 24, 2009).*	DWR staff will maintain a record of the survey results as well as wind speed and wind direction data.	DWR staff	Prior to a copper application by helicopter.

HYDROLOGY AND WATER QUALITY

HYDRO-1: Submit the Proper Regulatory Documents (NPDES Permit and APAP)

- Develop and follow the monitoring requirements associated with the NPDES permit and APAP.
- To the extent feasible, take full advantage of operational options (e.g., selective water withdrawal, bypass and blending) to avoid or minimize the use of copper compounds.
- To the extent feasible, treat algal blooms prior to their exponential growth phase to minimize the amount of aquatic pesticides used.

Implementation Procedure	Monitoring and Reporting Actions	Monitoring Responsibility	Monitoring Schedule
DWR will develop and follow the monitoring requirements associated with the NPDES permit and APAP.	DWR staff will conduct the monitoring required by the NPDES permit as outlined in the Monitoring Plan of the APAP. DWR will submit an annual monitoring report to the SWRCB, as required by the permit.	DWR staff. Environmental Assessment Branch staff will prepare the annual reports.	Monitoring will be conducted prior to, during, and after copper applications. Reporting will be done annually, by March 1.
DWR will take full advantage of operational options and will treat algal blooms prior to their exponential growth phase to minimize the use of copper compounds.	DWR staff will monitor the results of weekly Solid Phase Microextraction (SPME) analyses in order to control algal blooms prior to the exponential growth phase.	DWR staff	Prior to scheduling a copper application.

APPENDIX A

California Department of Water Resources
Application of Copper to the State Water Project to Control Aquatic Weeds and Algal Blooms

Certification of the Mitigated Negative Declaration for the Application of Copper to the State Water Project to Control Aquatic Weeds and Algal Blooms Project

Project Description

The California Department of Water Resources (DWR) prepared a Draft Initial Study and Mitigated Negative Declaration (IS/MND) in accordance with the California Environmental Quality Act (CEQA) and CEQA Guidelines to evaluate the environmental impacts of the proposed Application of Copper to the State Water Project to Control Aquatic Weeds and Algal Blooms Project. DWR's intent with regards to this project is to apply copper complexes including copper sulfate, chelated copper compounds (Komeen® and Nautique®), and EarthTec® on an as-needed basis to control aquatic weeds and algal blooms so that the blooms do not degrade drinking water through elevated tastes and odors, production of algal toxins, clogging of filters, and reduction in water flows. To implement this project, DWR has applied for authorization to apply copper compounds under the General NPDES Permit No. 2013-0002-DWQ. In addition, DWR is seeking a categorical exception from the toxics standards for copper under section 5.3 of the State Water Resources Control Board's State Implementation Plan (SIP).

Project Location

DWR's State Water Project reservoirs: 1) O'Neill Forebay, Merced County, 37°4'46.103"N, 121°2'53.37"W; 2) Quail Lake, Los Angeles County, 34°46'18.156"N, 118°44'49.629"W; 3) Pyramid Lake, Los Angeles County, 34°39'14.054"N, 118°46'19.483"W; and 4) Silverwood Lake, San Bernardino County, 37°17'30.214"N, 117°19'29.851"W

Lead Agency Contact Information

Agency Name: California Department of Water Resources
Contact Person: Anthony Chu

Mailing Address: 1416 Ninth St., P.O. Box 942836, Sacramento, CA 94236 0001

Phone: (916) 653-9978

Findings

As discussed in the draft IS/MND, the proposed project has environmental impacts in the areas of 1) biological resources and 2) hydrology and water quality. These impacts would be reduced to less than significant levels with the implementation of two mitigation measures identified in the IS/MND. These measures are:

BIO-1: Impact Avoidance to Nesting Birds

The following mitigation measure is recommended to reduce potential impacts to nesting birds during application of copper sulfate by helicopters:

- If a copper sulfate application is scheduled to occur during the breeding season (February 1–August 31), it is recommended that a qualified biologist conduct pre-application surveys of all potential nesting habitats within 500 feet of proposed helicopter application activities. At least one survey should be conducted no more than three days prior to these activities. If the application is scheduled to occur during the non-nesting season (September 1 through January 31), a pre-application survey is not necessary and no additional measures are recommended.

- If active nests are found, no-disturbance buffers shall be implemented around each nest based on the species and location of the nest as determined by a qualified biologist, or the nest should be closely monitored during applications to ensure that copper sulfate does not inadvertently drift into the nest. If a buffer is preferred, a general buffer distance typically includes 500 feet around any confirmed active raptor nest or a 300-foot buffer around nests of passerine bird species protected in accordance with the MBTA and/or Fish and Game Code. However, buffer distances can be determined by the biologist based on location, vegetation cover, species, and other factors. The buffers should be implemented until it is determined by a qualified wildlife biologist that young have fledged and the nest is determined to be inactive.

HYDRO-1: Submit the Proper Regulatory Documents (NPDES Permit and APAP)

- Develop and follow the monitoring requirements associated with the NPDES permit and APAP.
- To the extent feasible, take full advantage of operational options (e.g., selective water withdrawal, bypass and blending) to avoid or minimize the use of copper compounds.
- To the extent feasible, treat algal blooms prior to their exponential growth phase to minimize the amount of aquatic pesticides used.

Certification

As the Lead Agency, DWR has determined that it has complied with CEQA for the project identified above, and that the project is described in adequate and sufficient detail to allow the project's implementation.

I certify that the CEQA analysis for this project encompasses all aspects of the work to be completed.

Authorized Representative (Signature)	Date	Authorized Representative (Printed Name and Title)

The Department of Water Resources

Aquatic Pesticides Application Plan

WATER QUALITY ORDER NO. 2013-0002-DWQ

Statewide General National Discharge Pollutant Discharge Elimination System Permit for the Discharge of Aquatic Pesticides for Aquatic Weed Control in Waters of the United States

October 21, 2013

The Department of Water Resources
Environmental Assessment Branch
1416 Ninth Street
Sacramento, California 95814

Table of Contents

INTRODUCTION AND LOCATION

The Department of Water Resources (DWR) applied for a statewide general National Pollutant Discharge Elimination System (NPDES) Permit from the State Water Resources Control Board (SWRCB) to continue application of aquatic herbicides, when necessary, to State Water Project (SWP) aqueducts, forebays, and reservoirs (Table 1). Figures 1 to 13 show the locations of SWP facilities. A Mitigated Negative Declaration (MND) was prepared by DWR to comply with California Environmental Quality Act (CEQA) requirements associated with regulatory requirements established by the SWRCB. DWR, a public entity, was granted a Section 5.3 Exception by the SWRCB (Water Quality Order 2004-0009-DWQ).

DWR applies copper compounds (copper sulfate pentahydrate, Komeen®, Nautique®, Captain XTR®, EarthTec®) and sodium carbonate peroxyhydrate (PAK®27) on an as-needed basis to control aquatic weeds and algal blooms so that such blooms do not degrade drinking water quality through elevated tastes and odors, production of algal toxins, clogging of filters, and reduction in water flows. DWR is adding diquat, fluridone, imazamox, and triclopyr to the list of aquatic herbicide treatment options for the SWP. DWR does not use adjuvants or surfactants when treating SWP water bodies.

The proposed Project would involve the continued application of aquatic herbicides to control aquatic weeds and algal blooms at SWP reservoirs and aqueducts operated by DWR (Table 1). Figures 1 - 13 provide area maps for each of the reservoirs and aqueducts. The facilities are located within the boundaries of five Regional Water Quality Control Boards (RWQCB). DWR will request a prohibition exemption from the Lahontan Regional Water Quality Control Board as soon as practicable in order to comply with the Lahontan Regional Board's discharge requirements.

TABLE 1. Aquatic Weed and Algal Bloom Control Programs in the State Water Project

	Region (RWQCB)	Counties	Problem Biota	Associated Problems	Aquatic Herbicide
RESERVOIRS					
Clifton Court Forebay	5	Contra Costa	aquatic weeds and cyanobacteria	reduced water flows*, taste and odor, and filter clogging	copper-based
Patterson Reservoir	2	Alameda	filamentous algae (*Cladophora*)	filter clogging	copper-based and imazamox
Dyer Reservoir	2	Alameda	cyanobacteria	taste and odor and filter clogging	copper-based, imazamox, and sodium carbonate peroxyhydrate
O'Neill Forebay	5	Merced	aquatic weeds	reduced water flows*	fluridone, imazamox, and triclopyr

	Region (RWQCB)	Counties	Problem Biota	Associated Problems	Aquatic Herbicide
Coastal Branch Forebays	5	Kings and San Luis Obispo	aquatic weeds	filter clogging	sodium carbonate peroxyhydrate
Pyramid Lake	4	Los Angeles	aquatic weeds and cyanobacteria	taste and odor and toxins	diquat, fluridone, imazamox, sodium carbonate peroxyhydrate, and triclopyr
Castaic Lake	4	Los Angeles	aquatic weeds and cyanobacteria	taste and odor, filter clogging, and toxins	copper–based, fluridone, imazamox, and triclopyr
Silverwood Lake	6	San Bernardino	aquatic weeds and cyanobacteria	taste and odor and toxins	fluridone, imazamox, sodium carbonate peroxyhydrate, and triclopyr
Lake Perris	8	Riverside	aquatic weeds and cyanobacteria	taste and odor, filter clogging, and toxins	copper–based, fluridone, imazamox, and triclopyr
AQUEDUCTS					
South Bay Aqueduct	2	Alameda and Contra Costa	*Cladophora* and diatoms	reduced water flows*	copper-based
Coastal Branch Aqueduct	5	Kings and San Luis Obispo	aquatic weeds and cyanobacteria	taste and odor and filter clogging	copper-based
East Branch Aqueduct	6	Los Angeles, San Bernardino, and Riverside	cyanobacteria	taste and odor, filter clogging, and toxins	copper-based

*Creates operational problems by clogging trash racks and filters.

RWQCB – Regional Water Quality Control Boards

Region 2 San Francisco Bay
Region 4 Los Angeles
Region 5 Central Valley
Region 6 Lahontan
Region 8 Santa Ana

PROJECT BACKGROUND

DWR operates and manages the SWP, the largest state-built, multipurpose water project in the United States. The SWP depends on a complex system of dams, reservoirs, power plants, pumping plants, and aqueducts to deliver water. The Project provides drinking water to more than 25 million Californians and SWP water is used to irrigate about 750,000 acres of farmland, mainly in the south San Joaquin Valley. Also, the SWP was designed and built to control floods, generate power, and provide recreational facilities as well as enhance habitats for fish and wildlife.

The mission of DWR is to manage the water resources of California in cooperation with other agencies, to benefit the State's people, and to protect, restore, and enhance the natural and human environments. To carry out this mission, DWR routinely monitors and tests water samples from its reservoirs, aqueducts, and other water supply facilities to assure compliance with state and federal requirements for safe drinking water quality.

Water quality monitoring provides detailed information on concentrations and distribution of chemical, physical, and biological properties at more than 40 stations throughout the Project. Objectives of this monitoring are to:

- Assess the influence of hydrological conditions and project operations on water quality.
- Document long-term changes in SWP water quality.
- Provide water quality data to assess water treatment plant operational needs.
- Identify, monitor, and respond to water quality emergencies and determine impacts to the Project.
- Provide data needed to determine if State Water Contracts Article 19 and California Department of Public Health (CDPH) Drinking Water Standards are being met.
- Assess issues of concern through special studies.

DWR applies aquatic herbicides for two main purposes: 1) to control cyanobacteria (blue-green algae) that can produce taste and odor and toxic compounds and 2) to control aquatic weeds and algae that can negatively impact water conveyance for municipal, irrigation, and industrial purposes and clog filters at water treatment plants.

DWR routinely monitors taste and odor compounds produced by algae. Chemical substances in water that often are associated with earthy, musty smelling or tasting water include geosmin and 2-methylisoborneol (MIB), which are produced in natural and manmade lakes by cyanobacteria. Geosmin and MIB are natural by-products of algal chlorophyll production, although not all algae produce them or produce them in the same amounts, so the presence of algae alone is not a good indicator of taste and odor problems.

DWR’s evaluation of a taste and odor event is based upon microscopic examination of samples, and most importantly, the chemical analysis of MIB and geosmin. When sampling results indicate that concentrations of geosmin or MIB in reservoir waters are increasing within the 10 nanograms per liter (ng/l) range (1 ng/l is one nanogram per liter of water, or one part per trillion), DWR water quality staff respond by searching for the location of the source of the geosmin or MIB. To do this, water quality samples are collected and analyzed, and field staff ascertains possible algae sources. If an algae source is identified, DWR staff then develops an application plan to control the specific algae that are associated with the elevated geosmin and/or MIB concentrations.

1. SOUTH BAY AQUEDUCT

a. Site Description

The South Bay Aqueduct (SBA) originates at Bethany Reservoir, an enlarged section of the California Aqueduct about one mile downstream from the Harvey O. Banks Pumping Plant near the town of Byron and within the boundaries of the San Francisco Bay Regional Water Quality Control Board, Region 2. Completed in 1966, the 44.1-mile system serves portions of Alameda and Santa Clara Counties, including the cities of Livermore and Santa Clara (Figure 1). Eleven miles of the system are open aqueduct with the remainder consisting of pipelines and tunnels.

The open aqueduct section begins at the Backsurge Pool (Milepost (MP) 3.31) to Dyer Altamont Check (MP 5.15) and then continues as a pipeline for about 2.5 miles. The open aqueduct section continues from MP 7.61 to Del Valle Check 7 (MP 16.38) at which point the SBA again becomes a pipeline to the terminus at the Santa Clara terminal tank (MP 42.07). Due to the shallowness of about 5 feet, filter clogging diatoms and taste and odor causing cyanobacteria create water quality and delivery problems from about March to October.

b. Treatment Area

Application area: Copper sulfate or EarthTec® is applied at three locations: Backsurge Pool (MP 3.31), Patterson Check (MP 9.44), and Arroyo Seco Check (MP 12.0).

Treatment Area: Copper sulfate or EarthTec® is applied at a maximum of three locations in the open portion of the SBA. The treatment area is defined from the Backsurge Pool at MP 3.31 to the end of the open aqueduct section at Del Valle Check 7 (MP 16.38).

c. Aquatic Weeds and Algae Controlled and Rationale

i. Background

Algae problems began in the SBA soon after the start of aqueduct operations in 1966. DWR applies copper sulfate and EarthTec® for two main purposes: 1) to control cyanobacteria that can produce taste and odor compounds, and 2) to control attached algae such as *Melosira varians* and *Cladophora* sp. that can negatively impact conveyance of water supplies for municipal, irrigation, and industrial purposes and reduce filter run times in water treatment plants.

DWR routinely monitors for taste and odor compounds produced by algae. Chemical substances in water that are often associated with earthy, musty smelling or tasting water include geosmin and 2-methylisoborneol (MIB), which are produced in natural and manmade lakes by certain types of cyanobacteria. Geosmin and MIB are natural by-products of algal chlorophyll production, although not all algae produce them in the same amounts, so the presence of algae alone is not a good indicator of taste and odor problems.

ii. Control Tolerances

(1) Taste and Odor

MIB less than 5 ng/L and geosmin less than 10 ng/L are not detected in drinking water by most customers.

Taste and odor production is monitored on a weekly basis using Solid Phase Microextraction (SPME). The taste and odor causing substances, MIB and geosmin are reported in parts per trillion (ng/L) concentrations.

(2) Filter Clogging

Algal fluorescence less than 200 units and algal biomass less than 5,000 mg/m^3 do not cause operational problems to water conveyance or reduction in filter run times at water treatment plants.

Algal biomass and species composition are analyzed directly using the Utermohl technique (inverted microscope method). Algal fluorescence is measured continuously with a Turner 10AU fluorometer. The data are posted daily to the DWR Water Quality website: http://www.water.ca.gov/swp/waterquality/AutostationData/index.cfm.

d. Algaecides and Aquatic Herbicides Applied and Method of Application

Aquatic herbicide: Copper-based herbicides (copper sulfate pentahydrate crystals, EarthTec®). Copper sulfate pentahydrate crystals or EarthTec® are applied in a manner consistent with product labeling.

Application method: Burlap bags filled with copper sulfate crystals are suspended in the aqueduct in a manner consistent with product labeling. EarthTec® is applied according to label instructions.

e. Decision to Select Herbicides

DWR's decision to apply copper sulfate or EarthTec® is based upon microscopic examination of samples and most importantly, the chemical analysis of MIB and geosmin. When sampling results indicate that concentrations of taste and odor compounds, algal biomass or fluorescence exceed the control tolerances (see section c above), DWR water quality staff respond by searching for the location of the source of the problem. To do this, water quality samples are collected and analyzed, and field staff ascertains possible algae sources.

Prior to application of copper sulfate or EarthTec®, DWR evaluates potential operational strategies. These modifications may include withdrawing water from deeper depths on the intake tower of Lake Del Valle, blending, or utilizing other sources of water. If application of copper sulfate or EarthTec® is deemed necessary, the early warning monitoring for MIB and geosmin and biomass provides detailed information on the location of the source blooms.

f. Herbicide Dose and Determination

Copper sulfate pentahydrate or EarthTec® is applied consistent with product labeling instructions for control of attached and planktonic algae.

The quantity of copper applied is calculated based on the aqueduct flow and the target dose using a spreadsheet program (FlowTimes) developed by DWR. The model calculates the amount (pounds) of copper sulfate required at each of the three application points, and the start and end times of the copper sulfate application required to meet the target concentration.

g. Gates and Control Structures

Turnouts are closed for a minimum of two hours prior to the start of the copper sulfate or EarthTec® treatment and remain closed for a minimum of two hours after the copper sulfate or EarthTec® has passed the following three turnouts:

Arroyo Mocho Check – located at MP 14.6 on the South Bay Aqueduct.

Arroyo Valle 1 (AV1) – located at MP 0.9DV on the Del Valle Branch Pipeline.

Arroyo Valle 2 (AV2) – located at MP 1.53DV on the Del Valle Branch Pipeline.

AV1 and AV2 are operated manually while the Arroyo Mocho gate is controlled remotely at the Delta Field Division in Byron. The gates at AV1 and AV2 are inspected during operation to ensure that the gate is closed and no water is discharged into Arroyo Mocho Creek. The Arroyo Mocho gate is equipped with a flow meter that is monitored in the DWR control room to verify proper operation of the gate.

h. Exception Period

The Department of Water Resources was granted a section 5.3 exception. Application of copper to the South Bay Aqueduct would be carried out only on an as-needed basis during the year, after other options have been exhausted. Application of copper sulfate or EarthTec® to the aqueduct is required at regular intervals throughout the growing season to prevent loss in water delivery capacity.

i. Monitoring Plan

See Appendix A.

j. Procedures to Prevent Sample Contamination from Persons, Equipment, and Vehicles Associated with Algaecide and Aquatic Herbicide Application

Water quality sampling is conducted by trained DWR staff following established procedures designed to prevent contamination of samples. Sampling guidelines are contained in “Water Quality Field Manual for the State Water Project” produced by DWR.

Procedures that prevent sample contamination include:

- Use clean sample bottles that are non-reactive. Glass and polyethylene bottles are used for SWP water samples.

- Wear gloves that are powder-free vinyl to avoid the contamination associated with latex gloves.
- Samples are immediately placed in an ice chest away from contaminants as soon as the samples are taken.

k. Best Management Practices Implemented

Application: Copper sulfate or EarthTec® is applied under the supervision of a certified pesticide applicator. Delta Field Division has one licensed Pest Control Advisor (PCA) who also works in the San Luis Field Division and seven Certified Qualified Applicators (QAC). These individuals are trained to ensure that algaecides and aquatic herbicides are applied at rates consistent with label requirements and in a manner that avoids potential adverse effects including, but not limited to, fish kills. Copper sulfate has been used since the early 1970s to control filter clogging algae (*Cladophora*) and taste and odor producing cyanobacteria in the SBA.

Notification: The Department's South Bay Water Contractors, who also provide treated municipal water to customers, are notified by email at least 48 hours prior to a treatment. The notification includes date, start and end time of the treatment, and travel time of copper sulfate or EarthTec® by milepost. The Contractors are Alameda County Flood Control and Water Management District, Zone 7; Alameda County Water District; and Santa Clara Valley Water District. Additionally, a Pest Control Advisor (PCA) will submit a written recommendation for the use of aquatic herbicides to the County Agricultural Commissioner.

Treatment: The copper is applied during daylight hours of maximum photosynthetic activity to optimize copper uptake by the algal community.

Spill Prevention and Cleanup: Staff will apply copper sulfate or EarthTec® according to label instructions in order to prevent spills. In the event of a spill, staff will follow the field division's established emergency response procedures and refer to the applicable material safety data sheet (MSDS) for instructions on containing and cleaning up the spill. Emergency response and MSDS procedures will be reviewed regularly. A copy of the emergency response procedures and material safety data sheets will be available during each treatment. Cleanup equipment will be kept in good working order and will be readily available at each application site.

Water Quality Monitoring: SBA water quality is monitored continuously by automated instrumentation. The station at Del Valle Check (MP 16.38) is equipped with sensors to measure water temperature, turbidity, pH, specific conductance, and algal biomass (flow-through fluorometry). Additional data are obtained at the Vallecitos Check (MP 22.4) water quality station, which is equipped with water quality instruments that measure water temperature, turbidity, pH, and specific conductance. Further, water quality data from grab samples are available for Santa Clara Terminal Tank (MP 42, about 0.5 miles from the end of the treated section) each month in which water is released from Del Valle Reservoir.

Access: There are limited recreational activities on the SBA, and most sections are closed to public access with locked gates. Fishing is not permitted in the SBA.

Post-Treatment: The efficacy of the treatment is evaluated at about one week after the application. Algae are surveyed to determine the effectiveness of the treatment at reducing biomass, and taste and odor compounds are monitored weekly throughout the year.

l. Possible Alternatives to Algaecides and Aquatic Herbicide Use

i. Evaluation of Management Options

(1) No Action

If the SBA was not treated, attached algae would severely impact deliveries to water contractors in the South Bay region. A “no action” option is therefore not acceptable.

(2) Prevention

Nutrient Control. Some preventive measures involve limiting or eliminating nutrients that support aquatic weed and algae growth. Due to the size of the Delta and the numerous inflows, controlling nutrients is not a feasible preventive control option for the SBA.

(3) Mechanical or Physical Methods

Scraping of Aqueduct. Attempts were made in the 1980s to remove algae by scraping the aqueduct lining. A boom truck was used to drag a large link belt. The method was ineffective in removing algae and resulted in damage to the concrete aqueduct lining and mass loading of debris. The procedure was discontinued.

Continuously Operated Travelling Screens. Aquatic weeds and macro-algae (*Cladophora*) are removed at Del Valle Check (MP 16.38). The filter clogging diatoms are too small to be removed and are controlled with copper sulfate or EarthTec®.

(4) Cultural Methods

Aqueduct Dewatering. The aqueduct has been drained about every eight years since 1970. The main purpose of the draining is to remove accumulated silt that is deposited in the aqueduct invert. Attached algae recolonize the upper aqueduct lining soon after the silt is removed.

Reduction of Light. Enclosing the aqueduct (open section) of the SBA would eliminate light which is necessary for plant photosynthesis. This is not a viable BMP due to the high cost (about 10 million dollars) of covering the 11 miles of open aqueduct. Similarly, the use of dyes which work by screening portions of sunlight spectrum necessary for photosynthesis would not be a feasible alternative in a flowing aqueduct.

(5) Biological Control Agents

Introduction of Weed Eating Fish. Grass carp/white amur (*Ctenopharyngodon idella Val.*) have been approved for stocking by the California Department of Fish and Wildlife (CDFW) under controlled conditions where the water body is a closed system. The SBA has releases to streams, and in addition, water can be pumped

into Lake Del Valle. Therefore, grass carp would not be a viable alternative to copper sulfate or EarthTec® in managing algae in the SBA.

(6) Algaecides and Aquatic Herbicides

Aquatic Herbicide Treatment. An ongoing program of algae control using copper sulfate and EarthTec® is necessary to minimize the impacts on SBA water quality and quantity. Copper sulfate has proven to be effective at reducing the target algae without adverse effects on non-target organisms. There are no alternatives to using copper sulfate and EarthTec® that are effective at controlling attached algae and registered for use in California. If the SBA was not treated, attached algae would severely impact deliveries to water contractors in the South Bay region.

ii. Decision Matrix to Select the Most Appropriate Formulation

The decision matrix below evaluates the aquatic weed and algae control options identified for the South Bay Aqueduct (section i: "Evaluation of Management Options" above).

Decision Making Criteria	No Action	Prevention	Mechanical or Physical	Cultural Methods	Biological Agents	Algaecides and Aquatic Herbicides
Is the impact to the environment low or easily mitigated?	Yes	Yes	Yes	Yes	Yes	Yes
Is the cost of this option reasonable?	N/A	No	No	No	No	Yes
Has (have) the method(s) been effectively implemented at this site?	No	No	No	No	No	Yes
Option(s) selected for the South Bay Aqueduct.						X

2. CLIFTON COURT FOREBAY

a. Site Description

Clifton Court Forebay is located in the southeast corner of Contra Costa County about ten miles northwest of the city of Tracy and within the borders of the Central Valley Regional Water Quality Control Board, Region 5 (Figure 2). The forebay is a shallow 28,653 acre-foot reservoir at the head of the California Aqueduct. Water enters the forebay via a gated structure connected at West Canal, a channel of Old River that allows waters of Sacramento-San Joaquin Delta to enter the forebay.

The forebay provides storage for off-peak pumping and permits regulation of flows into the Harvey O. Banks Pumping Plant. Inflows to the forebay are generally made during high tides.

Construction of the forebay was completed in December 1969. Aquatic weeds were treated with Komeen® or Nautique® to reduce aquatic weeds that clog and obstruct the primary and secondary trash racks at the Skinner Fish Protection Facility and at Banks Pumping Plant.

Clogging of trash racks at the Skinner Fish Protection Facility has caused a number of unscheduled shutdowns in pumping at Banks Pumping Plant. In response to the operational problems caused by the excessive amounts of aquatic weeds, the first chemical treatment was conducted in May 1995. From 1995 to 2006, complex copper (Komeen® or Nautique®) was applied once or twice annually usually during May or June. Copper-based herbicides have not been applied in Clifton Court Forebay since 2006 with the listing of the North American green sturgeon (*Acipenser medirostris*) as a threatened species.

Future applications of herbicides to control aquatic weeds would not be done until those applications were determined to have little to no detrimental effect on resident salmon, steelhead, or sturgeon. Applications would be based on the life history of each species, their absence during the approved pesticide application dates, and modified operational procedures which help avoid pesticide exposure by the species.

b. Treatment Area

i. Aquatic Weeds

Application Area: Copper-based herbicides were applied to approximately 700 - 1,000 of the 2,180 surface acres in the forebay from 1995 to 2006. Historically, areas with the highest growth of weeds were targeted for treatment. Future application of the herbicides will be to the smallest area possible that provides relief to State Water Project operations.

Treatment Area: Aquatic weed problems in Clifton Court Forebay to 2006 were restricted to about 700 - 1,000 of the 2,180 total surface acres. Copper-based herbicides were applied either by helicopter or boats dispensing the herbicide by subsurface hoses to only those portions where aquatic weeds were abundant. For each application, a map was submitted in the annual report to the Regional Board showing the application area, treatment area, immediately adjacent areas, and water bodies receiving treated water (where applicable).

ii. Algae

Application Area: The nearshore zone of the forebay was treated with copper sulfate to control benthic cyanobacteria. The MIB or geosmin producing cyanobacteria were found in a zone extending out approximately 500 feet from the shoreline. Future application of the herbicides will be to the smallest area possible that provides relief to State Water Project operations.

Treatment Area: Algal problems in Clifton Court Forebay to 2006 were caused by attached benthic cyanobacteria that produce taste and odor compounds. Copper was applied to the nearshore areas of the forebay when results of Solid Phase Microextraction (SPME) analysis exceeded the control tolerances (discussed in section c below). The specific treatment area was variable and for each application, a map was submitted in the annual report to the Regional Board showing the application area, treatment area, immediately adjacent areas, and water bodies receiving treated water (where applicable).

c. Aquatic Weeds and Algae Controlled and Rationale

i. Background

Copper applications in Clifton Court Forebay are conducted to control: 1) aquatic weeds that often restrict the conveyance of water in the SWP and 2) algal blooms (cyanobacteria) that produce taste and odor compounds.

(1) Aquatic Weeds

Aquatic weed accumulation may be so severe that pumping at the Banks Pumping Plant is restricted or halted, and water delivery to the California and South Bay Aqueducts ceases. Six species of the submersed aquatic weeds that are prevalent in Clifton Court Forebay are listed as "Prevalent species in California considered among the world's most troublesome aquatic weeds" (University of California, 2001.).

The aquatic plant community in 2006 was composed of a mixed assemblage of mostly submersed plants including Egeria (*Egeria densa*), sago pondweed (*Potamogeton pectinalus*), Eurasian watermilfoil (*Myriophyllum spicatum*), coontail (*Cerataphyllum demersum*), American pondweed (P*otamogeton nodosus*), curly-leaf pondweed (*Potamogeton crispus*) and several other taxa of lesser abundance.

(2) Algae

DWR routinely monitors for taste and odor compounds produced by algae. Chemical substances in water that are often associated with earthy, musty smelling or tasting water include geosmin and 2-methylisoborneol (MIB), which are produced in natural and manmade lakes by certain types of algae. Geosmin and MIB are natural by-products of algal chlorophyll production, although not all algae produce them in the same amounts, so the presence of algae alone is not a good indicator of taste and odor problems.

ii. Control Tolerances

(1) Aquatic Weeds

The quantity of aquatic weeds removed from the Skinner Trash racks is recorded. Operational problems at Banks Pumping Plant and Skinner Fish Facility begin when approximately 20 yds^3 of aquatic weeds per day are removed from the trash racks.

(2) Algae

Taste and odor – MIB less than 5 ng/L and geosmin less than 10 ng/L are not detected in drinking water by consumers.

Taste and odor production is monitored on a weekly basis using SPME. The taste and odor causing substances MIB and geosmin are reported in parts per trillion (ng/L) concentrations.

d. Algaecides and Aquatic Herbicides Applied and Method of Application

Aquatic herbicide: Copper-based herbicides. Chelated copper products (Komeen® or Nautique®) and copper sulfate pentahydrate crystals were applied in a manner consistent with product labeling.

Application method: Two methods used at Clifton Court Forebay were aerial application by helicopter and subsurface application from boats.

e. Decision to Select Herbicides

i. Aquatic Weeds

No future treatments are planned unless the use of herbicides is determined to have little or no detrimental effect on resident salmon, steelhead, or sturgeon.

ii. Algae

No future treatments using copper-based herbicides are planned unless the use of herbicides is determined to have little or no detrimental effect on resident salmon, steelhead, or sturgeon.

f. Herbicide Dose and Determination

i. Aquatic Weeds

Complex copper was applied according to the label instructions and the depth of the forebay. The application rate was 13 gallons per surface acre.

ii. Algae

Copper sulfate pentahydrate was applied according to the label instructions. The target algae were benthic or attached algae, and the application rate was dependent on the water depth.

g. Gates and Control Structures

Prior to treatment, the radial gates at the Clifton Court Inlet structure will be closed for 24 hours to allow fish to move out of the proposed treatment areas and towards the salvage facility. The radial gates will remain closed for 24 hours after the treatment to allow at least 24 hours of contact time between the herbicide and the treated vegetation in the forebay. Gates will be reopened after a minimum of 48 hours.

h. Exception Period

The Department of Water Resources was granted a section 5.3 exception. Application of copper to Clifton Court Forebay would be carried out only as-needed between July 1 and August 31 dependent on the level of vegetation biomass in the forebay. The frequency of herbicide applications is not expected to occur more than twice per year.

i. Monitoring Plan

See Appendix A. Monitoring of the water column concentrations of copper is proposed during and after herbicide application. No monitoring of the copper concentration in the sediment or detritus is proposed.

j. Procedures to Prevent Sample Contamination

Water quality sampling is conducted by trained DWR staff following established procedures designed to prevent contamination of samples. Sampling guidelines are contained in "Water Quality Field Manual for the State Water Project" produced by DWR.

Procedures that prevent sample contamination include:

- Use clean sample bottles that are non-reactive. Glass and polyethylene bottles are used for SWP water samples.
- Wear gloves that are powder-free vinyl to avoid the contamination associated with latex gloves.
- Samples are immediately placed in an ice chest away from contaminants as soon as the samples are taken.

k. Best Management Practices Implemented

Note: No future treatments are planned unless the use of herbicides is determined to have little or no detrimental effects on resident salmon, steelhead, or sturgeon. If aquatic herbicide applications are allowed in Clifton Court Forebay, the BMPs described below will be implemented. In addition, EarthTec® would be considered as a potential chemical to control algae in the forebay.

Application. Delta Field Division has one licensed Pest Control Advisor (PCA) who also works in the San Luis Field Division and seven Certified Qualified Applicators (QAC). These individuals are trained to ensure that algaecides and aquatic herbicides are applied at rates consistent with label requirements and in a manner that avoids potential adverse effects including, but not limited to, fish kills. The aquatic herbicide use will be consistent with the label instructions. Copper compounds (Komeen® or Nautique®) will be applied by a certified contractor under the supervision of a California Certified Pest Control Advisor. The herbicide will be applied by boat, starting at the shore and moving sequentially farther offshore in its application.

Notification. The Byron-Bethany Irrigation District and SBA water contractors are notified prior to the treatment. Additionally, a Pesticide Control Advisor (PCA) will submit a written recommendation for use of the aquatic herbicide to the County Agricultural Commissioner.

Preliminary Site Evaluation. The forebay is surveyed by boat and from shore to determine when and if a chemical treatment is necessary. Based on aquatic weed growth patterns since 1995, DWR determined that one or two aquatic herbicide treatments were required each year to control aquatic weed growth in the forebay. In addition, staff is continuously evaluating different chemical treatment options. In 1999 and 2000, a non-copper based herbicide was tested in experimental plots using Sonar™ (active ingredient is fluridone).

Secondary site evaluations and pre-treatment monitoring are routinely done. The location of treatment sites in the forebay were based on results of a plant survey conducted from a boat.

The size and location of the treatment sites and herbicide application rates were determined by location, density, and species of aquatic weeds present. The location and number of acres to be treated are conveyed to the helicopter applicator.

Treatment: Prior to treatment, the radial gates that allow water to enter Clifton Court from Old River are closed. The forebay elevation is also lowered (-1.5 feet) to reduce surface area and thus increase exposure of the target aquatic weeds. The forebay is isolated from the Delta and downstream water users for a period of 36 hours. Following the herbicide label instructions, water is held in the forebay for a period of not less than 24 hours after the herbicide application is completed.

Prior to scheduling the helicopter, staff receives a weather forecast from the DWR meteorologist. Additionally, real-time data on wind direction and speed is collected at the DWR weather station located at the forebay. To minimize herbicide drift, the aerial application is cancelled if continuous wind velocity exceeds 10 mph.

Fish Monitoring: The salvage of listed fish at the Skinner Facility will be monitored prior to the application of the herbicides in Clifton Court Forebay.

Spill Prevention and Cleanup: Delta Field Division staff applies aquatic herbicides according to label instructions in order to prevent spills. In the event of a spill, staff will follow the field division's established emergency response procedures and refers to the material safety data sheet (MSDS) for instructions on containing and cleaning up the spill. Emergency response and MSDS procedures will be reviewed regularly. A copy of the emergency response procedures and material safety data sheets will be available during each treatment. Cleanup equipment will be kept in good working order and will be readily available at each application site.

Water Quality Monitoring: Clifton Court Forebay water quality is monitored on a real-time basis with automated equipment. The station at Clifton Court is equipped with sensors to measure water temperature, turbidity, pH, specific conductance, and algal biomass (flow-through fluorometry). Additional data are obtained near Banks Pumping Plant (about 3 miles from the treatment site). The Banks Pumping Plant water quality station measures the same water quality parameters as Clifton Court. Real-time total and dissolved organic carbon are also measured at Banks Pumping Plant.

Access: No recreational boats are permitted on Clifton Court Forebay except during a limited period during duck hunting season when no herbicide applications are done.

Post-Treatment: The efficacy of the treatment is evaluated about one week after the application. The aquatic weeds are surveyed both by boat and from the shore to determine the effectiveness of the treatment. Water quality conditions are also monitored closely at the Banks Pumping Plant water quality station.

Minimize Treatment Area: The smallest area will be treated that provides relief to State Water Project operations.

l. Possible Alternatives to Algaecide and Aquatic Herbicide Use

i. Evaluation of Management Options

(1) No Action

Since 2006, when application of copper-based herbicides was suspended due to the listing of the North American green sturgeon, aquatic weed biomass increased and coverage expanded to more than 1,000 surface acres.

(2) Prevention

Nutrient Control. Preventive measures involve limiting or eliminating nutrients that support aquatic weed and algae growth. Due to the size of the Delta and the numerous inflows, controlling nutrients is not a realistic preventive control option for Clifton Court Forebay.

(3) Mechanical or Physical Methods

Mechanical Harvesting. Since 2006, when aquatic herbicide application was suspended, a mechanical harvester has been used to remove weeds near the outlet from Clifton Court Forebay. The harvester is used for regular removal of pond weeds to help maintain flows to Skinner Fish Facility and Banks Pumping Plant.

Dredging. Clifton Court Forebay is shallow with many areas less than 2 meters deep allowing light to penetrate to the bottom substrate. Dredging would deepen the forebay and reduce the amount of light available for photosynthesis of rooted aquatic weeds. DWR is evaluating options, costs, and potential environmental impacts from dredging the forebay.

(4) Cultural Methods

Drawdown. A potential method of control would be to lower the water level and control aquatic weeds by desiccation. The major drawback is that draining of the forebay would be required since the nuisance aquatic weeds are rooted to the substrate. A drawdown of two to three weeks to allow for desiccation is not feasible due to demands on water conveyance and pumping.

Dredging. See above discussion under (3) Mechanical or Physical Methods.

(5) Biological Control Agents

Weed Eating Fish. CDFW has approved use of triploid grass carp/white amur (*Ctenopharyngodon idella Val.*) in a few closed water systems in California. Clifton Court Forebay is not a closed system, and fish stocked in the forebay could swim back into the Delta under certain conditions. CDFW is opposed to introducing grass carp in the Delta due to the potential impacts to the sensitive fisheries. Therefore, grass carp would not be an alternative to aquatic herbicides in managing aquatic weeds and algae in the Clifton Court Forebay.

(6) Algaecides and Aquatic Herbicides

In 1999, DWR tested a non-copper based aquatic herbicide to control aquatic weeds. A granular formulation of Sonar™ (SRP) was applied in four 10-acre test plots, and after one month, weed density was compared to untreated controls. We found no significant reduction in aquatic weeds within the Sonar™ treated plots. Although Sonar™ has been effective in a number of lakes, the short residence time in Clifton Court and high water movements combined to reduce its efficacy in the forebay. In 2000, we treated one 50-acre test plot again using the granular Sonar™. Due to the high flushing rate in the forebay, Sonar had no effect on the aquatic weed biomass.

An ongoing program of algal control using algaecides is necessary to minimize the impacts on SBA water quality and quantity.

ii. Decision Matrix to Select the Most Appropriate Formulation

The decision matrix below evaluates the aquatic weed and algae control options identified for Clifton Court Forebay (section i: "Evaluation of Management Options" above).

Decision Making Criteria	No Action	Prevention	Mechanical or Physical	Cultural Methods	Biological Agents	Algaecides and Aquatic Herbicides
Is the impact to the environment low or easily mitigated?	Yes	Yes	Yes	Yes	Yes	Yes
Is the cost of this option reasonable?	N/A	No	No	No	No	Yes
Has (have) the method(s) been effectively implemented at this site?	No	No	Yes	No	No	Yes
Option(s) selected for Clifton Court Forebay.			X			X

3. PATTERSON RESERVOIR

a. Site Description

Patterson Reservoir, an extension of the South Bay Aqueduct (SBA), is a small storage facility located in the boundaries of the San Francisco Bay Regional Water Quality Control Board, Region 2 (Figure 3). The reservoir serves the primary purposes of increasing water reliability by providing water to the Patterson Pass Water Treatment Plant during power interruptions, lowering power costs, and improving quality of delivered water. It has an area of 4.2 acres, a storage capacity of 90 acre-feet (AF), and 0.3 miles of shoreline. Water enters the reservoir from the SBA through a weir at Milepost (MP) 9.36.

b. Treatment Area

The reservoir shoreline is treated by broadcasting the algaecide to control filamentous algae (*Cladophora).*

c. Algae Controlled and Rationale

i. Background

Growth of attached filamentous algae (*Cladophora*) in Patterson Reservoir is a recurring problem that negatively impacts operations at Patterson Pass Water Treatment Plant. Algal biomass and species composition are monitored routinely in Patterson Reservoir during the growing season.

ii. Control Tolerances

Algal fluorescence less than 200 units and algal biomass less than 5,000 mg/m^3 do not cause operational problems to water conveyance or reduction in filter run times at water treatment plants.

Algal biomass and species composition are analyzed directly using the Utermohl technique (inverted microscope method). Algal fluorescence is measured continuously with a Turner 10AU fluorometer. The data are posted daily to the DWR Water Quality website: http://www.water.ca.gov/swp/waterquality/AutostationData/index.cfm.

d. Algaecides and Aquatic Herbicides Applied and Method of Application

i. Aquatic herbicide: Copper sulfate pentahydrate crystals.

Application method: Applications are made by broadcasting or spraying the aquatic herbicide by DWR staff or an approved aquatic herbicide applicator following product label instructions.

ii. Aquatic herbicide: Imazamox. Imazamox is a derivative of ammonium salt of imazamox, the active ingredient in the herbicide Clearcast®. Imazamox is a selective herbicide that controls floating, emergent, and shoreline weed species while allowing non-target species to colonize. The chemical is absorbed through the leaves, stems, and roots of aquatic weeds. Once absorbed by a plant, imazamox inhibits an enzyme essential to the plant's synthesis of three-branched chain amino acids.

As indicated in the U.S. EPA Ecotoxicity Database, imazamox has low toxicity to aquatic life. Imazamox has been granted a tolerance exemption by the U.S. EPA, meaning that there are no food residue limits in fish, shellfish, crustaceans, or irrigated crops.

Application method: Imazamox will be applied to the nearshore areas by broadcasting from the shore or by boat following the product label instructions.

e. Decision to Select Herbicides

DWR's decision to apply copper sulfate or EarthTec® in Patterson Reservoir is based on microscope analysis of algal species composition and biomass. When results indicate that algal biomass exceeds the control tolerances (see c above), an aquatic herbicide application is scheduled.

Early detection of increasing levels of algal biomass allows Patterson Reservoir to be treated early before populations of nuisance algae reach maximum growth. The result is that much lower quantities of the algaecide are needed to reduce algal biomass.

f. Herbicide Dose and Determination

Aquatic herbicides are applied according to the label instructions. The target algae are filamentous algae (*Cladophora*) and the total application dose depends on the water depth and reservoir volume.

g. Gates and Control Structures

There are no gates or control structures at the inlet from the SBA, and the reservoir outlet is directly connected to the Patterson Pass Water Treatment Plant.

h. Exception Period

The Department of Water Resources was granted a section 5.3 exception. Application of copper to Patterson Reservoir would be carried out only on an as-needed basis during the year, after other options have been exhausted. Application of copper sulfate or EarthTec® to the reservoir is required periodically during the growing season to prevent loss in water delivery capacity.

An exception period does not apply to the use of imazamox.

i. Monitoring Plan

See Appendix A.

j. Procedures to Prevent Sample Contamination

Water quality sampling is conducted by trained DWR staff following established procedures designed to prevent contamination of samples. Sampling guidelines are contained in "Water Quality Field Manual for the State Water Project" produced by DWR.

Procedures that prevent sample contamination include:

- Use clean sample bottles that are non-reactive. Glass and polyethylene bottles are used for SWP water samples.
- Wear gloves that are powder-free vinyl to avoid the contamination associated with latex gloves.
- Samples are immediately placed in an ice chest away from contaminants as soon as the samples are taken.

k. Best Management Practices Implemented

Application: Copper sulfate and EarthTec® are applied under the supervision of a certified herbicide applicator. Delta Field Division has one licensed Pest Control Advisor (PCA) who also works in the San Luis Field Division and seven Certified Qualified Applicators (QAC). These individuals are trained to ensure that algaecides and aquatic herbicides are applied at rates consistent with label requirements and in a manner that avoids potential adverse effects including, but not limited to, fish kills.

Notification: Zone 7 Water Agency provides treated municipal water to customers and is notified by email at least 48 hours prior to a treatment. The notification includes the treatment date, time and amount of copper sulfate or EarthTec® being applied. Zone 7 Water Agency has the only intake on Patterson Reservoir. Additionally, a Pesticide Control Advisor (PCA) will submit a written recommendation for use of the aquatic herbicide to the County Agricultural Commissioner.

Treatment: Aquatic herbicides are dispensed by broadcasting directly on the algal mats to maximize the herbicide's effectiveness and minimize the amount applied.

Spill Prevention and Cleanup: Staff will apply aquatic herbicides according to label instructions in order to prevent spills. In the event of a spill, staff will follow the field division's established emergency response procedures and refer to the material safety data sheet (MSDS) for instructions on containing and cleaning up the spill. Emergency response and MSDS procedures will be reviewed regularly. A copy of the emergency response procedures and material safety data sheets will be available during each treatment. Cleanup equipment will be kept in good working order and will be readily available at each application site.

Water Quality Monitoring: SBA water quality is monitored continuously by automated instrumentation. The station at Del Valle Check (MP 16.38) is equipped with sensors to measure water temperature, turbidity, pH, specific conductance, and algal biomass (flow-through fluorometry). Additional data are obtained at the Vallecitos Check (MP 22.4) water quality station, which is equipped with water quality instruments that measure water temperature, turbidity, pH, and specific conductance. Further, water quality data from grab samples are available for Santa Clara Terminal Tank (MP 42, about 0.5 miles from the end of the treated section) each month in which water is released from Del Valle Reservoir.

Access: Patterson Reservoir has locked gates that allow access to authorized personnel only. Public access is not allowed, and fishing is not permitted in Patterson Reservoir.

Post-Treatment: The efficacy of the treatment is evaluated one week after the application. Algae are surveyed to determine the effectiveness of the treatment at reducing filamentous algae.

l. Possible Alternatives to Algaecides and Aquatic Herbicide Use

i. Evaluation of Management Options

(1) No Action

If Patterson Reservoir was not treated, algae would severely impact deliveries to Zone 7 Water Agency and to customers in the South Bay region. A "no action" option is therefore not acceptable.

(2) Prevention

Nutrient Control. Some preventive measures involve limiting or eliminating nutrients that support aquatic algal growth. Due to the vast size of the Sacramento-San Joaquin Delta and the numerous inflows, controlling nutrient inputs is not a realistic preventive control option for Patterson Reservoir.

(3) Mechanical or Physical Methods

Use of Rakes or Nets. Filamentous algae can sometimes be controlled by physically removing algae with a rake or net. Due to the rapid rate of growth of the algae during the growing season, this method requires ongoing efforts and an inordinate amount of limited staff resources. Therefore, this control method is not a feasible alternative.

(4) Cultural Method

Drawdown. Lowering the water level with drawdown is a potential method to control some species of algae by desiccation. The major drawback is that a long period of several weeks would be necessary. The resulting negative impact on water deliveries to Zone 7 Water Agency makes this control method unacceptable.

(5) Biological Control Agents

Introduction of Weed Eating Fish. Grass carp/white amur (*Ctenopharyngodon idella* Val.) have been approved for stocking by CDFW under controlled conditions where the water body is a closed system. Patterson Reservoir is connected to the SBA by a weir, and fish could swim out of the reservoir. Therefore, grass carp would not be a feasible alternative to algaecides to manage algae in Patterson Reservoir.

(6) Algaecides and Aquatic Herbicides

Aquatic Herbicide Treatment. An ongoing program of algae control using copper sulfate, EarthTec®, and imazamox is necessary to minimize the impacts on SBA water quality and quantity. Aquatic herbicides have proven to be effective at reducing the target algae without adverse effects on non-target organisms. There are no alternatives to using the aquatic herbicides that are effective at controlling attached algae and registered for use in California. If the SBA was not treated, attached algae would severely impact deliveries to water contractors in the South Bay region.

ii. Decision Matrix to Select the Most Appropriate Formulation

The decision matrix below evaluates the aquatic weed and algae control options identified for Patterson Reservoir (section i: "Evaluation of Management Options" above).

Decision Making Criteria	No Action	Prevention	Mechanical or Physical	Cultural Methods	Biological Agents	Algaecides and Aquatic Herbicides
Is the impact to the environment low or easily mitigated?	Yes	Yes	Yes	Yes	Yes	Yes
Is the cost of this option reasonable?	N/A	No	No	No	No	Yes
Has (have) the method(s) been effectively implemented at this site?	No	No	Yes	No	No	Yes
Option(s) selected for Patterson Reservoir.						X

4. DYER RESERVOIR

a. Site Description

Dyer Reservoir is a small storage facility located in the boundaries of the San Francisco Bay Regional Water Quality Control Board, Region 2 (Figure 4). The reservoir was completed by the Department of Water Resources in 2011 as part the enlargement of the South Bay Aqueduct Branch (SBA) of the California State Water Project. The 43 mile SBA supplies water to three water retailers (Zone 7 Water Agency, Alameda County Water District, and Santa Clara Valley Water Agency) in Alameda and Santa Clara counties in the San Francisco Bay area, serving about two million residents. It currently supplies about 170,000 acre-feet of water a year for ground water replenishment and for six municipal water treatment plants.

Dyer Reservoir serves the primary purposes of increasing water reliability by providing water to treatment plants during power interruptions, lowering power costs, and improving quality of delivered water. The reservoir has a maximum storage capacity of 500 acre-feet, surface area of 24 acres, and a depth of about 25 feet. Water is pumped into the reservoir from the California Aqueduct and discharged into the Dyer Canal, the first aqueduct reach of the SBA.

b. Treatment Area

The entire volume of the reservoir is treated by boat to control planktonic cyanobacteria.

c. Algae Controlled and Rationale

i. Background

Blooms of filter clogging and taste and odor causing cyanobacteria (cyanoHabs) appeared shortly after Dyer Reservoir was completed and filled in 2011. Weekly microscopic analysis identified the main nuisance algae as *Aphanizomenon flos-aquae* and *Anabaena* sp. Phytoplankton biomass and species composition as well as taste and odor compounds are monitored weekly. In addition, samples are analyzed twice monthly from May to October for cyanotoxins (microcystins, anatoxin-a).

ii. Control Tolerances

(1) Taste and Odor

MIB less than 5 ng/L and geosmin less than 10 ng/L are not detected in drinking water by most customers.

Taste and odor production is monitored weekly using Solid Phase Microextraction (SPME). The taste and odor causing substances 2-methylisoborneol (MIB) and geosmin are reported in parts per trillion (ng/L) concentrations.

(2) Filter Clogging

We determined that algal biomass of less than 5,000 mg/m^3 does not cause operational problems to water conveyance or reduction in filter run times at water treatment plants.

Algal biomass and species composition are analyzed directly using an inverted microscope.

d. Herbicides and Application Method

i. **Aquatic herbicide: Copper-based herbicides.** Chelated copper products (Komeen® or Nautique®), copper sulfate pentahydrate crystals, and EarthTec® are applied in a manner consistent with product labeling.

Application method: Subsurface application from boats is the method used at Dyer Reservoir. The applications are conducted by DWR or an approved aquatic herbicide applicator following product label instructions.

ii. **Aquatic herbicide: Imazamox.** Imazamox is a derivative of ammonium salt of imazamox, the active ingredient in the herbicide Clearcast®. Imazamox is a selective herbicide that controls floating, emergent, and shoreline weed species while allowing non-target species to colonize. The chemical is absorbed through the leaves, stems, and roots of aquatic weeds. Once absorbed by a plant, imazamox inhibits an enzyme essential to the plant's synthesis of three-branched chain amino acids.

As indicated in the U.S. EPA Ecotoxicity Database, imazamox has low toxicity to aquatic life. Imazamox has been granted a tolerance exemption by the U.S. EPA, meaning that there are no food residue limits in fish, shellfish, crustaceans, or irrigated crops.

Application method: Imazamox will be applied to the nearshore areas from a GPS guided application vessel and following the product label instructions.

iii. **Aquatic herbicide: Sodium carbonate peroxyhydrate.** Sodium carbonate peroxyhydrate (e.g., PAK®27) is approved for use as an algaecide in California and by the U.S. Environmental Protection Agency (EPA). PAK®27 is also approved under NSF/ANSI Standard 60 (drinking water treatment chemicals). All ingredients in PAK®27 have either Generally Recognized as Safe (GRAS) food additive status from the U.S. Food and Drug Administration (FDA) or exemptions from tolerances from the U.S. EPA.

The active ingredient in PAK®27 is sodium carbonate peroxyhydrate which is an addition compound of sodium carbonate and hydrogen peroxide (H_2O_2). The nominal amount of sodium carbonate peroxyhydrate is 85% in PAK®27 which corresponds to 27.6% H_2O_2. The approved application rate is 3 to 100 pounds per acre-foot.

Application of method: Applications are made by boat and are conducted by DWR or an approved aquatic herbicide applicator following product label instructions.

e. Decision to Use Herbicides

DWR's decision to apply aquatic herbicides in Dyer Reservoir is based on microscope analysis of algae species composition and biomass and the chemical analysis of MIB and geosmin. When results indicate that concentrations of taste and odor compounds or algal biomass exceed the control tolerances (see c above), an aquatic herbicide application is scheduled.

Early detection of increasing levels of algal biomass and taste and odor compounds allows Dyer Reservoir to be treated early before populations of nuisance cyanoHabs reach maximum growth. The result is that much lower quantities of the algaecide are needed to reduce algal biomass and control the taste and odor producing algae.

f. Herbicide Dose and Determination

When selecting an aquatic herbicide for application, DWR will consider factors such as the species to be controlled and the beneficial uses of the water body. The target algae in Dyer Reservoir are planktonic cyanobacteria and the total application dose depends on the water depth and reservoir volume. During PAK®27 treatments, the reservoir elevation is lowered and total volume reduced to about 100 acre-feet resulting in a lower quantity of the algaecide required to effectively control the cyanoHabs. All aquatic herbicide applications will follow product label instructions.

g. Gates and Control Structures

The reservoir inlet and outlet valves are closed prior to applying aquatic herbicides and remain closed for a minimum of six hours. When copper is applied, inlet and outlet valves will remain closed for at least 24 hours.

h. Exception Period

The Department of Water Resources was granted a section 5.3 exception. Application of copper to Dyer Reservoir would be carried out only on an as-needed basis during the year, after other options have been exhausted.

An exception period does not apply to the use of imazamox and sodium carbonate peroxyhydrate since these aquatic herbicides do not contain copper.

i. Monitoring Plan

See Appendix A.

j. Procedures to Prevent Sample Contamination

Water quality sampling is conducted by trained DWR staff following established procedures designed to prevent contamination of samples. Sampling guidelines are contained in "Water Quality Field Manual for the State Water Project" produced by DWR.

Procedures that prevent sample contamination include:

- Use clean sample bottles that are non-reactive. Glass and polyethylene bottles are used for SWP water samples.
- Wear gloves that are powder-free vinyl to avoid the contamination associated with latex gloves.
- Samples are immediately placed in an ice chest away from contaminants as soon as the samples are taken.

k. Best Management Practices Implemented

Application: Copper-based herbicides, imazamox, and sodium carbonate peroxyhydrate (e.g., PAK®27) are applied under the supervision of a certified herbicide applicator such as Clean Lakes, Inc. or by DWR staff. Delta Field Division has one licensed Pest Control Advisor (PCA) who also works in the San Luis Field Division and seven Certified Qualified Applicators (QAC). These individuals are trained to ensure that algaecides and aquatic herbicides are applied at rates consistent with label requirements and in a manner that avoids potential adverse effects including, but not limited to, fish kills.

Notification: The Department's South Bay Water Contractors, who also provide treated municipal water to customers, are notified by email at least 48 hours prior to a treatment. The notification includes the treatment date and time and date and time when releases will resume from Dyer reservoir. The Contractors are Alameda County Flood Control and Water Management District, Zone 7; Alameda County Water District; and Santa Clara Valley Water District. Additionally, a Pesticide Control Advisor (PCA) will submit a written recommendation for use of the aquatic herbicide to the County Agricultural Commissioner.

Treatment: Copper-based herbicide treatments are by subsurface application from boats. Imazamox is an aqueous formulation that is broadcast sprayed by subsurface hoses to submerged vegetation. Sodium carbonate peroxyhydrate (PAK®27) is dispensed by subsurface hoses from a boat to maximize the effectiveness of the algaecide.

Spill Prevention and Cleanup: Staff will apply aquatic herbicides (copper-based products, imazamox, or sodium carbonate peroxyhydrate) according to label instructions in order to prevent spills. In the event of a spill, staff will follow the field division's established emergency response procedures and refer to the applicable material safety data sheet (MSDS) for instructions on containing and cleaning up the spill. Emergency response and MSDS procedures will be reviewed regularly. A copy of the emergency response procedures and material safety data sheets will be available during each treatment. Cleanup equipment will be kept in good working order and will be readily available at each application site.

Water Quality Monitoring: SBA water quality is monitored continuously by automated instrumentation. The station at Del Valle Check 7 (MP 16.38) is equipped with sensors to measure water temperature, turbidity, pH, specific conductance, and algal biomass (flow-through fluorometry). Additional data are obtained at the Vallecitos Check (MP 22.4) water quality station, which is equipped with water quality instruments that measure water temperature, turbidity, pH, and specific conductance. Further, water quality data from grab sample are available for Santa Clara Terminal Tank (MP 42, about 0.5 miles from the end of the treated section) each month in which water is released from Del Valle Reservoir.

Access: Most sections are closed to public access with locked gates, and fishing is not permitted in the SBA.

Post-Treatment: The efficacy of the treatment is evaluated one week after the application. Algae are surveyed to determine the effectiveness of the treatment at reducing cyanoHabs and taste and odor compounds are monitored weekly throughout the year.

l. Possible Alternatives to Algaecides and Aquatic Herbicide Use

i. Evaluation of Management Options

(1) No Action

If Dyer Reservoir was not treated, planktonic algae would severely impact deliveries to water contractors in the South Bay region. A "no action" option is therefore not acceptable.

(2) Prevention

Nutrient Control. Some preventive measures involve limiting or eliminating nutrients that support aquatic algal growth. Due to the vast size of the Sacramento-San Joaquin Delta and the numerous inflows, controlling nutrient inputs is not a realistic preventive control option for Dyer Reservoir.

(3) Mechanical or Physical Methods

Planktonic cyanoHabs in Dyer Reservoir are too small to be controlled by mechanical or physical methods.

(4) Cultural Method

Drawdown. Lowering the water level with drawdown is a potential method to control some species of algae by desiccation. The major drawback is that a long

period of several weeks would be necessary. Cyanobacteria are extremely tolerant to desiccation; therefore, drawdown is not feasible for Dyer Reservoir.

(5) Biological Control Agents

Introduction of Weed Eating Fish. Grass carp/white amur (*Ctenopharyngodon idella* Val.) have been approved for stocking by the California Department of Fish and Wildlife under controlled conditions where the water body is a closed system. Dyer reservoir is connected to the SBA allowing fish to escape from the reservoir. Therefore, grass carp would not be a feasible alternative to algaecides to manage cyanoHabs algae in Dyer Reservoir.

(6) Algaecides and Aquatic Herbicides

Copper-based herbicides, imazamox, and sodium carbonate peroxyhydrate have been proven to be environmentally safe herbicides that are effective at reducing target aquatic weeds and cyanobacteria without adverse effects on non-target species. If Dyer Reservoir was not treated, taste and odor compounds, and filter clogging algae would have severe impacts on the quality of water deliveries to the three SBA water districts. The early warning plan of high frequency monitoring has greatly reduced the quantity of algaecides applied to Dyer Reservoir.

ii. Decision Matrix to Select the Most Appropriate Formulation

The decision matrix below evaluates the aquatic weed and algae control options identified for Dyer Reservoir (section i: "Evaluation of Management Options" above).

Decision Making Criteria	No Action	Prevention	Mechanical or Physical	Cultural Methods	Biological Agents	Algaecides and Aquatic Herbicides
Is the impact to the environment low or easily mitigated?	Yes	Yes	Yes	Yes	Yes	Yes
Is the cost of this option reasonable?	N/A	No	No	No	No	Yes
Has (have) the method(s) been effectively implemented at this site?	No	No	Yes	No	No	Yes
Option(s) selected for Dyer Reservoir.						X

5. O'NEILL FOREBAY

a. Site Description

O'Neill Forebay is located approximately ten miles west of Los Banos in Merced County and is within the borders of the Central Valley Regional Water Quality Control Board, Region 5

(Figure 5). The forebay has a capacity of 56,400 acre-feet, a surface area of 2,700 acres, 12 miles of shoreline, and a maximum depth of 40 feet.

O'Neill Forebay receives Sacramento-San Joaquin Delta water via the California Aqueduct (SWP) and the Delta-Mendota Canal (federal Central Valley Project). Gianelli Pumping-Generating Plant, operated by DWR, pumps water from O'Neill Forebay into San Luis Reservoir for storage beginning in fall or for temporary storage to generate electricity when water is released from the reservoir back into O'Neill Forebay. During irrigation months, water is released into O'Neill Forebay and into the San Luis Canal (California Aqueduct between Mileposts 70.89 and 172.26) and flows by gravity to Dos Amigos Pumping Plant where it is lifted more than 100 feet to allow gravity flow for 165 miles to the Buena Vista Pumping Plant. Water is lifted at several pumping plants and continues down the California Aqueduct to water contractors serving customers in Southern California.

b. Treatment Area

The smallest area possible that provides relief to the SWP will be treated by boat to control aquatic weeds.

c. Aquatic Weeds Controlled and Rationale

i. Background

Aquatic weeds of concern in O'Neill Forebay include narrow-leaf pondweeds (*Potamogeton* sp.), broad pondweed (*Stuckenia striata*), and sago pondweed (Potamogeton pectinatus *L.).* Aquatic weeds problems associated with the forebay include clogged trash racks and reduction of water flow into San Luis Reservoir.

d. Herbicides and Application Method

i. Aquatic herbicide: Fluridone. Fluridone (e.g., Sonar®) is a slow-acting systemic herbicide used to control broad-leaved submerged aquatic vegetation (SAV), including Eurasian watermilfoil. Fluridone works by inhibiting the weed's ability to produce carotene, resulting in the degradation of chlorophyll and finally the death of the plant. Since this is a slow process, it is necessary to maintain an adequate concentration of the chemical for a sufficient period of time in order to effectively control aquatic weeds.

Fluridone, applied at the approved concentration rate in accordance with label instructions, has not been found to be toxic to waterfowl and wildlife. The label does not restrict the use of fluridone-treated water for swimming, fishing, or drinking water. However, there is a restriction against the use of fluridone within 1/4 mile of any potable water intake.

Application method: Fluridone will be applied when the target SAV begins active growth. Fluridone will be applied to the nearshore area of the reservoir from a GPS guided application vessel using a granular pellet blower following product label instructions.

ii. Aquatic herbicide: Imazamox. Imazamox is a derivative of ammonium salt of imazamox, the active ingredient in the herbicide Clearcast®. Imazamox is a selective herbicide that controls floating, emergent, and shoreline weed species while allowing

non-target species to colonize. The chemical is absorbed through the leaves, stems, and roots of aquatic weeds. Once absorbed by a plant, imazamox inhibits an enzyme essential to the plant's synthesis of three-branched chain amino acids.

As indicated in the U.S. EPA Ecotoxicity Database, imazamox has low toxicity to aquatic life. Imazamox has been granted a tolerance exemption by the U.S. EPA, meaning that there are no food residue limits in fish, shellfish, crustaceans, or irrigated crops.

Application method: Imazamox will be applied to the nearshore areas of the forebay from a GPS guided application vessel following the product label instructions.

iii. **Aquatic herbicide: Triclopyr.** Triclopyr (e.g., Renovate®) is a systemic broadleaf herbicide. This product is effective against Eurasian watermilfoil and is not a restricted use material. Triclopyr is approved by the EPA for use in potable water reservoirs provided setback buffers are created and maintained between the application site and the location of the intake. The set back distance is a function of the application rate selected for use. The buffers allow dilution to occur and ensure that herbicide ingredients that might reach the intake will be below the applicable federal drinking water tolerances. Triclopyr is a desirable tool for controlling Eurasian watermilfoil because of the systemic and selective nature of the herbicide.

Application method: Triclopyr is applied to O'Neill Forebay to control aquatic weeds including sago pondweed (*Stuckenia pectinata*) that grow in the littoral zone. The amount of herbicide applied varies and is a function of the surface area of the treatment site, average water depth of the site, and recommended application rate. Renovate® OTF granular formulation, or other triclopyr product, is applied from a GPS guided application vessel using a combination of granular pellet blower and eductor systems following product label instructions.

e. Decision to Use Herbicides

The decision to apply aquatic herbicides is made when aquatic weeds have the potential to negatively affect the beneficial uses of the forebay. Early treatment of aquatic weeds before the plant populations reach maximum biomass will allow DWR to reduce the quantity of aquatic herbicide needed to control the nuisance species.

f. Herbicide Dose and Determination

When selecting an aquatic herbicide for application, DWR will consider factors such as the species to be controlled and the beneficial uses of the forebay to ensure the most appropriate herbicide is applied. The selected aquatic herbicide (fluridone, imazamox, or triclopyr) will be applied according to the label instructions. The target species in O'Neill Forebay are aquatic weeds such as sago pondweed. The total application dose depends on the water depth and volume.

g. Gates and Control Structures

Pumping from O'Neill Forebay to San Luis Reservoir will be curtailed during the aquatic weed application.

h. Exception Period

An exception period does not apply to the use of fluridone, imazamox, and triclopyr since copper is not an active ingredient of these aquatic herbicides.

i. Monitoring Plan

See Appendix A.

j. Procedures to Prevent Sample Contamination

Water quality sampling is conducted by trained DWR staff following established procedures designed to prevent contamination of samples. Sampling guidelines are contained in "Water Quality Field Manual for the State Water Project" produced by DWR.

Procedures that prevent sample contamination include:

- Use clean sample bottles that are non-reactive. Glass and polyethylene bottles are used for SWP water samples.
- Wear gloves that are powder-free vinyl to avoid the contamination associated with latex gloves.
- Samples are immediately placed in an ice chest away from contaminants as soon as the samples are taken.

k. Best Management Practices Implemented

Application: Fluridone, imazamox, and triclopyr are applied under the supervision of a certified herbicide applicator by a contractor or DWR staff. San Luis Field Division has four Certified Qualified Applicators (QAC). In addition, this field division shares a Pest Control Adviser (PCA) with the Delta Field Division. These individuals are trained to ensure that algaecides and aquatic herbicides are applied at rates consistent with label requirements and in a manner that avoids potential adverse effects including, but not limited to, fish kills.

Notification: State Water Contractors are notified by email at least 48 hours prior to a treatment. The notification includes the type of aquatic herbicide applied, surface area, and treatment date and time. Additionally, a Pesticide Control Advisor (PCA) will submit a written recommendation for use of the aquatic herbicide to the County Agricultural Commissioner.

Treatment: Granular formulations of fluridone and triclopyr are applied by boat using a pellet blower. Imazamox (e.g., Clearcast®) is an aqueous formulation that is broadcast sprayed or applied by subsurface hoses to submerged vegetation.

Spill Prevention and Cleanup: Staff will apply aquatic herbicides according to label instructions in order to prevent spills. In the event of a spill, staff will follow the field division's established emergency response procedures and refer to the applicable material safety data sheet (MSDS) for instructions on containing and cleaning up the spill. Emergency response and MSDS procedures will be reviewed regularly. A copy of the emergency response procedures and material safety data sheets will be available during each treatment. Cleanup equipment will be kept in good working order and will be readily available at each application site.

Water Quality Monitoring: O'Neill Forebay water quality is monitored continuously by automated instrumentation. The automated station at California Aqueduct Check 13 (MP 70.89) is equipped with sensors to measure water temperature, turbidity, pH, specific conductance, and UVA-254 absorbance. Additional data are obtained from monthly grab samples collected at this station.

Access: O'Neill Forebay is open to the public for recreational use. The forebay will be closed to the public during aquatic herbicide applications.

Post-Treatment: The efficacy of the treatment is evaluated one week after the application.

l. Possible Alternatives to Aquatic Herbicide Use

i. Evaluation of Management Options

(1) No Action

If O'Neill Forebay was not treated, aquatic weeds would impact pumping into San Luis Reservoir and deliveries to water contractors. A "no action" option is therefore not acceptable.

(2) Prevention

Nutrient Control. Some preventive measures involve limiting or eliminating nutrients that support aquatic algal growth. Due to the vast size of the Sacramento-San Joaquin Delta and the numerous inflows, controlling nutrient inputs is not a realistic preventive control option for O'Neill Forebay.

(3) Mechanical or Physical Methods

Mechanical Harvesting. Aquatic weeds are harvested during the summer and fall months with a mechanical weed harvester. The weed harvester mows aquatic weeds near the intake channel to Gianelli Pumping-Generating Plant during the summer and fall to increase water delivery. Harvesting is labor intensive and the area cleared of aquatic weeds daily is minor compared to the total area of the forebay impacted by weeds.

(4) Cultural Method

Drawdown. Operation of O'Neill Forebay prevents lowering the water elevation sufficiently to expose aquatic weeds to desiccation for the required time period; therefore drawdown is not feasible for O'Neill Forebay.

(5) Biological Control Agents

Introduction of Weed Eating Fish. Grass carp/white amur (*Ctenopharyngodon idella* Val.) have been approved for stocking by the California Department of Fish and Wildlife under controlled conditions where the water body is a closed system. However, feeding by this species is initially selective, and as sources of preferred weeds become scarce, feeding will continue on other plants which can result in reduction of native vegetation needed for game fish habitat. In addition, O'Neill

Forebay is connected to both San Luis Reservoir and the California Aqueduct which would allow fish movement out of the Forebay. Therefore, grass carp would not be a feasible alternative to aquatic herbicides to manage aquatic weeds in O'Neill Forebay.

(6) Algaecides and Aquatic Herbicides

Aquatic Herbicide Treatment. Fluridone, imazamox, and triclopyr have been proven to be environmentally safe herbicides that are effective at reducing target aquatic weeds without adverse effects on non-target species. If O'Neill Forebay was not treated, aquatic weeds would negatively impact agricultural, municipal and industrial water deliveries in the SWP.

ii. Decision Matrix to Select the Most Appropriate Formulation

The decision matrix below evaluates the aquatic weed and algae control options identified for O'Neill Forebay (section i: "Evaluation of Management Options" above).

Decision Making Criteria	No Action	Prevention	Mechanical or Physical	Cultural Methods	Biological Agents	Algaecides and Aquatic Herbicides
Is the impact to the environment low or easily mitigated?	Yes	Yes	Yes	Yes	Yes	Yes
Is the cost of this option reasonable?	N/A	No	No	No	No	Yes
Has (have) the method(s) been effectively implemented at this site?	No	No	Yes	No	No	Yes
Option(s) selected for O'Neill Forebay.						X

6. COASTAL BRANCH AQUEDUCT

a. Site Description

The Coastal Branch Aqueduct originates at California Aqueduct at Milepost (MP) 184.63 near Kettleman City and extends 115 miles to near Vandenberg Air Force Base in San Luis Obispo County (Figure 6). Most of the aqueduct system consists of enclosed pipelines and tunnels. Algae and attached weed problems are restricted to the first 14.8-mile open section of the aqueduct beginning at the junction of the California Aqueduct to Devil's Den Pumping Plant. The treated section is within the boundaries of the Central Valley Regional Water Quality Control Board (Region 5).

b. Treatment Areas

Application Area: Copper-based herbicides are applied at one to three locations: MP 0.2 and, when necessary, Badger Hill Pumping Plant (MP 4.3) and Devil's Den Forebay.

Treatment Area: The treatment area is the aqueduct from MP 0.2 to Bluestone Pumping Plant at MP 19.0.

c. Aquatic Weeds and Algae Controlled and Rationale

i. Background

Copper sulfate crystals have been used since 1985 to control clogging problems caused by attached algae (*Cladophora*), aquatic weeds including horned pondweed (*Zannichellia palustris* L.) and sago pondweed (*Potamogeton pectinalus*), and taste and odor producing cyanobacteria at turnouts, forebays, and trash racks at the three pumping plants. Copper-based herbicides are applied during the growth season which typically runs from April to October. Sodium carbonate peroxyhydrate (e.g., PAK®27) may be applied to the forebays to control cyanobacteria.

ii. Control Tolerances

Taste and odor – MIB less than 5 ng/L and geosmin less than 10 ng/L are not detected by consumers in drinking water supplies.

Taste and odor production is monitored using Solid Phase Microextraction (SPME). The taste and odor causing substances, 2-methylisoborneol (MIB) and geosmin are reported in parts per trillion (ng/L) concentrations.

Filter clogging – High accumulation of aquatic weeds and algae on turnouts and trash racks at the pumping plants may result in complete plant shutdown or reduced pumping. Copper-based herbicides are applied when aquatic weeds and algae create operational problems.

d. Aquatic Herbicides Applied and Method of Application

i. Aquatic herbicide: Copper-based herbicides. Chelated copper products (Komeen® or Nautique®), copper sulfate pentahydrate crystals, and EarthTec® are applied in a manner consistent with product labeling.

Application method: Copper-based herbicides are applied according to label instructions at two to four sites in the aqueduct.

ii. Aquatic herbicide: Sodium carbonate peroxyhydrate (e.g., PAK®27).

Application method: PAK®27 is applied to the CBA according to label instructions.

e. Decision to Select Herbicides

The decision to treat the CBA with copper-based algaecides is made when water operations begin to be impacted by algae or aquatic weeds clogging turnouts and trash racks and

reducing water flow. The application dose rate is determined by water flow rate in the aqueduct and the target species.

Preliminary site evaluation is done to determine the timing of a copper-based herbicide application. Based on data since 1985, DWR determined that treatments are needed to control algae and aquatic weeds during the growth season which usually runs from April to October. The treatment schedule is based on visual inspection of the Aqueduct, accumulation of plant material on trash racks, and reduced flows at the pumping plants.

Copper-based herbicides have proven to be effective at reducing the target aquatic weeds and algae without adverse effects on non-target organisms. Sodium carbonate peroxyhydrate (e.g., PAK®27) is also an effective algaecide identified for use in the forebays. There are no alternatives to copper-based herbicides and sodium carbonate peroxyhydrate that are effective at controlling aquatic weeds and algae and registered for use in California. If the Coastal Branch Aqueduct was not treated, aquatic weeds and algae could severely impact deliveries to water users in the Central Coast region and the Berrenda Mesa Water District.

f. Herbicide Dose and Determination

Copper–based herbicides are applied consistent with product labeling instructions for the control of algae and aquatic weeds. Sodium carbonate peroxyhydrate (e.g., PAK®27) is applied according to the label instructions and is used to control cyanobacteria in the forebays of the Coastal Branch Aqueduct.

g. Gates and Control Structures

Not applicable.

h. Exception Period

The Department of Water Resources was granted a section 5.3 exception. Application of copper to the Coastal Branch Aqueduct would be carried out only on an as-needed basis during the year. Application of copper-based herbicides to the aqueduct is required at regular intervals throughout the growing season to prevent loss in water delivery capacity. An exception period does not apply to the use of sodium carbonate peroxyhydrate since copper is not an active ingredient of that algaecide.

i. Monitoring Plan

See Appendix A.

j. Procedures to Prevent Sample Contamination

Water quality sampling is conducted by trained DWR staff following established procedures designed to prevent contamination of samples. Sampling guidelines are contained in “Water Quality Field Manual for the State Water Project” produced by DWR.

Procedures that prevent sample contamination include:

- Use clean sample bottles that are non-reactive. Glass and polyethylene bottles are used for SWP water samples.
- Wear gloves that are powder-free vinyl to avoid the contamination associated with latex gloves.
- Samples are immediately placed in an ice chest away from contaminants as soon as the samples are taken.

k. Best Management Practices Implemented

Application: San Joaquin Field Division (SJFD) has two licensed Pest Control Advisors (PCA) and 15 Certified Qualified Applicators (QAC). These individuals are trained to ensure that algaecides and aquatic herbicides are applied at rates consistent with label requirements and in a manner that avoids potential adverse effects. Copper sulfate has been used in the Coastal Branch Aqueduct since about 1985 to control clogging problems at trash racks and pumping plants caused by attached algae (*Cladophora*) and aquatic weeds including horned pondweed (*Zannichellia palustris* L.). The copper sulfate applications are directed under the supervision of a PCA, and the use of copper sulfate is consistent with label instructions in order to avoid adverse effects including, but not limited to, fish kills.

Sodium carbonate peroxyhydrate (e.g., PAK®27) is applied under the supervision of a certified herbicide applicator by a contractor or DWR staff. PAK®27 is used to control cyanobacteria in the forebays of the Coastal Branch Aqueduct.

Spill Prevention and Cleanup: Staff will apply copper-based compounds and sodium carbonate peroxyhydrate (e.g., PAK®27) according to label instructions in order to prevent spills. In the event of a spill, staff will follow the field division's established emergency response procedures and refer to the applicable material safety data sheet (MSDS) for instructions on containing and cleaning up the spill. Emergency response and MSDS procedures will be reviewed regularly. A copy of the emergency response procedures and material safety data sheets will be available during each treatment. Cleanup equipment will be kept in good working order and will be readily available at each application site.

Notification: Downstream water users that could be impacted by a copper-based herbicide or sodium carbonate peroxyhydrate application are notified prior to a treatment. The notified water users are Berrenda Mesa Water District and Central Coast Water Authority. Additionally, a Pesticide Control Advisor (PCA) will submit a written recommendation for use of the aquatic herbicide to the County Agricultural Commissioner.

Treatment: Copper-based herbicides are applied during the daylight hours of maximum photosynthetic activity to optimize copper uptake by the aquatic vegetation. Sodium carbonate peroxyhydrate is dispensed by subsurface hoses from a boat to maximize the effectiveness of the algaecide.

Access: There are no recreational activities in the Coastal Aqueduct and most sections are inaccessible to the public with locked gates and fences.

l. Possible Alternatives to Algaecides and Aquatic Herbicide Use

i. Evaluation of Management Options

(1) No Action

If Coastal Branch Aqueduct was not treated, algae and aquatic weeds would severely impact deliveries to water users. A "no action" option is therefore not feasible.

(2) Prevention

Nutrient Control. Some preventive measures involve limiting or eliminating nutrients that support aquatic weed and algal growth. Due to the vast size of the Sacramento-San Joaquin Delta and the numerous inflows, controlling upstream nutrient loading is not a realistic preventive control option for the Coastal Branch Aqueduct.

(3) Mechanical or Physical Methods

Scraping of Aqueduct. DWR routinely removes aquatic weeds and algae by dragging a large chain along the aqueduct lining. The method removes algae and aquatic weeds but is time consuming and requires a large expenditure of manpower. The procedure provides a short-term solution and must be repeated frequently to reduce the impact of aquatic vegetation on water conveyance.

Self-Cleaning Trash Racks. A travelling screen is installed at the forebay to Devil's Den Pumping Plant at MP 14.8. The travelling screen is effective when aquatic weed biomass is low but when weeds are abundant, removal of the weeds from the screen must be assisted with one to two DWR staff working nearly continuously during the peak weed season.

Floating Weed Boom Deflector. DWR staff is investigating installation of a weed deflection system at the California Aqueduct to deflect floating aquatic weeds past the Coastal Aqueduct intake channel. During the early weed season, the main contribution of aquatic weeds is from weeds grown upstream in the 100 miles aqueduct section below the Dos Amigos Pumping Plant. These weeds break off and are entrained into the Coastal Aqueduct. The floating boom would be installed at an angle or arc to deflect floating weeds but not impede flow in the main aqueduct. Several designs are being evaluated.

(4) Cultural Methods

Drawdown. Drawdown is a potential method that entails lowering the water level to control algae by desiccation. The major drawback is that a long period of two to three weeks would be necessary. A drawdown of that length of time would be difficult due to demands on water conveyance and pumping. Therefore, drawdown is not feasible for the Coastal Branch Aqueduct.

(5) Biological Control Agents

Introduction of Weed Eating Fish. Grass carp/white amur (*Ctenopharyngodon idella* Val.) have been approved for stocking by the California Department of Fish and Wildlife under controlled conditions where the water body is a closed system. Water from the Coastal Branch Aqueduct could not be completely isolated from the main California Aqueduct and the stocked fish could potentially escape from the Coastal Branch Aqueduct. Therefore, grass carp would not be an alternative to copper–based compounds in managing algae and aquatic weeds in the Coastal Branch Aqueduct.

(6) Algaecides and Aquatic Herbicides

Copper-based herbicides have proven to be effective at reducing the target aquatic weeds and algae without adverse effects on non-target organisms. Sodium carbonate peroxyhydrate (e.g., PAK®27) is also an effective algaecide identified for use in the forebays of the Coastal Branch Aqueduct to control cyanobacteria. There are no alternatives to using the copper herbicides and sodium carbonate peroxyhydrate that are effective at controlling attached weeds and cyanobacteria and registered for use in California. If the Coastal Branch Aqueduct was not treated, algae and aquatic weeds would negatively affect water delivery and quality.

ii. Decision Matrix to Select the Most Appropriate Formulation

The decision matrix below evaluates the aquatic weed and algae control options identified for the Coastal Branch Aqueduct (section i: "Evaluation of Management Options" above).

Decision Making Criteria	**No Action**	**Prevention**	**Mechanical or Physical**	**Cultural Methods**	**Biological Agents**	**Algaecides and Aquatic Herbicides**
Is the impact to the environment low or easily mitigated?	Yes	Yes	Yes	Yes	Yes	Yes
Is the cost of this option reasonable?	N/A	No	Yes	No	No	Yes
Has (have) the method(s) been effectively implemented at this site?	No	No	No	No	No	Yes
Option(s) selected for the Coastal Branch Aqueduct.						X

7. EAST BRANCH AQUEDUCT

a. Site Description

The California Aqueduct divides into two branches at Tehachapi Afterbay at Milepost (MP) 304.02. The West Branch extends for 32 miles passing through Pyramid Lake to the terminus at Castaic Lake. The East Branch continues about 140 miles from the bifurcation with the West Branch to its terminus at Lake Perris at MP 443 and is within the boundaries of the Lahontan Regional Water Quality Control Board, Region 6 (Figures 7 - 9).

b. Treatment Areas

Application Area: Dependent on the location of the source of taste and odor production as determined by Solid Phase Microextraction (SPME) analysis.

Treatment Area: The specific area is variable and dependent on the location of the source of taste and odor production as determined by monitoring and SPME analysis. For each application, a map will be submitted in the annual report to the Regional Board showing the application area, treatment area, immediately adjacent areas, and water bodies receiving treated water (where applicable).

c. Weeds Controlled and Rationale

i. Background

Off-flavor compounds, MIB and geosmin, produced by attached cyanobacteria in the East Branch of the California Aqueduct have been controlled with copper sulfate since about 1991. The most troublesome portion for taste and odor problems is located between MP 326 and MP 403. Copper sulfate has also been applied to the first and second Devil Canyon Afterbays to control the attached cyanobacterial genera, *Phormidium* and *Oscillatoria*. Treatment with copper sulfate and EarthTec® is limited to the aqueduct pools where taste and odor producing cyanobacteria are present.

ii. Control Tolerances

Taste and odor – MIB less than 5 ng/L and geosmin less than 10 ng/L are not detected by consumers in drinking water supplies.

Taste and odor production is monitored weekly using SPME. The taste and odor causing substances 2-methylisoborneol (MIB) and geosmin are reported in parts per trillion (ng/L) concentrations.

d. Herbicides and Application Method

i. **Aquatic herbicide: Copper-based herbicides.** Chelated copper products (CaptainXTR®), copper sulfate pentahydrate crystals, and EarthTec® are applied in a manner consistent with product labeling.

Application method: Copper-based products are applied according to label instructions.

ii. Aquatic herbicide: Sodium carbonate peroxyhydrate (e.g., PAK®27).

Application method: PAK®27 is applied to the EBA according to label instructions.

e. Decision to Use Herbicides

A comprehensive early warning plan developed cooperatively between DWR and Metropolitan Water District of Southern California (MWD) minimizes the quantity of aquatic herbicides required to control taste and odor production and helps to determine optimal timing of the application. The strategy involves ongoing weekly or biweekly monitoring of the taste and odor compounds, MIB and geosmin, in the aqueduct, reservoirs, and MWD's water treatment plants. Elevated levels of MIB or geosmin trigger additional high frequency monitoring at additional locations.

Secondary site evaluations and pre-treatment monitoring are routinely done. The decision to treat the Aqueduct with aquatic herbicides is made after evaluating the results of taste and odor analysis by Solid Phase Micro-extraction (SPME). The application dose rate of herbicide is determined by water flow rate in the aqueduct following label instructions.

f. Herbicide Dose and Determination

Copper–based herbicides and sodium carbonate peroxyhydrate are applied in a manner consistent with product labeling.

g. Gates and Control Structures

Not applicable.

h. Exception Period

The Department of Water Resources was granted a section 5.3 exception. Application of copper to the East Branch Aqueduct would be carried out only on an as-needed basis during the year, after other options have been exhausted. Application of copper sulfate or EarthTec® to the aqueduct is required at regular intervals throughout the growing season to prevent loss in water delivery capacity. However, copper treatments may also be necessary at other times of the year. An exception period does not apply to the use of sodium carbonate peroxyhydrate since copper is not an active ingredient of this algaecide.

i. Monitoring Plan

See Appendix A.

j. Procedures to Prevent Sample Contamination

Water quality sampling is conducted by trained DWR or MWD staff following established procedures designed to prevent contamination of samples. Sampling guidelines are contained in "Water Quality Field Manual for the State Water Project" produced by DWR.

Procedures that prevent sample contamination include:

- Use clean sample bottles that are non-reactive. Glass and polyethylene bottles are used for SWP water samples.
- Wear gloves that are powder-free vinyl to avoid the contamination associated with latex gloves.
- Samples are immediately placed in an ice chest away from contaminants as soon as the samples are taken.

k. Best Management Practices Implemented

Application: Southern Field Division has two licensed Pest Control Advisors (PCAs) and six to eight certified Qualified Applicators (QAC). These individuals are trained to ensure that algaecides and aquatic herbicides are applied at rates consistent with label requirements and in a manner that avoids potential adverse effects including, but not limited to, fish kills.

Off-flavor compounds, MIB and geosmin, produced by cyanobacteria in the East Branch of the California Aqueduct have been controlled with copper-based herbicides since about 1991.

Use of sodium carbonate peroxyhydrate (PAK®27) in the EBA was first considered in 2013. It is applied under the supervision of one of DWR's QACs or by a contract certified herbicide applicator.

Notification: Downstream water users are notified prior to a copper-based herbicide or sodium carbonate peroxyhydrate treatment. Additionally, a Pesticide Control Advisor (PCA) will submit a written recommendation for use of the aquatic herbicide to the County Agricultural Commissioner.

Spill Prevention and Cleanup: Staff will apply aquatic herbicides according to label instructions in order to prevent spills. In the event of a spill, staff will follow the field division's established emergency response procedures and refer to the applicable material safety data sheet (MSDS) for instructions on containing and cleaning up the spill. Emergency response and MSDS procedures will be reviewed regularly. A copy of the emergency response procedures and material safety data sheets will be available during each treatment. Cleanup equipment will be kept in good working order and will be readily available at each application site.

Treatment: Prior to treatment, the water contractors are notified. Copper-based herbicides are applied during the daylight hours of maximum photosynthetic activity to optimize copper uptake by attached cyanobacteria. Sodium carbonate peroxyhydrate is applied to the water's surface using a broadcast spreader with a hopper to control the rate of application.

Access: There are limited recreational activities in the East Branch Aqueduct, and most sections are inaccessible to the public due to locked gates.

Minimize Treatment Area: Only those specific sections or Aqueduct "pools" where attached cyanobacteria grow are treated to minimize cost, use, and secondary impacts.

l. Possible Alternatives to Algaecides and Aquatic Herbicide Use

i. Evaluation of Management Options

(1) No Action

If East Branch Aqueduct was not treated with aquatic herbicides, elevated concentrations of taste and odor compounds would severely impact the quality of water delivered to MWD. A "no action" option is therefore not feasible.

(2) Prevention

Nutrient Control. Some preventive measures involve limiting or eliminating nutrients that support aquatic weed and algal growth. Due to the vast size of the Sacramento-San Joaquin Delta and the numerous inflows, controlling upstream nutrient loading is not a realistic preventive control option for the East Branch Aqueduct.

(3) Mechanical or Physical Methods

Mechanical Removal. DWR has evaluated physical and mechanical methods to control aquatic weeds. Mechanical removal such as dragging a large chain with a crane along the aqueduct has been evaluated. The method would be expensive, labor intensive and result in potential damage to the concrete aqueduct lining. In addition, the chain could not be used upstream of any water turnouts. The procedure would break off large amounts of attached algae that could clog the water intakes.

(4) Cultural Methods

Drawdown. Lowering the water level with drawdown is a potential method to control some species of algae by desiccation; however, cyanobacteria are also extremely tolerant to desiccation. One major drawback is that a long period of several weeks would be necessary and a drawdown of that duration would be difficult due to demands on water conveyance and pumping. An additional problem with drawdown is that damage to the concrete aqueduct panels was found when the water level in pools was reduced to below where the cyanobacteria grow. Therefore, drawdown is not feasible to control attached cyanobacteria in the East Branch Aqueduct.

(5) Biological Control Agents

Introduction of Weed Eating Fish. Grass carp/white amur (*Ctenopharyngodon idella* Val.) have been approved for stocking by the California Department of Fish and Wildlife under controlled conditions where the water body is a closed system. Water from the East Branch Aqueduct could not be isolated from Silverwood Lake and Lake Perris where the carp could graze on native aquatic vegetation and also compete with native fishes. Therefore, grass carp would not be an alternative to copper-based herbicides in managing taste and odor production in the East Branch Aqueduct.

(6) Algaecides and Aquatic Herbicides

Aquatic Herbicide Treatments. Copper-based herbicides have proven to be effective at reducing the targeted taste and odor producing cyanobacteria with minimal adverse effects to non-target organisms. Sodium carbonate peroxyhydrate (e.g., PAK®27) has proven to be an environmentally safe algaecide that is effective at reducing target cyanobacteria without adverse effects on non-target species. There are no alternatives to aquatic herbicides that are effective at controlling attached cyanobacteria and registered for use in California. If the East Branch Aqueduct was not treated, taste and odor products produced by attached cyanobacteria would negatively impact the quality of water delivered to Metropolitan Water District.

ii. Decision Matrix to Select the Most Appropriate Formulation

The decision matrix below evaluates the algal control options identified for the East Branch Aqueduct (section i: "Evaluation of Management Options" above).

Decision Making Criteria	No Action	Prevention	Mechanical or Physical	Cultural Methods	Biological Agents	Algaecides and Aquatic Herbicides
Is the impact to the environment low or easily mitigated?	Yes	Yes	Yes	Yes	Yes	Yes
Is the cost of this option reasonable?	N/A	No	No	No	No	Yes
Has (have) the method(s) been effectively implemented at this site?	No	No	No	No	No	Yes
Option(s) selected for the East Branch Aqueduct.						X

8. PYRAMID LAKE

a. Site Description

Pyramid Lake is a reservoir on the West Branch of the California Aqueduct at Milepost (MP) 14.10 within the boundaries of the Los Angeles Regional Water Quality Control Board, Region 4 (Figure 10). It has a surface area of 1,300 acres, a storage capacity of 171,200 acre-feet (AF), a length of 25,300 feet, and 21 miles of shoreline.

As a SWP reservoir, Pyramid Lake stores water that is delivered to the City of Los Angeles and other cities of Southern California. It also provides regulated storage for Castaic Powerplant, flood protection along Piru Creek, emergency storage for water deliveries from the West Branch, and various recreational uses including fishing, swimming, and boating.

b. Application and Treatment Areas

i. Aquatic Weeds

Application Area: Every year the application area will be determined based on the results of a vegetation survey and after analysis of impacts to beneficial uses.

Treatment Area: The specific area is variable and dependent on the location of aquatic weeds. For each application, a map will be submitted in the annual report to the Regional Board showing the application area, treatment area, immediately adjacent areas, and water bodies receiving treated water (where applicable).

ii. Algae

Application Area: The application area is dependent on the location of the source of taste and odor production as determined by Solid Phase Microextraction analysis (SPME).

Treatment Area: The specific area is variable and dependent on the location of the source of taste and odor production as determined by monitoring and SPME analysis. For each application, a map will be submitted in the annual report to the Regional Board showing the application area, treatment area, immediately adjacent areas, and water bodies receiving treated water (where applicable).

c. Aquatic Weeds and Algae Controlled and Rationale

i. Background

Aquatic herbicides are applied to Pyramid Lake to manage taste and odor problems produced by cyanobacteria. In recent years, Pyramid Lake has experienced an increasing number of algal blooms. Production of 2-methylisoborneol (MIB) and geosmin by cyanoHabs results in earthy, musty, and fishy tastes and odors in the water supply. In addition, some species of cyanobacteria produce algal toxins that may be harmful to human and animal health. Cyanobacteria species identified in the lake have included *Microcystis* sp., *Gloeotrichia* sp., and *Anabaena* sp.

Pyramid Lake is subject to infestations of aquatic weeds including Eurasian watermilfoil (*Myriophyllum spicatum*) and sago pondweed (*Stuckenia pectinata*). Eurasian watermilfoil can grow up to one foot per week and reach the lake surface from depths of up to 25 feet. It forms dense mats that clog the lake surface. This species, if uncontrolled, shades out native aquatic plants in the lake. The native species then die back and may be replaced by non-native species. Eurasian watermilfoil beds can become so dense in Pyramid Lake that they create a hazard for swimmers who become entangled in the plants.

ii. Control Tolerances

(1) Algae

MIB less than 5 ng/L and geosmin less than10 ng/L are not detected in drinking water by most customers.

Taste and odor production is monitored weekly using SPME. The taste and odor causing substances, MIB and geosmin are reported in parts per trillion (ng/L) concentrations.

(2) Aquatic Weeds

Control tolerances for aquatic weeds are based on a number of factors. Beneficial uses and the impact of the weed growth on those uses is a primary determining factor when using integrated aquatic plant management technologies to control weed growth. The factors critical to Pyramid Lake are:

- Eurasian watermilfoil is a non-native invasive aquatic weed that has been described by the U.S. Congress Office of Technology as a "harmful non-indigenous species."
- Eurasian watermilfoil alters the water quality and species diversity of Pyramid Lake.
- Heavy infestations of weeds such as Eurasian watermilfoil have been shown to cause taste and odor problems in drinking water supplies.
- As this invasive weed spreads from lake to lake on boat trailers, the presence of this weed in Pyramid Lake is a threat to all other water bodies in the region that might be visited by vessels leaving the lake.

The tolerance for invasive aquatic species should be extremely low and eradication of this class of plants is often a desired outcome, if technically possible. The tolerance for the presence of aquatic weed growth, especially Eurasian watermilfoil, in the community beach areas is zero. The presence of dense plant beds is a direct threat to swimmer safety as described above.

d. Herbicides and Application Method

i. Aquatic herbicide: Diquat. Diquat is a contact herbicide that is effective at controlling a broad spectrum of aquatic weeds. Diquat applications typically provide weed control within seven to ten days. Water bodies treated with diquat may be reopened for swimming just after application. Depending on the size of the treatment, water from the treatment area cannot be used for irrigation for 24 to 72 hours.

Application method: Diquat is applied through injection hoses into the treatment area. Applications are made following label instructions.

ii. Aquatic herbicide: Fluridone. Fluridone (e.g., Sonar®) is a slow-acting systemic herbicide used to control broad-leaved submerged aquatic vegetation (SAV), including Eurasian watermilfoil. Fluridone works by inhibiting the weed's ability to produce carotene, resulting in the degradation of chlorophyll and finally the death of the plant. Since this is a slow process, it is necessary to maintain an adequate concentration of the chemical for a sufficient period of time in order to effectively control aquatic weeds.

Fluridone, applied at the approved concentration rate in accordance with label instructions, has not been found to be toxic to waterfowl and wildlife. The label does not restrict the use of fluridone-treated water for swimming, fishing, or drinking water. However, there is a restriction against the use of fluridone within 1/4 mile of any potable water intake.

Application method: Fluridone will be applied when the target SAV begins active growth. Fluridone will be applied to the nearshore area of the lake from a GPS guided application vessel using a granular pellet blower following label instructions.

iii. **Aquatic herbicide: Imazamox.** Imazamox is a derivative of ammonium salt of imazamox, the active ingredient in the herbicide Clearcast®. Imazamox is a selective herbicide that controls floating, emergent, and shoreline weed species while allowing non-target species to colonize. The chemical is absorbed through the leaves, stems, and roots of aquatic weeds. Once absorbed by a plant, imazamox inhibits an enzyme essential to the plant's synthesis of three-branched chain amino acids.

As indicated in the U.S. EPA Ecotoxicity Database, imazamox has low toxicity to aquatic life. Imazamox has been granted a tolerance exemption by the U.S. EPA, meaning that there are no food residue limits in fish, shellfish, crustaceans, or irrigated crops.

Application method: Imazamox will be applied to the nearshore areas from a GPS guided application vessel and following the product label instructions.

iv. **Aquatic herbicide: Sodium carbonate peroxyhydrate.** Sodium carbonate peroxyhydrate (e.g., PAK®27) is approved for use as an algaecide in California and by the U.S. Environmental Protection Agency (EPA). PAK®27 is also approved under NSF/ANSI Standard 60 (drinking water treatment chemicals). All ingredients in PAK®27 have either Generally Recognized as Safe (GRAS) food additive status from the U.S. Food and Drug Administration (FDA) or exemptions from tolerances from the U.S. EPA.

Sodium carbonate peroxyhydrate is an addition compound of sodium carbonate and hydrogen peroxide (H_2O_2). The nominal amount of sodium carbonate peroxyhydrate is 85% in PAK®27 which corresponds to 27.6% H_2O_2. The approved application rate is 3 to 100 pounds per acre-foot.

Application method: Boat. Applications are conducted by DWR or an approved aquatic herbicide applicator following label instructions.

v. **Aquatic herbicide: Triclopyr.** Triclopyr (e.g., Renovate®) is a systemic broadleaf herbicide. This product is effective against Eurasian watermilfoil and is not a restricted use material. Triclopyr is approved by the EPA for use in potable water reservoirs provided setback buffers are created and maintained between the application site and the location of the intake. The set back distance is a function of the rate selected for use. The buffers allow dilution to occur and ensure that herbicide ingredients that might reach the intake will be below the applicable federal drinking water tolerances. Triclopyr is a desirable tool for controlling Eurasian watermilfoil because of the systemic and selective nature of the herbicide.

Application method: Triclopyr is applied to Pyramid Lake near shore to control aquatic weeds including sago pondweed (*Stuckenia pectinata*) and Eurasian watermilfoil (*Myriophyllum spicatum*) that grow in the littoral zone. The amount of herbicide applied varies and is a function of the surface area of the treatment site, average water depth of the site, and recommended application rate. Renovate® OTF granular formulation, or other triclopyr product, is applied from a GPS guided application vessel using a combination of granular pellet blower and eductor systems following label instructions.

e. Decision To Use Herbicides

i. Algae - DWR's decision to apply aquatic algaecides in Pyramid Lake is based on microscope analysis of algae species composition and biomass and the chemical analysis of MIB and geosmin. When results indicate that concentrations of taste and odor compounds or algal biomass exceed the control tolerances (see c above), an aquatic herbicide application will be scheduled.

Early detection of increasing levels of algal biomass and taste and odor compounds allows Pyramid Lake to be treated early before populations of nuisance cyanoHabs reach maximum growth. The result is that much lower quantities of herbicides are needed to reduce algal biomass and control the taste and odor producing algae.

ii. SAV - The decision to apply aquatic herbicides is made when aquatic weeds have the potential to negatively affect the beneficial uses of the lake. Early treatment of aquatic weeds before the plant populations reach maximum biomass will allow DWR to reduce the quantity of aquatic herbicide needed to control the nuisance species.

f. Herbicide Dose and Determination

When selecting an aquatic herbicide for application, DWR will consider factors such as the species to be controlled and the beneficial uses of the lake to ensure the most appropriate herbicide is applied. The selected aquatic herbicide (sodium carbonate peroxyhydrate, imazamox, fluridone, or triclopyr) will be applied according to the label instructions. The target species in Pyramid Lake are planktonic and attached cyanobacteria and aquatic weeds such as Eurasian watermilfoil. The total application dose depends on the water depth and volume.

g. Gates and Control Structures

Reservoir releases will be restricted prior to application of the aquatic herbicide and the outlet valves will remain closed for a sufficient time period to meet the specifications of the product label.

h. Exception Period

Not applicable since copper is not an active ingredient of sodium carbonate peroxyhydrate, fluridone, imazamox, or triclopyr.

i. Monitoring Plan

See Appendix A.

j. Procedures to Prevent Sample Contamination

Water quality sampling is conducted by trained DWR staff or a contracted Certified Pesticide Applicator following established procedures designed to prevent contamination of samples. Sampling guidelines are contained in "Water Quality Field Manual for the State Water Project" produced by DWR.

Procedures that prevent sample contamination include:

- Use clean sample bottles that are non-reactive. Glass and polyethylene bottles are used for SWP water samples.
- Wear gloves that are powder-free vinyl to avoid the contamination associated with latex gloves.
- Samples are immediately placed in an ice chest away from contaminants as soon as the samples are taken.

k. Best Management Practices

Application: Fluridone, imazamox, sodium carbonate peroxyhydrate (PAK®27), and triclopyr are applied under the supervision of a certified herbicide applicator by Clean Lakes, Inc., Aqua Technex, or DWR staff. DWR's Southern Field Division has two licensed Pest Control Advisors (PCAs) and six to eight certified Qualified Applicators (QAC). These individuals are trained to ensure that aquatic herbicides are applied at rates consistent with label requirements, in a manner that avoids potential adverse effects (including, but not limited to, fish kills), and following proper storage and disposal practices.

Notification: Water contractors are notified by email at least 48 hours prior to a treatment. The notification includes the treatment date and time and date and time when releases will resume from Pyramid Lake. Notices are posted to inform the public of lake closures. Additionally, a Pesticide Control Advisor (PCA) will submit a written recommendation for use of the aquatic herbicide to the County Agricultural Commissioner.

Treatment: Granular formulations of fluridone and triclopyr are applied by boat using a pellet blower. Diquat and imazamox (e.g., Clearcast®) are aqueous formulations that are applied by subsurface hoses to submerged vegetation. Imazamox may also be broadcast sprayed. Sodium carbonate peroxyhydrate (PAK®27) is dispensed by subsurface hoses by boat to maximize the effectiveness of the algaecide.

Spill Prevention and Cleanup: Staff will apply aquatic herbicides according to label instructions in order to prevent spills. In the event of a spill, staff will follow the field division's established emergency response procedures and refer to the applicable material safety data sheet (MSDS) for instructions on containing and cleaning up the spill. Emergency response and MSDS procedures will be reviewed regularly. A copy of the emergency response procedures and material safety data sheets will be available during each treatment. Cleanup equipment will be kept in good working order and will be readily available at each application site.

Water Quality Monitoring: Monitoring is conducted before, during and after treatments as outlined in Appendix A. In addition, water quality is monitored at Pyramid Lake at least quarterly, and the analytical results are available online through DWR's Water Data Library.

Access: Pyramid Lake is open to the public for recreational use. The lake will be closed to the public during aquatic herbicide applications.

Post-Treatment: The efficacy of the treatment is evaluated one week after the application. Algae are surveyed to determine the effectiveness of the treatment at reducing cyanoHabs. Taste and odor compounds produced by cyanobacteria are monitored on an episodic basis. After treating the lake for aquatic weeds, post-treatment will involve an evaluation of weed population to determine the effectiveness of the treatment.

l. Possible Alternatives to Algaecides and Aquatic Herbicide Use

i. Evaluation of Management Options

(1) No Action

If Pyramid Lake was not treated with aquatic herbicides, elevated concentrations of taste and odor compounds would severely impact the quality of water delivered to water contractors. The potential of cyanobacteria found in the lake to produce harmful cyanotoxins requires that DWR take action to control the cyanobacteria. Additionally, aquatic weeds must be controlled due to the numerous problems they may cause such as negative impacts to water quality and entanglement hazards for swimmers at the lake. A “no action” option is therefore not feasible.

(2) Prevention

Nutrient Control. Some preventive measures involve limiting or eliminating nutrients that support aquatic weed and algal growth. Due to the vast size of the Sacramento-San Joaquin Delta and the numerous inflows, controlling upstream nutrient loading is not a realistic preventive control option for Pyramid Lake.

(3) Mechanical or Physical Methods

Planktonic algae such as the cyanobacteria found in Pyramid Lake are too small to be controlled by mechanical and physical methods.

Removal by Hand. Removal of weeds by hand using dive teams can be an effective method of controlling Eurasian watermilfoil and other aquatic plants under certain conditions. Pioneering infestations of Eurasian watermilfoil are generally targeted using this control method. Divers swim through the littoral area of the lake, and hand remove and bag the plant material and roots. The method provides rapid removal and clears the plants from the water column. One of the drawbacks of this method is the expense of deploying divers. Many states require prevailing wages for this activity that can cost up to $100.00 per hour for a dive team. Due to budget constraints, this would not be a feasible option for Pyramid Lake.

Benthic Barriers. Benthic barriers are materials that come in sheets and are negatively buoyant. They can be attached to the bottom and rolled over the top of existing aquatic plants beds where they are then weighted or pinned to the lake bottom. These systems provide immediate and long term control of all aquatic vegetation where they are placed. One significant drawback is the generally the high costs of materials. These barriers cost from $0.75 to $1.00 per square foot installed. At this rate they are not cost effective for a lake the size of Pyramid Lake. In addition, barriers can trap gases between the lake sediment and the barrier causing them to lift into propellers or create areas that might be a threat to swimmers diving under the water line. Regular maintenance and inspections are required. As with the hand removal method, a major issue, aside from being costly and labor intensive, is that if the entire root structure of the plant is not removed, then control is not achieved. Therefore, benthic barriers are not a feasible alternative for Pyramid Lake.

(4) Cultural Methods

Drawdown. Drawdown is a potential method that entails lowering the water level to control algae by desiccation. The major drawback is that a longer period of two to three weeks would be necessary. A drawdown of that length of time would be difficult due to demands on Pyramid Lake for water supply and other uses. Therefore, drawdown is not feasible.

(5) Biological Control Agents

Introduction of Weed Eating Fish. Grass carp/white amur (*Ctenopharyngodon idella* Val.) have been approved for stocking by the California Department of Fish and Wildlife under controlled conditions where the water body is a closed system. However, feeding by this species is initially selective, and as sources of preferred weeds become scarce, feeding will continue on other plants which can result in reduction of native vegetation needed for game fish habitat. In addition, grass carp could not be contained in Pyramid Lake and could swim to adjoining waters where aquatic weed control was not needed. Therefore, grass carp would not be an alternative to aquatic algaecides and herbicides in managing algae in Pyramid Lake.

(6) Algaecides and Aquatic Herbicides

Diquat, fluridone, imazamox, sodium carbonate peroxyhydrate, and triclopyr have been proven to be environmentally safe herbicides that are effective at reducing target aquatic weeds and cyanobacteria without adverse effects on non-target species. If Pyramid Lake was not treated, aquatic weeds and cyanobacteria that produce taste and odor compounds would negatively impact the quality of water delivered to Metropolitan Water District.

ii. Decision Matrix to Select the Most Appropriate Formulation

The decision matrix below evaluates the algal control options identified for Pyramid Lake (section i: “Evaluation of Management Options” above).

Decision Making Criteria	No Action	Prevention	Mechanical or Physical	Cultural Methods	Biological Agents	Algaecides and Aquatic Herbicides
Is the impact to the environment low or easily mitigated?	Yes	Yes	Yes	Yes	Yes	Yes
Is the cost of this option reasonable?	N/A	No	No	No	No	Yes
Has (have) the method(s) been effectively implemented at this site?	No	No	No	No	No	No
Option(s) selected for Pyramid Lake.						X

9. CASTAIC LAKE

a. Site Description

Castaic Lake is the terminal reservoir on the West Branch of the California Aqueduct, located 45 miles northwest of Los Angeles and within the boundaries of the Los Angeles Regional Water Quality Control Board, Region 4 (Figure 11). The lake, completed in 1974, has four main purposes: 1) provides emergency storage in the event of shutdown of the California Aqueduct to the north, 2) acts as a regulatory storage facility for deliveries during normal operation, 3) provides recreation, and 4) provides fish and wildlife enhancement. The reservoir has a maximum operating storage of 323,702 acre-feet with a surface area of 2,235 acres.

b. Application and Treatment Areas

Application Area: The application area is dependent on the location of the source of taste and odor production as determined by SPME analysis.

Treatment Area: The specific area is variable and dependent on the location of the source of taste and odor production as determined by monitoring and SPME analysis. For each application, a map will be submitted in the annual report to the Regional Board showing the application area, treatment area, immediately adjacent areas, and water bodies receiving treated water (where applicable).

c. Aquatic Weeds and Algae Controlled and Rationale

i. Background

Copper sulfate and EarthTec® are applied to Castaic Lake to manage taste and odor problems produced by planktonic cyanobacteria. Production of 2-methylisoborneol (MIB) and geosmin by cyanoHabs results in earthy, musty, and fishy tastes and odors in the water supply. In addition, some species of cyanobacteria can produce algal toxins that may be harmful to human health. High diatom abundance clogs filters in water treatment plants and reduces filter run times.

The Metropolitan Water District of Southern California (MWD), a cooperative of 26 cities and water agencies serving 18 million people in six counties, receives water from Castaic Lake at the Joseph Jensen Filtration Plant in Granada Hills. Production of taste and odor compounds in Castaic Lake could impact MWD member water agencies including the cities of Los Angeles, Beverly Hills, Burbank, Compton, Glendale, San Fernando, Santa Monica and Torrance, as well as the Central Basin and West Basin municipal water districts in Los Angeles County, and Calleguas Municipal Water District and Las Virgenes Municipal Water District in Ventura County.

ii. Control Tolerances

(1) Algae

Sensitive water customers can detect MIB at 5 ng/L and geosmin at 10 ng/L. Concentrations greater than the 5 and 10 ng/L levels will trigger complaints to the water agencies.

(2) Aquatic Weeds

Control tolerances for aquatic weeds are based on a number of factors. Beneficial uses and the impact of the weed growth on those uses is a primary determining factor when using integrated aquatic plant management technologies to control weed growth.

d. Herbicides and Application Method

i. Aquatic herbicide: Copper-based herbicides. Copper-based herbicides have proven to be effective at reducing the target algae in SWP water bodies without adverse effects on non-target organisms.

Application method: Copper sulfate pentahydrate will be applied aerially by helicopter following product label instructions. Chelated copper products (CaptainXTR®) and EarthTec® will be applied in a manner consistent with product labeling.

ii. Aquatic herbicide: Fluridone. Fluridone (e.g., Sonar®) is a slow-acting systemic herbicide used to control broad-leaved submerged aquatic vegetation (SAV), including Eurasian watermilfoil (*Myriophyllum spicatum*). Fluridone works by inhibiting the weed's ability to produce carotene, resulting in the degradation of chlorophyll and finally the death of the plant. Since this is a slow process, it is necessary to maintain an adequate concentration of the chemical for a sufficient period of time in order to effectively control aquatic weeds.

Fluridone, applied at the approved concentration rate in accordance with label instructions, has not been found to be toxic to waterfowl and wildlife. The label does not restrict the use of fluridone-treated water for swimming, fishing, or drinking water. However, there is a restriction against the use of fluridone within 1/4 mile of any potable water intake.

Application method: Fluridone will be applied when the target SAV begins active growth. Fluridone will be applied to the nearshore area of the lake from a GPS guided application vessel using a granular pellet blower following product label instructions.

iii. **Aquatic herbicide: Imazamox.** Imazamox is a derivative of ammonium salt of imazamox, the active ingredient in the herbicide Clearcast®. Imazamox is a selective herbicide that controls floating, emergent, and shoreline weed species while allowing non-target species to colonize. The chemical is absorbed through the leaves, stems, and roots of aquatic weeds. Once absorbed by a plant, imazamox inhibits an enzyme essential to the plant's synthesis of three-branched chain amino acids.

As indicated in the U.S. EPA Ecotoxicity Database, imazamox has low toxicity to aquatic life. Imazamox has been granted a tolerance exemption by the U.S. EPA, meaning that there are no food residue limits in fish, shellfish, crustaceans, or irrigated crops.

Application method: Imazamox will be applied to the nearshore areas from a GPS guided application vessel and following the product label instructions.

iv. **Aquatic herbicide: Triclopyr.** Triclopyr (e.g., Renovate®) is a systemic broadleaf herbicide. This product is effective against Eurasian watermilfoil and is not a restricted use material. Triclopyr is approved by the EPA for use in potable water reservoirs provided setback buffers are created and maintained between the application site and the location of the intake. The set back distance is a function of the rate selected for use. The buffers allow dilution to occur and ensure that herbicide ingredients that might reach the intake will be below the applicable federal drinking water tolerances. Triclopyr is a desirable tool for controlling Eurasian watermilfoil because of the systemic and selective nature of the herbicide.

Application method: Triclopyr is applied to Castaic Lake near shore to control aquatic weeds that grow in the littoral zone. The amount of herbicide applied varies and is a function of the surface area of the treatment site, average water depth of the site, and recommended application rate. Renovate® OTF granular formulation, or other triclopyr product, is applied from a GPS guided application vessel using a combination of granular pellet blower and eductor systems following product label instructions.

e. Decision To Use Herbicides

A comprehensive early warning plan developed cooperatively between DWR and MWD minimizes the quantity of aquatic herbicide required to treat taste and odor events in Castaic Lake. The strategy involves ongoing weekly or biweekly monitoring of the taste and odor compounds MIB and geosmin in the reservoir and at MWD's water treatment plants. Elevated levels of MIB or geosmin trigger additional high frequency monitoring at multiple locations and depths in the reservoir. In addition to SPME analysis for taste and odor compounds, phytoplankton abundance and composition are determined microscopically.

Early detection of increasing levels of MIB and geosmin allows Castaic Lake to be treated early before populations of cyanoHabs reach maximum growth. The result is that much lower quantities of aquatic herbicide are applied to successfully reduce the biomass of cyanobacteria and control the taste and odor event.

Secondary site evaluations and pre-treatment monitoring are routinely done. The concentrations of MIB and geosmin from SPME analysis and phytoplankton abundance from microscopic counts at multiple sampling locations are used to establish the location of the treatment zone**.** Since the spatial distribution of phytoplankton is heterogeneous, DWR is able to map the areas of highest taste and odor production and target those areas for treatment.

f. Herbicide Dose and Determination

When selecting an aquatic herbicide for application, DWR will consider factors such as the species to be controlled and the beneficial uses of the lake to ensure the most appropriate herbicide is applied. The selected aquatic herbicide (copper-based compounds, fluridone, imazamox, or triclopyr) will be applied according to the label instructions. The target species in Castaic Lake are aquatic weeds, planktonic and attached cyanobacteria, and diatoms. The total application dose depends on the water depth and volume.

The application area was determined from a USGS quad map of Castaic Lake which is about 2,240 total surface acres. To protect fish and wildlife, the application area excludes the following: the entire area extending 100 yards out from the shoreline into the reservoir, all reservoir coves, the upper portions of the North East arm, and the Inlet arms. The application area estimated from dimensions on a quad map is 1,200 surface acres or 55 percent of the total surface area of Castaic Lake.

Copper sulfate pentahydrate crystals are applied to Castaic Lake by aerial application using a spreader bucket suspended from a helicopter. The application is essentially a banding application in which the helicopter flies in pre-determined transects in the application zone. Transects are spaced about 50 - 75 yards apart and 400 - 600 pounds of copper sulfate is applied per transect.

The copper dose is determined based on the label recommendations and past experience of DWR biologists in controlling taste and odor causing algae. A normal treatment to control taste and odor producing cyanobacteria such as *Anabaena* would utilize about 16,000 lbs of copper sulfate pentahydrate. Since the material contains 25% copper, 4,000 lbs of active ingredient would be applied to the reservoir. The application area is 1,200 surface acres which includes the photoic zone and epilimnion. By direct observation, staff found that the copper granules dissolve in the uppermost 10 feet of the lake. Therefore, staff determined that 12,000 acre-feet of water is treated at a concentration of 0.12 ppm. The label recommendation is 0.25 - 0.50 ppm copper, depending on water hardness. Thus DWR applies copper sulfate at a concentration that is well below the lower range recommended on the product label.

g. Gates and Control Structures

Not applicable.

h. Exception Period

The Department of Water Resources was granted a section 5.3 exception. Application of copper to Castaic Lake would be carried out only on an as-needed basis during the year, after other options have been exhausted. An exception period does not apply to the use of fluridone, imazamox, or triclopyr because these herbicides do not contain copper.

i. Monitoring Plan

See Appendix A.

j. Procedures to Prevent Sample Contamination

Water quality sampling is conducted by trained DWR or MWD staff following established procedures designed to prevent contamination of samples. Sampling guidelines are contained in "Water Quality Field Manual for the State Water Project" produced by DWR.

Procedures that prevent sample contamination include:

- Use clean sample bottles that are non-reactive. Glass and polyethylene bottles are used for SWP water samples.
- Wear gloves that are powder-free vinyl to avoid the contamination associated with latex gloves.
- Samples are immediately placed in an ice chest away from contaminants as soon as the samples are taken.

k. Best Management Practices Implemented

Application: Southern Field Division (SFD) currently has two licensed Pest Control Advisors (PCA) and six to eight certified Qualified Applicators (QAC). These individuals are trained to ensure that algaecides and aquatic herbicides are applied at rates consistent with label requirements and in a manner that avoids potential adverse effects including, but not limited to, fish kills. Copper sulfate has been used intermittently since 1994 to control phytoplanktonic blue-green algae and diatoms in the drinking water supplied from Castaic Lake. Alternatively, fluridone, imazamox, or triclopyr may be applied according to label instructions.

Notification: MWD, Department of Fish and Wildlife, and the Department of Parks and Recreation are notified prior to the treatment. Additionally, a Pesticide Control Advisor (PCA) will submit a written recommendation for use of the aquatic herbicide to the County Agricultural Commissioner.

Spill Prevention and Cleanup: Staff will apply aquatic herbicides according to label instructions in order to prevent spills. In the event of a spill, staff will follow the field division's established emergency response procedures and refer to the applicable material safety data sheet (MSDS) for instructions on containing and cleaning up the spill. Emergency response and MSDS procedures will be reviewed regularly. A copy of the emergency response procedures and material safety data sheets will be available during each treatment. Cleanup equipment will be kept in good working order and will be readily available at each application site.

Treatment: Prior to treatment, MWD is notified and the reservoir is shut down to recreational users during the day of application.

Prior to scheduling the helicopter, DWR receives a weather forecast and monitor wind direction and speed. To minimize herbicide drift, the aerial application is cancelled if continuous wind velocity exceeds 10 mph.

Minimize Treatment *Area:* The smallest practicable area is treated to minimize chemical cost, use, and secondary impacts.

l. Possible Alternatives to Algaecides and Aquatic Herbicide Use

i. Evaluation of Management Options

(1) No Action

If Castaic Lake was not treated, attached algae would severely impact the quality of water delivered to MWD. A "no action" option is therefore not feasible.

(2) Prevention

Nutrient Control. Some preventive measures involve limiting or eliminating nutrients that support aquatic weed and algal growth. Due to the vast size of the Sacramento-San Joaquin Delta and the numerous inflows, controlling upstream nutrient loading is not a realistic preventive control option for Castaic Lake.

(3) Mechanical or Physical Methods

Planktonic algae such as the cyanobacteria found in Castaic Lake are too small to be controlled by mechanical and physical methods.

(4) Cultural Methods

Drawdown. Drawdown is a potential method that entails lowering the water level to control algae by desiccation. The major drawback is that a longer period of two to three weeks would be necessary. A drawdown of that length of time would be difficult due to demands on water supply. Therefore, drawdown is not feasible for Castaic Lake.

(5) Biological Control Agents

Introduction of Weed Eating Fish. Grass carp/white amur (*Ctenopharyngodon idella* Val.) have been approved for stocking by the California Department of Fish and Wildlife under controlled conditions where the water body is a closed system. However, feeding by this species is initially selective, and as sources of preferred weeds become scarce, feeding will continue on other plants which can result in reduction of native vegetation needed for game fish habitat. Therefore, grass carp would not be an alternative to copper sulfate in managing algae in Castaic Lake.

(6) Algaecides and Aquatic Herbicides

Copper sulfate has proven to be effective at reducing the target phytoplankton without adverse effects on non-target species. The early warning plan of high frequency monitoring has greatly reduced the quantity of copper applied to Castaic Lake. In addition, fluridone, imazamox, and triclopyr have been proven to be environmentally safe herbicides that are effective at reducing target aquatic weeds and cyanobacteria without adverse effects on non-target species. If Castaic Lake was not treated, aquatic weeds and cyanobacteria that produce taste and odor

compounds would negatively impact the quality of water delivered to water contractors.

ii. Decision Matrix to Select the Most Appropriate Formulation

The decision matrix below evaluates the aquatic weed and algae control options identified for Castaic Lake (section i: "Evaluation of Management Options" above).

Decision Making Criteria	No Action	Prevention	Mechanical or Physical	Cultural Methods	Biological Agents	Algaecides and Aquatic Herbicides
Is the impact to the environment low or easily mitigated?	Yes	Yes	Yes	Yes	Yes	Yes
Is the cost of this option reasonable?	N/A	No	No	No	No	Yes
Has (have) the method(s) been effectively implemented at this site?	No	No	No	No	No	Yes
Option(s) selected for Castaic Lake.						X

10. SILVERWOOD LAKE

a. Site Description

Silverwood Lake is a SWP reservoir on the East Branch of the California Aqueduct at Milepost 405.70 within the boundaries of the Lahontan Regional Water Quality Control Board, Region 6 (Figure 12). Silverwood Lake is the highest reservoir in the State Water Project with an elevation of 3,350 feet. It has a surface area of 980 acres, a storage capacity of 75,000 acre-feet (AF), a length of 25,300 feet, and 13 miles of shoreline.

As a SWP reservoir, Silverwood Lake stores water that is delivered to water contractors in Southern California. These contractors are: Crestline-Lake Arrowhead Water Agency, Metropolitan Water District of Southern California (MWD), and San Bernardino Valley Municipal Water District. It also provides various recreational uses, including swimming, boating, water skiing, and fishing.

b. Application and Treatment Areas

i. Algae

Application Area: The application area is dependent on the location of the source of taste and odor production as determined by SPME analysis.

Treatment Area: The specific area is variable and dependent on the location of the source of taste and odor production as determined by monitoring and SPME analysis. For each

application, a map will be submitted in the annual report to the Regional Board showing the application area, treatment area, immediately adjacent areas, and water bodies receiving treated water (where applicable).

ii. Aquatic Weeds

Application Area: Every year the application area will be determined based on the results of a vegetation survey and after analysis of impacts to beneficial uses.

Treatment Area: The specific area is variable and dependent on the location of aquatic weeds. For each application, a map will be submitted in the annual report to the Regional Board showing the application area, treatment area, immediately adjacent areas, and water bodies receiving treated water (where applicable).

c. Aquatic Weeds and Algae Controlled and Rationale

i. Background

When taste and odor compound concentrations are high in the East Branch Aqueduct and algae are not controlled with aquatic herbicides, unacceptably high concentrations of taste and odor compounds often result in Silverwood Lake. Algal production of geosmin in Silverwood Lake itself began in 2013, necessitating the treatment of the lake. In the summer of 2013, Silverwood Lake experienced a bloom of the species *Anabaena lemmermannii* that caused severe taste and odor problems.

ii. Control Tolerances

Sensitive water customers can detect MIB at 5 ng/L and geosmin at 10 ng/L. Concentrations greater than the 5 and 10 ng/L levels will trigger complaints to the water agencies.

d. Herbicides and Application Method

i. Aquatic herbicide: Fluridone. Fluridone (e.g., Sonar®) is a slow-acting systemic herbicide used to control broad-leaved submerged aquatic vegetation (SAV), including Eurasian watermilfoil (*Myriophyllum spicatum*). Fluridone works by inhibiting the weed's ability to produce carotene, resulting in the degradation of chlorophyll and finally the death of the plant. Since this is a slow process, it is necessary to maintain an adequate concentration of the chemical for a sufficient period of time in order to effectively control aquatic weeds.

Fluridone, applied at the approved concentration rate in accordance with label instructions, has not been found to be toxic to waterfowl and wildlife. The label does not restrict the use of fluridone-treated water for swimming, fishing, or drinking water. However, there is a restriction against the use of fluridone within 1/4 mile of any potable water intake.

Application method: Fluridone will be applied when the target SAV begins active growth. Fluridone will be applied to the nearshore area of the lake from a GPS guided application vessel using a granular pellet blower following label instructions.

ii. **Aquatic herbicide: Imazamox.** Imazamox is a derivative of ammonium salt of imazamox, the active ingredient in the herbicide Clearcast®. Imazamox is a selective herbicide that controls floating, emergent, and shoreline weed species while allowing non-target species to colonize. The chemical is absorbed through the leaves, stems, and roots of aquatic weeds. Once absorbed by a plant, imazamox inhibits an enzyme essential to the plant's synthesis of three-branched chain amino acids.

As indicated in the U.S. EPA Ecotoxicity Database, imazamox has low toxicity to aquatic life. Imazamox has been granted a tolerance exemption by the U.S. EPA, meaning that there are no food residue limits in fish, shellfish, crustaceans, or irrigated crops.

Application method: Imazamox will be applied to the nearshore areas from a GPS guided application vessel and following the product label instructions.

iii. **Aquatic herbicide: Sodium carbonate peroxyhydrate.** Sodium carbonate peroxyhydrate (e.g., PAK®27) is approved for use as an algaecide in California and by the U.S. Environmental Protection Agency (EPA). PAK®27 is also approved under NSF/ANSI Standard 60 (drinking water treatment chemicals). All ingredients in PAK®27 have either Generally Recognized as Safe (GRAS) food additive status from the U.S. Food and Drug Administration (FDA) or exemptions from tolerances from the U.S. EPA.

Sodium carbonate peroxyhydrate is an addition compound of sodium carbonate and hydrogen peroxide (H_2O_2). The nominal amount of sodium carbonate peroxyhydrate is 85% in PAK®27 which corresponds to 27.6% H_2O_2. The approved application rate is 3 to 100 pounds per acre-foot.

Application method: Boat. Applications are conducted by DWR or a certified aquatic herbicide applicator, such as Clean Lakes, Inc., following label instructions. Clean Lakes, Inc.'s treatments involve an eductor system which uses a venturi effect to draw water through the system which pulls the algaecide (dry granular material) from a hopper and injects to the surface of the water body.

iv. **Aquatic herbicide: Triclopyr.** Triclopyr (e.g., Renovate®) is a systemic broadleaf herbicide. This product is effective against Eurasian watermilfoil and is not a restricted use material. Triclopyr is approved by the EPA for use in potable water reservoirs provided setback buffers are created and maintained between the application site and the location of the intake. The set back distance is a function of the rate selected for use. The buffers allow dilution to occur and ensure that herbicide ingredients that might reach the intake will be below the applicable federal drinking water tolerances. Triclopyr is a desirable tool for controlling Eurasian watermilfoil because of the systemic and selective nature of the herbicide.

Application method: Triclopyr is applied to Silverwood Lake near shore to control aquatic weeds that grow in the littoral zone. The amount of herbicide applied varies and is a function of the surface area of the treatment site, average water depth of the site, and recommended application rate. Renovate® OTF granular formulation, or other triclopyr product, is applied from a GPS guided application vessel using a combination of granular pellet blower and eductor systems following label instructions.

e. Decision To Use Herbicides

A comprehensive early warning plan developed cooperatively between DWR and MWD will minimize the quantity of aquatic herbicide required to control taste and odor production and helps to determine optimal timing of the application. The strategy involves ongoing weekly or biweekly monitoring of the taste and odor compounds, MIB and geosmin, in the aqueduct, reservoirs, and MWD's water treatment plants. Elevated levels of MIB or geosmin trigger additional high frequency monitoring at additional locations.

Early detection of increasing levels of MIB and geosmin allows Silverwood Lake to be treated early before populations of cyanoHabs reach maximum growth. The result is that much lower quantities of aquatic herbicide are applied to successfully reduce the biomass of cyanobacteria and control the taste and odor event.

Secondary site evaluations and pre-treatment monitoring are routinely done. The concentrations of MIB and geosmin from SPME analysis and phytoplankton abundance from microscopic counts at multiple sampling locations are used to establish the location of the treatment zone**.** Since the spatial distribution of phytoplankton is heterogeneous, DWR is able to map the areas of highest taste and odor production and target those areas for treatment.

If algal blooms are not treated before the control tolerances are reached, taste and odor issues pose a problem for customers in a large service area. Algal blooms also have the potential to cause low dissolved oxygen levels, which can lead to fish kills. An additional concern at Silverwood Lake is the potential for algal blooms to produce cyanotoxins such as Microcystin. If cyanotoxins reach critical levels, they can cause health problems in humans and animals that use the lake.

f. Herbicide Dose and Determination

After determining algal species and algal counts, the optimal treatment rate is calculated by a licensed pest control advisor. Aquatic herbicides will be applied in a manner consistent with product labeling.

g. Gates and Control Structures

Reservoir releases will be restricted prior to application of the aquatic herbicide and the outlet valves will remain closed for a sufficient time period to meet the specifications of the product label.

h. Exception Period

Not applicable since copper is not an active ingredient of fluridone, imazamox, sodium carbonate peroxyhydrate, or triclopyr.

i. Monitoring Plan

See Appendix A.

j. Procedures to Prevent Sample Contamination

Water quality sampling is conducted by trained DWR staff following established procedures designed to prevent contamination of samples. Sampling guidelines are contained in "Water Quality Field Manual for the State Water Project" produced by DWR.

Procedures that prevent sample contamination include:

- Use clean sample bottles that are non-reactive. Glass and polyethylene bottles are used for SWP water samples.
- Wear gloves that are powder-free vinyl to avoid the contamination associated with latex gloves.
- Samples are immediately placed in an ice chest away from contaminants as soon as the samples are taken.

k. Best Management Practices Implemented

Application: Fluridone, imazamox, sodium carbonate peroxyhydrate (e.g., PAK®27), and triclopyr are applied under the supervision of a certified herbicide applicator by a contractor such as Clean Lakes, Inc. or Aqua Technex, or by DWR staff. DWR's Southern Field Division has two licensed Pest Control Advisors (PCAs) and six to eight certified Qualified Applicators (QAC). These individuals are trained to ensure that aquatic herbicides are applied at rates consistent with label requirements, in a manner that avoids potential adverse effects (including, but not limited to, fish kills), and following proper storage and disposal practices.

Notification: Water contractors are notified by email at least 48 hours prior to a treatment. The notification includes the treatment date and time and date and time when releases will resume from Silverwood Lake. Notices are posted to inform the public of lake closures. Additionally, a Pesticide Control Advisor (PCA) will submit a written recommendation for use of the aquatic herbicide to the County Agricultural Commissioner.

Treatment: Granular formulations of fluridone and triclopyr are applied by boat using a pellet blower. Imazamox (e.g., Clearcast®) is an aqueous formulation that is broadcast sprayed or applied by subsurface hoses to submerged vegetation. Sodium carbonate peroxyhydrate (PAK®27) is dispensed by subsurface hoses by boat to maximize the effectiveness of the algaecide.

Spill Prevention and Cleanup: Staff will apply aquatic herbicides according to label instructions in order to prevent spills. In the event of a spill, staff will follow the field division's established emergency response procedures and refer to the applicable material safety data sheet (MSDS) for instructions on containing and cleaning up the spill. Emergency response and MSDS procedures will be reviewed regularly. A copy of the emergency response procedures and material safety data sheets will be available during each treatment. Cleanup equipment will be kept in good working order and will be readily available at each application site.

Water Quality Monitoring: Monitoring is conducted before, during and after treatments as outlined in Appendix A. In addition, water quality is monitored at Silverwood Lake at least quarterly, and the analytical results are available online through DWR's Water Data Library.

Access: Silverwood Lake is open to the public for recreational use. The lake will be closed to the public during aquatic herbicide applications.

Post-Treatment: The efficacy of the treatment is evaluated one week after the application. Algae are surveyed to determine the effectiveness of the treatment at reducing cyanoHabs. Taste and odor compounds produced by cyanobacteria are monitored on an episodic basis. After treating the lake for aquatic weeds, post-treatment will involve an evaluation of weed population to determine the effectiveness of the treatment.

l. Possible Alternatives to Algaecides and Aquatic Herbicide Use

i. Evaluation of Management Options

(1) No Action

If Silverwood Lake was not treated, algae would severely impact the quality of water delivered to MWD. A "no action" option is therefore not feasible.

(2) Prevention

Nutrient Control. Some preventive measures involve limiting or eliminating nutrients that support aquatic weed and algal growth. Due to the vast size of the Sacramento-San Joaquin Delta and the numerous inflows, controlling upstream nutrient loading is not a realistic preventive control option for Silverwood Lake.

(3) Mechanical or Physical Methods

Mechanical Aerators. Mechanical aerators oxygenate the water column and upper portions of lake sediment. One effect of this oxygenation is to prevent the release of reduced forms of phosphorus from bottom sediments back into the water. Reduction in phosphorus and other changes in water quality parameters are thought to decrease planktonic algal blooms. However, due to the inability to control nutrient inputs in Silverwood Lake, aeration is not likely to be an effective means of controlling algal blooms over the long term. Further, aeration is not a workable option for algae control in Silverwood Lake due to budgetary limits and lack of staff needed to maintain a large aeration system.

Planktonic algae such as the cyanobacteria found in Silverwood Lake are too small to be controlled by other mechanical and physical methods.

(4) Cultural Method

Drawdown. Lowering the water level with drawdown is a potential method to control some species of algae by desiccation. The major drawback is that a long period of several weeks would be necessary. Cyanobacteria are extremely tolerant to desiccation; therefore, drawdown is not feasible for Silverwood Lake.

(5) Biological Control Agents

Introduction of Weed Eating Fish. Grass carp/white amur (*Ctenopharyngodon idella* Val.) has been approved for stocking by the California Department of Fish and Wildlife under controlled conditions where the water body is a closed system. However, feeding by this species is initially selective, and as sources of preferred

weeds become scarce, feeding will continue on other plants which can result in reduction of native vegetation needed for game fish habitat. Therefore, grass carp would not be a feasible alternative to algaecides to manage cyanoHabs algae in Silverwood Lake.

(6) Algaecides and Aquatic Herbicides

Fluridone, imazamox, sodium carbonate peroxyhydrate, and triclopyr have been proven to be environmentally safe herbicides that are effective at reducing target aquatic weeds and cyanobacteria without adverse effects on non-target species. If Silverwood Lake was not treated, taste and odor compounds produced by cyanobacteria would have severe impacts on the quality of water deliveries to water districts. The early warning plan of high frequency monitoring has greatly reduced the quantity of algaecides and aquatic herbicides applied to other SWP waters and is expected to be beneficial in minimizing the amount of aquatic herbicides used in Silverwood Lake.

ii. Decision Matrix to Select the Most Appropriate Formulation

The decision matrix below evaluates the aquatic weed and algae control options identified for Silverwood Lake (section i: "Evaluation of Management Options" above).

Decision Making Criteria	No Action	Prevention	Mechanical or Physical	Cultural Methods	Biological Agents	Algaecides and Aquatic Herbicides
Is the impact to the environment low or easily mitigated?	Yes	Yes	Yes	Yes	Yes	Yes
Is the cost of this option reasonable?	N/A	No	No	No	No	Yes
Has (have) the method(s) been effectively implemented at this site?	No	No	No	No	No	No
Option(s) selected for Silverwood Lake.						X

11. LAKE PERRIS

a. Site Description

Lake Perris is the terminal storage facility on the California Aqueduct, located in northwestern Riverside County about 13 miles southeast of the City of Riverside and within the boundaries of the Santa Ana Regional Water Quality Control Board, Region 8 (Figure 13). Completed in 1975, Lake Perris has a 131,450 acre-foot storage capacity and surface area of 2,320 acres. This shallow reservoir with a mean depth of about 50 feet is a

multi-purpose facility that provides water supply, recreation, and fish and wildlife enhancement.

b. Application and Treatment Areas

i. Aquatic Weeds

Application Area: Every year the application area will be determined based on the results of a vegetation survey and after analysis of impacts to beneficial uses.

Treatment Area: The specific area is variable and dependent on the location of aquatic weeds. For each application, a map will be submitted in the annual report to the Regional Board showing the application area, treatment area, immediately adjacent areas, and water bodies receiving treated water (where applicable).

ii. Algae

Application Area: The application area is dependent on the location of the source of taste and odor production as determined by Solid Phase Microextraction analysis (SPME).

Treatment Area: The specific area is variable and dependent on the location of the source of taste and odor production as determined by monitoring and SPME analysis. For each application, a map will be submitted in the annual report to the Regional Board showing the application area, treatment area, immediately adjacent areas, and water bodies receiving treated water (where applicable).

c. Weeds Controlled and Rationale

i. Background

Taste and odor problems were first reported in Lake Perris in the late 1970s. Copper sulfate was applied at a low dose rate during the early copper treatments from 1978 to 1984. Major off-flavor events in Lake Perris are common due to the shallow depth of the lake and high concentrations of bio-available nitrogen and phosphorus. In 1987, the first helicopter application was done and copper application rates increased to 10,000 to 12,000 pounds per treatment. The cyanobacterial genera, *Synechococcus, Pseuodoanabaena*, and *Anabaena* were isolated as the primary contributors to off-flavor incidents in Lake Perris. Normally, only the area west of Alessandro Island is treated with copper sulfate.

ii. Control Tolerances

(1) Algae

Sensitive water customers can detect MIB at 5 ng/L and geosmin at 10 ng/L. Concentrations greater than the 5 and 10 ng/L levels will trigger complaints to the water agencies.

Taste and odor production is monitored weekly using SPME. The taste and odor causing substances, MIB and geosmin are reported in parts per trillion (ng/L) concentrations.

(2) Aquatic Weeds

Control tolerances for aquatic weeds are based on a number of factors. Beneficial uses and the impact of the weed growth on those uses is a primary determining factor when using integrated aquatic plant management technologies to control weed growth.

d. Herbicides and Application Method

i. Aquatic herbicide: Copper-based herbicides. Copper-based herbicides have proven to be effective at reducing the target algae in SWP water bodies without adverse effects on non-target organisms.

Application method: Copper sulfate pentahydrate is applied aerially by helicopter following product label instructions. Chelated copper products (CaptainXTR®), copper sulfate pentahydrate crystals, and EarthTec® are applied in a manner consistent with product labeling.

ii. Aquatic herbicide: Fluridone. Fluridone (e.g., Sonar®) is a slow-acting systemic herbicide used to control broad-leaved submerged aquatic vegetation (SAV), including Eurasian watermilfoil (*Myriophyllum spicatum*). Fluridone works by inhibiting the weed's ability to produce carotene, resulting in the degradation of chlorophyll and finally the death of the plant. Since this is a slow process, it is necessary to maintain an adequate concentration of the chemical for a sufficient period of time in order to effectively control aquatic weeds.

Fluridone, applied at the approved concentration rate in accordance with label instructions, has not been found to be toxic to waterfowl and wildlife. The label does not restrict the use of fluridone-treated water for swimming, fishing, or drinking water. However, there is a restriction against the use of fluridone within 1/4 mile of any potable water intake.

Application method: Fluridone will be applied when the target SAV begins active growth. Fluridone will be applied to the nearshore area of the lake from a GPS guided application vessel using a granular pellet blower following product label instructions.

iii. Aquatic herbicide: Imazamox. Imazamox is a derivative of ammonium salt of imazamox, the active ingredient in the herbicide Clearcast®. Imazamox is a selective herbicide that controls floating, emergent, and shoreline weed species while allowing non-target species to colonize. The chemical is absorbed through the leaves, stems, and roots of aquatic weeds. Once absorbed by a plant, imazamox inhibits an enzyme essential to the plant's synthesis of three-branched chain amino acids.

As indicated in the U.S. EPA Ecotoxicity Database, imazamox has low toxicity to aquatic life. Imazamox has been granted a tolerance exemption by the U.S. EPA, meaning that there are no food residue limits in fish, shellfish, crustaceans, or irrigated crops.

Application method: Imazamox will be applied to the nearshore areas from a GPS guided application vessel and following the product label instructions.

iv. **Aquatic herbicide: Triclopyr.** Triclopyr (e.g., Renovate®) is a systemic broadleaf herbicide. This product is effective against Eurasian Milfoil and is not a restricted use material. Triclopyr is approved by the EPA for use in potable water reservoirs provided setback buffers are created and maintained between the application site and the location of the intake. The set back distance is a function of the rate selected for use. The buffers allow dilution to occur and ensure that herbicide ingredients that might reach the intake will be below the applicable federal drinking water tolerances. Triclopyr is a desirable tool for controlling Eurasian watermilfoil because of the systemic and selective nature of the herbicide.

Application method: Triclopyr is applied to Lake Perris near shore to control aquatic weeds that grow in the littoral zone. The amount of herbicide applied varies and is a function of the surface area of the treatment site, average water depth of the site, and recommended application rate. Renovate® OTF granular formulation, or other triclopyr product, is applied from a GPS guided application vessel using a combination of granular pellet blower and eductor systems following product label instructions.

e. Decision to Use Herbicides

A comprehensive early warning plan developed cooperatively between DWR and Metropolitan Water District of Southern California (MWD) minimizes the quantity of aquatic herbicide required to treat taste and odor events in Lake Perris. The strategy involves ongoing weekly or biweekly monitoring of the taste and odor compounds MIB and geosmin in the reservoir and at MWD's water treatment plants. Elevated levels of MIB or geosmin trigger additional high frequency monitoring at multiple locations and depths in the reservoir. In addition to the SPME, phytoplankton abundance and composition are determined microscopically.

Early detection of increasing levels of MIB and geosmin allows Lake Perris to be treated early before populations of cyanobacteria reach maximum growth. The result is that much lower quantities of aquatic herbicide are applied to successfully reduce the biomass of cyanobacteria and control the taste and odor event.

Secondary site evaluations and pre-treatment monitoring are routinely done. The concentrations of MIB and geosmin from SPME and phytoplankton abundance from microscopic counts at multiple sampling locations are used to establish the location of the treatment zone. Since the spatial distribution of phytoplankton is heterogeneous, DWR is able to map the areas of highest taste and odor production and target those areas for treatment.

f. Herbicide Dose and Determination

Copper sulfate is applied in a manner consistent with product labeling.

g. Gates and Control Structures

Not applicable.

h. Exception Period

DWR was granted a section 5.3 exception. Application of copper to Lake Perris would be carried out only on an as-needed basis during the year, after other options have been

exhausted. DWR was granted a section 5.3 exception. Application of copper to Lake Perris would be carried out only on an as-needed basis during the year, after other options have been exhausted. An exception period does not apply to the use of fluridone, imazamox, or triclopyr because these herbicides do not contain copper.

i. Monitoring Plan

See Appendix A.

j. Procedures to Prevent Sample Contamination

Water quality sampling is conducted by trained DWR or MWD staff following established procedures designed to prevent contamination of samples. Sampling guidelines are contained in "Water Quality Field Manual for the State Water Project" produced by DWR.

Procedures that prevent sample contamination include:

- Use clean sample bottles that are non-reactive. Glass and polyethylene bottles are used for SWP water samples.
- Wear gloves that are powder-free vinyl to avoid the contamination associated with latex gloves.
- Samples are immediately placed in an ice chest away from contaminants as soon as the samples are taken.

k. Best Management Practices Implemented

Application: Southern Field Division has two licensed Pest Control Advisors (PCAs) and six to eight certified Qualified Applicators (QAC). These individuals are trained to ensure that algaecides and aquatic herbicides are applied at rates consistent with label requirements and in a manner that avoids potential adverse effects including, but not limited to, fish kills.

Taste and odor problems were first reported in Lake Perris in the late 1970s. Major off-flavor events in Lake Perris are common due to the shallow depth of the lake and high concentrations of bio-available nitrogen and phosphorus. The cyanobacterial genera, *Synechococcus*, *Pseudoanabaena*, and *Anabaena* were isolated as the primary contributors to off-flavor incidents in Lake Perris. Copper sulfate is applied according to label instructions by a licensed helicopter applicator. Alternatively, fluridone, imazamox, or triclopyr may be applied according to label instructions.

Notification: MWD, Department of Fish and Wildlife, and the Department of Parks and Recreation are notified prior to the treatment. Additionally, a Pesticide Control Advisor (PCA) will submit a written recommendation for use of the aquatic herbicide to the County Agricultural Commissioner.

Spill Prevention and Cleanup: Staff will apply copper sulfate according to label instructions in order to prevent spills. In the event of a spill, staff will follow the field division's established emergency response procedures and refer to the applicable material safety data sheet (MSDS) for instructions on containing and cleaning up the spill. Emergency response and MSDS procedures will be reviewed regularly. A copy of the emergency response procedures and material safety data sheets will be available during each treatment. Cleanup equipment will be kept in good working order and will be readily available at each application site.

Treatment: Prior to treatment, MWD is notified and the reservoir is shut down to recreational users during the day of application.

Prior to scheduling the helicopter for a copper sulfate treatment, DWR receives a weather forecast and monitor wind direction and speed. To minimize herbicide drift, the aerial application is cancelled if continuous wind velocity exceeds 10 mph.

Access: Lake Perris is open to the public for recreational use. The lake will be closed to the public during aquatic herbicide applications. Lake closure information is available online.

Minimize Treated Area: The smallest practicable area is treated to minimize chemical cost, use, and secondary impacts.

Post-Treatment: The efficacy of the treatment is evaluated one week after the application. Algae are surveyed to determine the effectiveness of the treatment at reducing cyanoHabs. Taste and odor compounds produced by cyanobacteria are monitored on an episodic basis. After treating the lake for aquatic weeds, post-treatment will involve an evaluation of weed population to determine the effectiveness of the treatment.

l. Possible Alternatives to Algaecides and Aquatic Herbicide Use

i. Evaluation of Management Options

(1) No Action

If Lake Perris was not treated, algae would severely impact the quality of water delivered to MWD. A “no action” option is, therefore, not feasible.

(2) Prevention

Nutrient Control. Some preventive measures involve limiting or eliminating nutrients that support aquatic weed and algal growth. Due to the vast size of the Sacramento-San Joaquin Delta and the numerous inflows, controlling upstream nutrient loading is not a realistic preventive control option for Lake Perris.

(3) Mechanical or Physical Methods

Mechanical Aerators. Mechanical aerators oxygenate the water column and upper portions of lake sediment. One effect of this oxygenation is to prevent the release of reduced forms of phosphorus from bottom sediments back into the water. Reduction in phosphorus and other changes in water quality parameters are thought to decrease planktonic algal blooms. While Lake Perris currently has an aeration system, due to the inability to control nutrient inputs in the lake, aeration alone cannot be relied upon as an effective means of controlling algal blooms over the long term. Further, aeration is not a workable option for algae control in Lake Perris due to budgetary limits and lack of staff needed to maintain a large aeration system.

Planktonic algae such as the cyanobacteria found in Lake Perris are too small to be controlled by other mechanical and physical methods.

(4) Cultural Method

Drawdown. Drawdown is a potential method that entails lowering the water level to control algae by desiccation. The major drawback is that a longer period of two to three weeks would be necessary. A drawdown of that length of time would be difficult due to demands on water supply. Therefore, drawdown is not feasible for Lake Perris.

(5) Biological Control Agents

Introduction of Weed Eating Fish. Grass carp/white amur (*Ctenopharyngodon idella* Val.) have been approved for stocking by the California Department of Fish and Wildlife under controlled conditions where the water body is a closed system. However, feeding by this species is initially selective, and as sources of preferred weeds become scarce, feeding will continue on other plants which can result in reduction of native vegetation needed for game fish habitat. Therefore, grass carp would not be a feasible alternative to copper sulfate in managing algae in Lake Perris.

(6) Algaecides and Aquatic Herbicides

Copper sulfate has proven to be effective at reducing the target phytoplankton without adverse effects on non-target species. The early warning plan of high frequency monitoring has greatly reduced the quantity of copper applied to Lake Perris. In addition, fluridone, imazamox, and triclopyr have been proven to be environmentally safe herbicides that are effective at reducing target aquatic weeds and cyanobacteria without adverse effects on non-target species. If Lake Perris was not treated, aquatic weeds and cyanobacteria that produce taste and odor compounds would negatively impact the quality of water delivered to water contractors.

ii. Decision Matrix to Select the Most Appropriate Formulation

The decision matrix below evaluates the aquatic weed and algae control options identified for Lake Perris (section i: “Evaluation of Management Options” above).

Decision Making Criteria	**No Action**	**Prevention**	**Mechanical or Physical**	**Cultural Methods**	**Biological Agents**	**Algaecides and Aquatic Herbicides**
Is the impact to the environment low or easily mitigated?	Yes	Yes	Yes	Yes	Yes	Yes
Is the cost of this option reasonable?	N/A	No	No	No	No	Yes
Has (have) the method(s) been effectively implemented at this site?	No	No	No	No	No	Yes
Option(s) selected for Lake Perris.						X

FIGURES

Figure 1. Map of South Bay Aqueduct Showing Location of Application and Treatment Areas

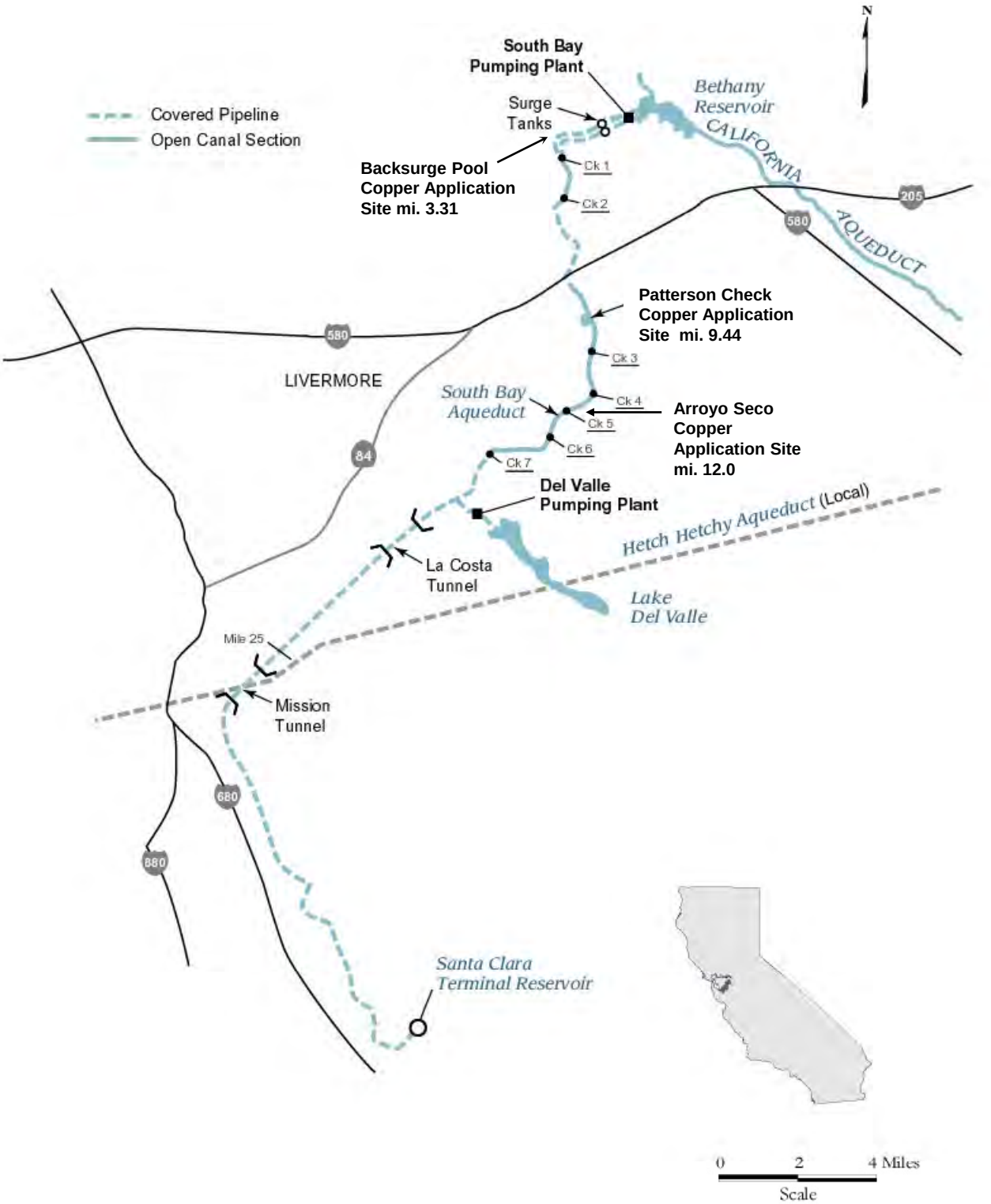


Figure 2. Map of Clifton Court Forebay Showing Location of Application and Treatment Areas for Copper Sulfate Application to Control Taste and Odor Producing Algae

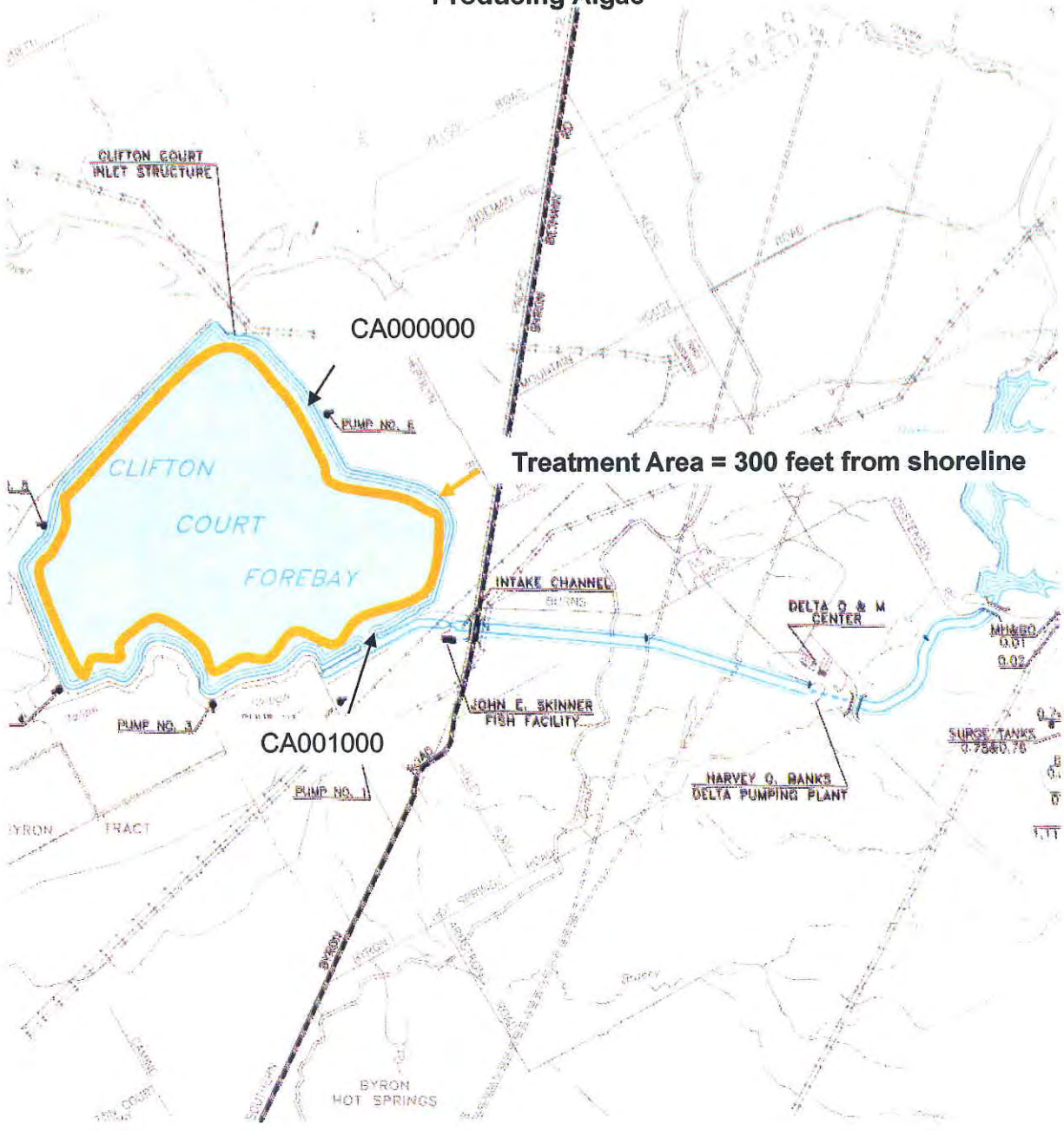


Figure 3. Patterson Reservoir Application Area

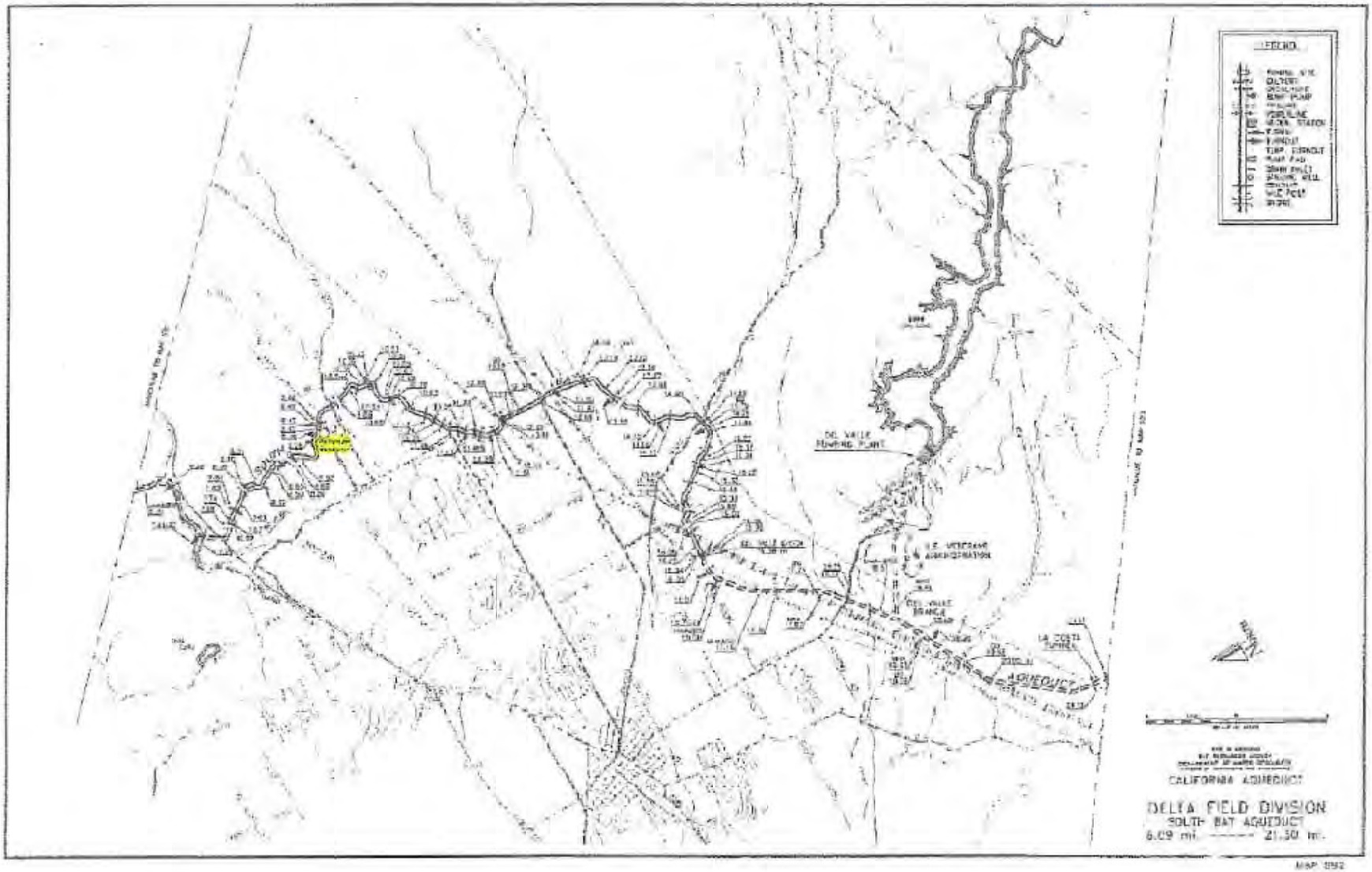


Figure 4. Map of Dyer Reservoir Application Site

N

0.7

Miles

Map Citations:
Main: ESRI Street Map
Inset: ESRI Street Map

Figure 5 - O'Neill Forebay Overview Map

Aquatic Pesticides Application Plan

Merced County, CA
121°2'53.37"W
37°4'46.103"N

Legend

★ Sampling Sites

Station Name
(Station Number)

Figure 6. Map of Coastal Branch Aqueduct Showing Location of Treatment and Application Areas

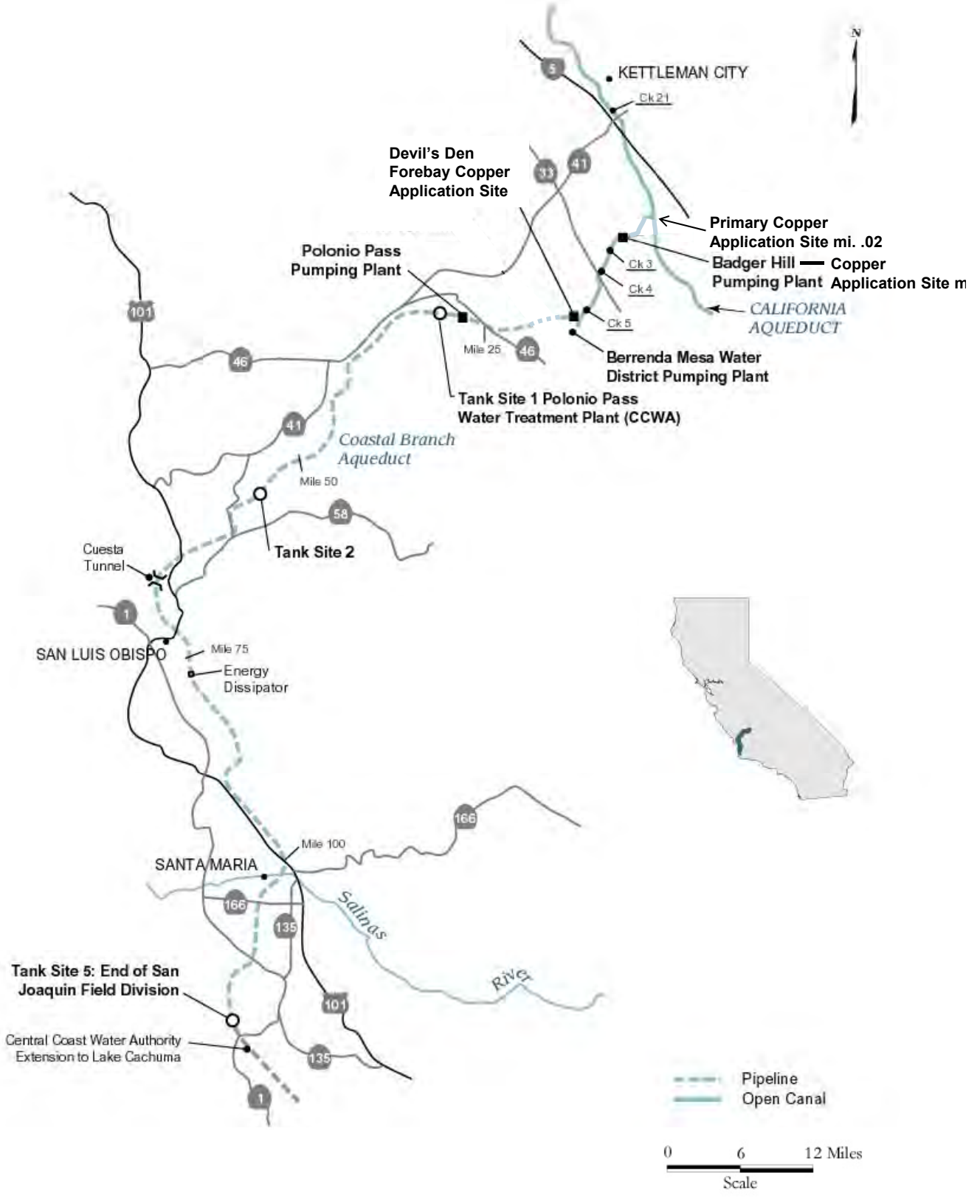


Figure 7. East Branch California Aqueduct from Miles 328.82 to 343.05 Showing Location of Application Sites (Pools 49, 50, 51, and 52) and Event and Post Event Sampling Sites

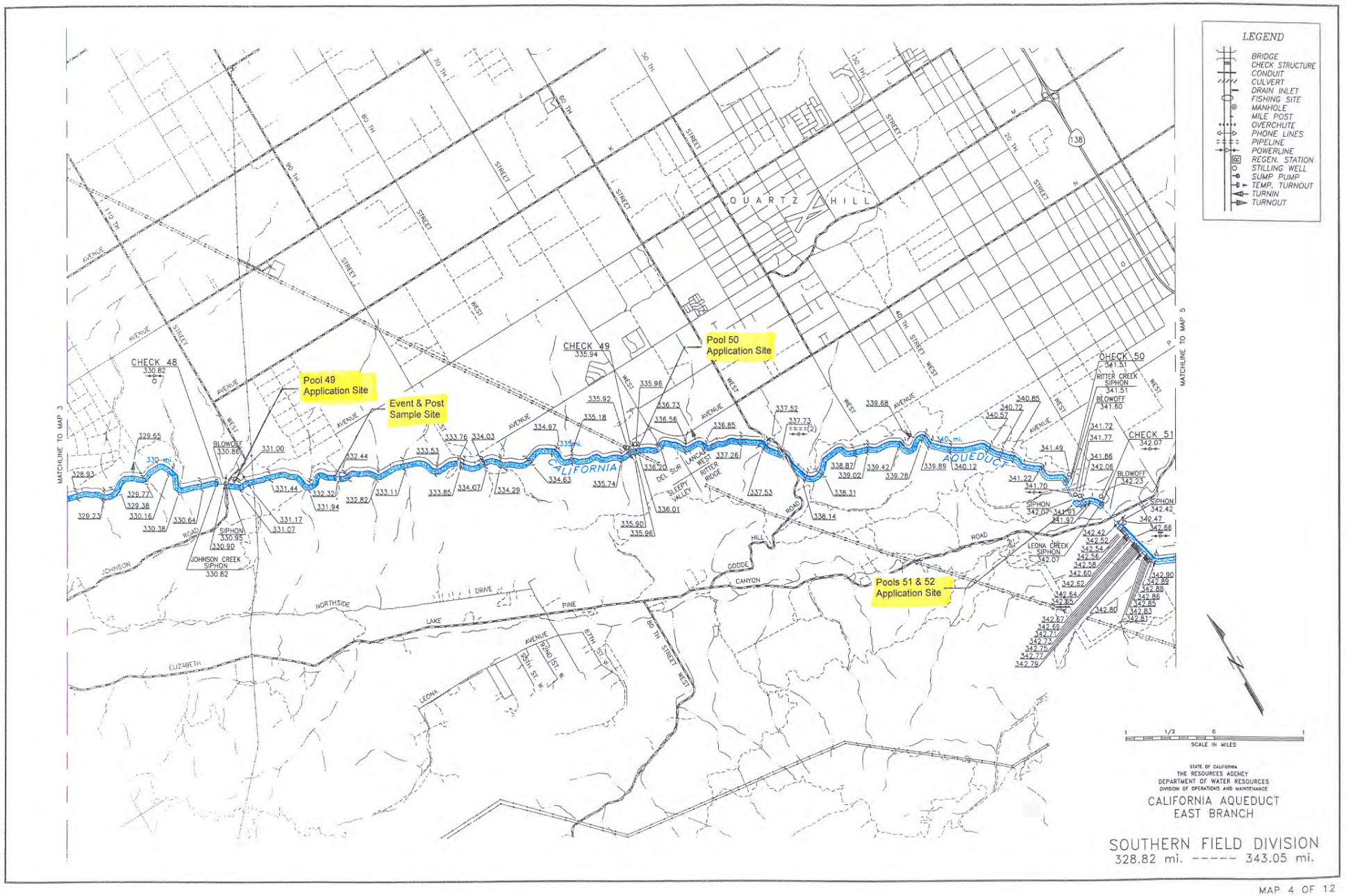


Figure 8. East Branch California Aqueduct from Miles 371.37 to 383.52 Showing Location of Application Sites (Pools 61 and 62)

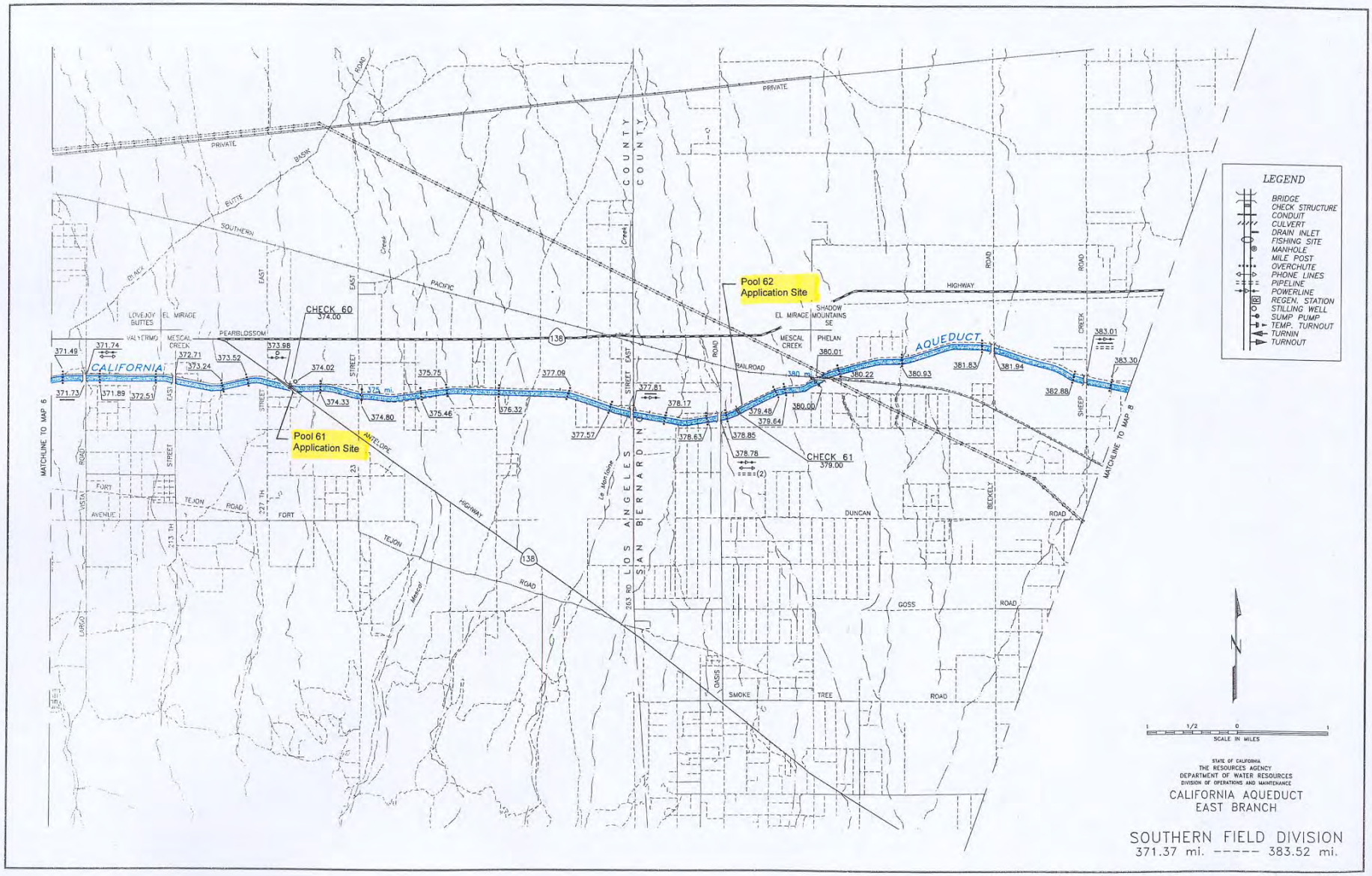


Figure 9. East Branch California Aqueduct from Miles 383.52 to 395.63 Showing Location of Application Sites (Pools 63 and 65)

N

0.5

Miles

Map Citations:
Main: ESRI Street Map
Inset: ESRI Street Map

Figure 10 - Pyramid Lake Overview Map

Aquatic Pesticides Application Plan

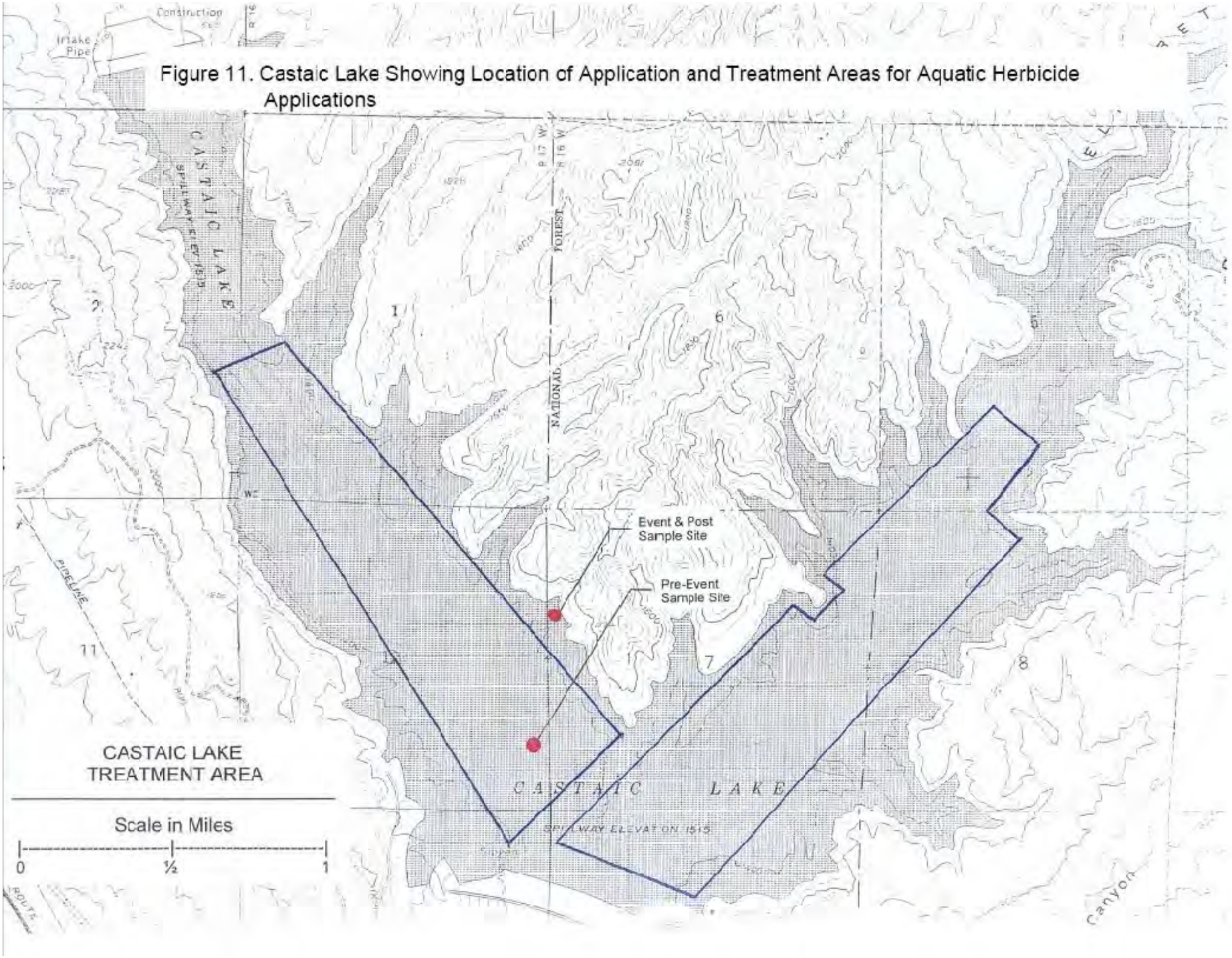
Los Angeles County, CA
118°46'19.483"W
34°39'14.054"N

Legend

★ Sampling Sites

Station Name
(Station Number)

Figure 11. Castaic Lake Showing Location of Application and Treatment Areas for Aquatic Herbicide Applications



N

0.5

Miles

Map Citations:
Main: ESRI Street Map
Inset: ESRI Street Map

Figure 12 - Silverwood Lake Overview Map

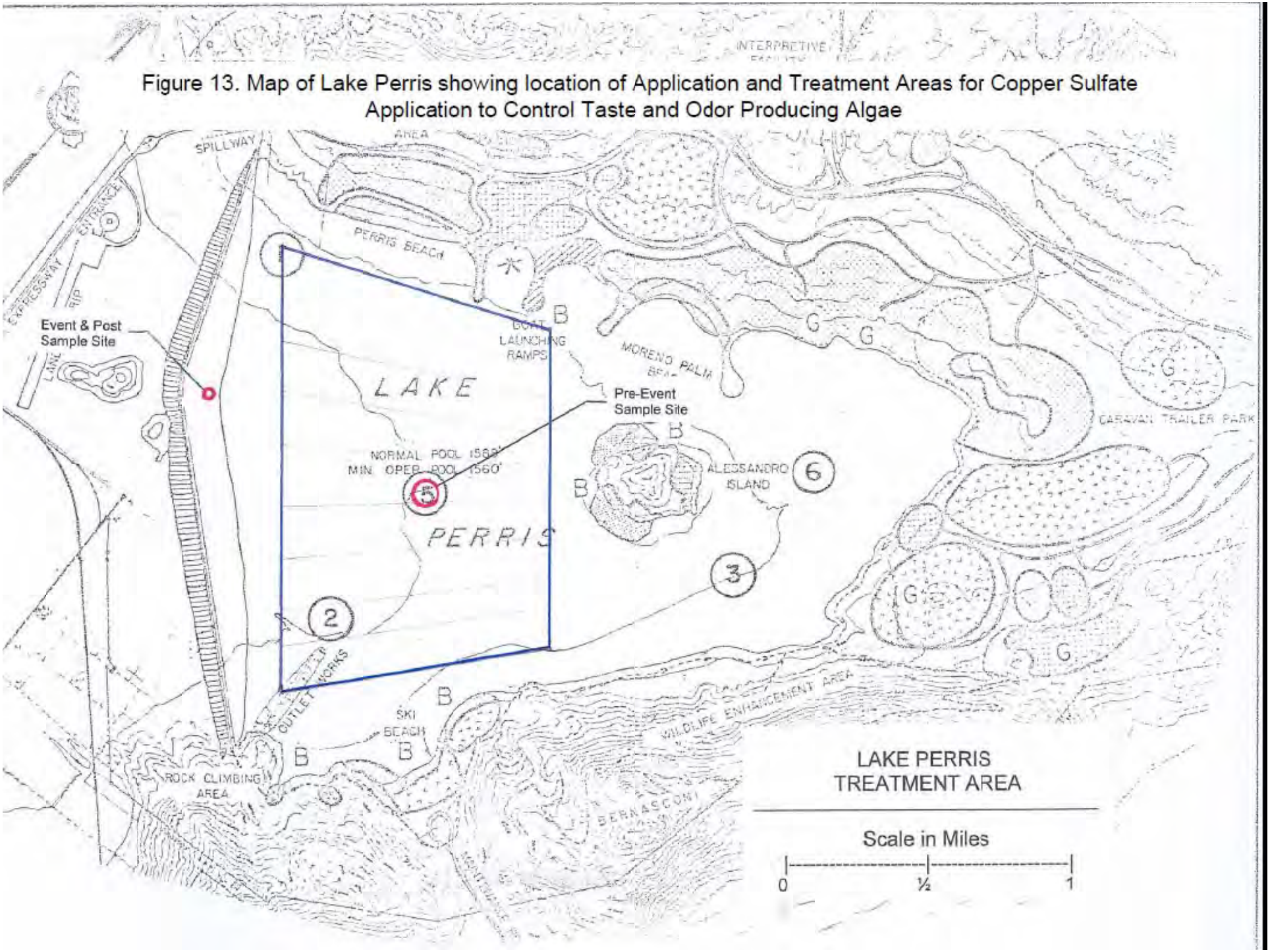
Aquatic Pesticides Application Plan

San Bernardino County, CA
117°19'29.851"W
34°17'30.214"N

Legend

Sampling Sites
Station Name
(Station Number)

Figure 13. Map of Lake Perris showing location of Application and Treatment Areas for Copper Sulfate Application to Control Taste and Odor Producing Algae



APPENDIX A.

MONITORING PLAN

Selection of Monitoring Sites

The Monitoring and Reporting Program for Water Quality Order No. 2013-0002-DWQ sets a sampling frequency as stated below:

> "Collect samples from a minimum of six application events for each active ingredient in each environmental setting (flowing water and non-flowing water) per year, except for glyphosate. If there are less than six application events in a year, collect samples during each application event for each active ingredient in each environmental setting (flowing water and non-flowing water). If the results from six consecutive sampling events show concentrations that are less than the receiving water limitation/trigger for an active ingredient in an environmental setting, sampling shall be reduced to one application event per year for that active ingredient in that environmental setting."

DWR applies aquatic herbicides to non-flowing and flowing application sites as shown in the table below.

Site type	Aquatic herbicide	Application sites (number)
1. **Non-flowing (reservoirs):** Clifton Court Forebay	• copper-based compounds: o chelated copper (Komeen®, Nautique®) o copper sulfate o EarthTec®	1
Patterson Reservoir	• copper-based compounds: o copper sulfate o EarthTec® • imazamox	1
Dyer Reservoir	• copper-based compounds: o copper sulfate o EarthTec® • imazamox • sodium carbonate peroxyhydrate	1
O'Neill Forebay	• fluridone • imazamox • triclopyr	1

Site type	Aquatic herbicide	Application sites (number)
Coastal Branch Aqueduct Forebays	• sodium carbonate peroxyhydrate	1 - 3
Pyramid Lake	• diquat • fluridone • imazamox • sodium carbonate peroxyhydrate • triclopyr	1
Castaic Lake	• copper-based compounds: o chelated copper (Komeen®, Nautique®) o copper sulfate o EarthTec® • fluridone • imazamox • triclopyr	1
Silverwood Lake	• fluridone • imazamox • sodium carbonate peroxyhydrate • triclopyr	1
Lake Perris	• copper-based compounds: o chelated copper (Komeen®, Nautique®) o copper sulfate o EarthTec® • fluridone, • imazamox, • triclopyr	1

Site type	Aquatic herbicide	Application sites (number)
2. Flowing (aqueduct):		
South Bay Aqueduct	• copper-based compounds: o copper sulfate o EarthTec®	2 - 4
Coastal Branch Aqueduct	• copper-based compounds: o chelated copper (Komeen®, Nautique®) o copper sulfate o EarthTec®	1 - 3
East Branch Aqueduct	• copper-based compounds: o chelated copper (Komeen®, Nautique®) o copper sulfate o EarthTec® • sodium carbonate peroxyhydrate	5 – 10

a. Non-Flowing (Reservoirs): Samples will be collected at Clifton Court Forebay, Patterson Reservoir, Dyer Reservoir, O'Neill Forebay, forebays of the Coastal Branch Aqueduct, Pyramid Lake, Castaic Lake, Silverwood Lake, and Lake Perris. There is one application site at each reservoir. Samples will be collected for at least six applications per year for each active ingredient in the non-flowing environmental setting or during every application event if the total number of events is less than six. If the results for six consecutive applications show concentrations of the active ingredient below the receiving water limitation, then the frequency will be reduced to once a year for the non-flowing environmental setting.

The applicable active ingredients to be analyzed are: dissolved copper, diquat, fluridone, imazamox, and triclopyr. Sodium carbonate peroxyhydrate (e.g., PAK®27, Phycomycin, and Green Clean) does not have a receiving water limitation or monitoring trigger in the General Permit. Therefore, DWR will not monitor concentrations of the active ingredient sodium carbonate peroxyhydrate.

Physical, chemical, and visual monitoring parameters are shown in Tables A1 and A2. Visual observations only (Table A2) will be done at the Coastal Branch Aqueduct forebays. All laboratory analyses will be conducted by a laboratory certified by the California Department of Public Health (CDPH) for such analyses. Laboratory results will be reported in the annual report to the appropriate Regional Boards. Records will be maintained for a minimum of three years from the date of sample measurement or report.

b. Flowing (Aqueducts): Samples will be collected at the South Bay Aqueduct and East Branch Aqueduct. Samples will be collected for at least six applications per year for each active ingredient. The samples will be collected from at least one of the aqueduct sites to determine the effects of the chemical treatment in a flowing environment. If the results for six consecutive applications show concentrations of the active ingredient copper below the receiving water limitation, then the frequency will be reduced to once a year for the flowing environmental setting. Sodium carbonate peroxyhydrate (e.g., PAK®27, Phycomycin, and Green Clean) does not have a receiving water limitation or monitoring trigger in the General Permit. Therefore, DWR will not monitor concentrations of the active ingredient sodium carbonate peroxyhydrate.

Physical, chemical, and visual monitoring parameters are shown in Tables A1 and A2. Visual observations only (Table A2) will be done at the Coastal Branch Aqueduct. All laboratory analyses will be conducted by a laboratory certified by CDPH to do such analyses. Laboratory results will be reported in the annual report to the appropriate Regional Boards. Records will be maintained for a minimum of three years from the date of sample measurement or report.

TABLE A1

PHYSICAL AND CHEMICAL MONITORING PARAMETERS

Constituent/ Parameter	Sampling Method	Analytical Method
1. Water temperature (°F) 2. pH (number) 3 Turbidity (NTU) 4. Electrical Conductivity (umhos/cm) 5. Active ingredient[2] (ug/L) 6. Dissolved Oxygen (mg/L) 7. Hardness (mg/L) (if copper monitored)	Grab[1]	See USEPA Guidelines

[1] Samples will be collected at three feet below the surface of the water body or at mid water column depth if the depth is less than three feet, as stipulated in Table C-1 Monitoring Requirements of Order No. 2013-0002-DWQ.
[2] Dissolved copper, diquat, fluridone, imazamox, and triclopyr.

TABLE A2

VISUAL MONITORING PARAMETERS IN THE SWP

Parameter	Description
1. Monitoring area	Reservoir Aqueduct
2. Appearance of waterway	Sheen Color Clarity
3. Weather conditions	Fog Wind Rain

Types of Monitoring Required (Water Quality Order 2013-0002-DWQ)

a. Background Monitoring

Background monitoring samples shall be collected upstream at the time of the application event or in the application area just prior to (up to 24 hours in advance of) the application event.

b. Event Monitoring

Event monitoring samples shall be collected immediately downstream of the treatment area in flowing waters or immediately outside of the treatment area in non-flowing waters, immediately after the application event, but after sufficient time has elapsed such that treated water would have exited the treatment area.

c. Post-Event Monitoring

Post-event samples shall be collected within the treatment area and within one week after the application event.

State Water Project Monitoring for Water Quality Order 2013-0002-DWQ

1. Type: Reservoir (Non-flowing environmental setting)

a. Clifton Court Forebay

Aquatic Herbicides Applied: copper-based herbicides (chelated compounds [Nautique® and Komeen®], copper sulfate pentahydrate, and EarthTec®).

Treatment Area: Copper-based herbicides are applied to the smallest area possible that provides relief to State Water Project operations The treatment area is variable for each application event. A map will be submitted in the annual report to the Regional Board showing the application area, treatment area, and water bodies receiving treatment water (where applicable).

Monitoring: Refer to Table A3 for monitoring sample types, timing of sample collection, and sample location.

NOTE: There are currently no treatments planned due to the listing of the North American green sturgeon (*Acipenser medirostris*).

b. Patterson Reservoir

Aquatic Herbicides Applied: copper-based herbicides (copper sulfate pentahydrate and EarthTec®) and imazamox.

Treatment Area: The specific area is variable and dependent on the location of the algae as determined by monitoring. For each application event, a map will be submitted in the annual report to the Regional Board showing the application area and treatment area.

Monitoring: Refer to Table A3 for monitoring sample types, timing of sample collection, and sample location.

c. Dyer Reservoir

Aquatic Herbicides Applied: copper-based herbicides (copper sulfate pentahydrate and EarthTec®), imazamox, and sodium carbonate peroxyhydrate.

Treatment Area: The specific area is variable and dependent on the location of the algae as determined by monitoring. For each application event, a map will be submitted in the annual report to the Regional Board showing the application area and treatment area.

Monitoring: Refer to Table A3 for monitoring sample types, timing of sample collection, and sample location.

d. O'Neill Forebay

Aquatic Herbicides Applied: fluridone, imazamox, and triclopyr.

Treatment Area: The specific area is variable and dependent on the location of the algae as determined by monitoring. For each application event, a map will be submitted in the annual report to the Regional Board showing the application area and treatment area.

Monitoring: Refer to Table A3 for monitoring sample types, timing of sample collection, and sample location.

e. Forebays of the Coastal Branch Aqueduct

Aquatic Herbicide Applied: sodium carbonate peroxyhydrate.

Treatment Area: The specific area is variable and dependent on the location of the algae as determined by monitoring. For each application event, a map will be submitted in the annual report to the Regional Board showing the application area and treatment area.

Monitoring: Refer to Table A3 for monitoring sample types, timing of sample collection, and sample location.

f. Pyramid Lake

Aquatic Herbicides Applied: fluridone, imazamox, sodium carbonate peroxyhydrate, and triclopyr.

Treatment Area: The specific area is variable and dependent on the location of the algae as determined by monitoring. For each application event, a map will be submitted in the annual report to the Regional Board showing the application area and treatment area.

Monitoring: Refer to Table A3 for monitoring sample types, timing of sample collection, and sample location.

g. Castaic Lake

Aquatic Herbicides Applied: copper-based herbicides (chelated compounds [Nautique® and Komeen®], copper sulfate pentahydrate, and EarthTec®), fluridone, imazamox, and triclopyr.

Treatment Area: The specific area is variable and dependent on the location of the source of taste and odor production as determined by monitoring. For each application event, a map will be submitted in the annual report to the Regional Board showing the application area, treatment area, and water bodies receiving treated water (where applicable).

Monitoring: Refer to Table A3 for monitoring sample types, timing of sample collection, and sample location.

h. Silverwood Lake

Aquatic Herbicides Applied: fluridone, imazamox, sodium carbonate peroxyhydrate, and triclopyr.

Treatment Area: The treatment area is variable and dependent on the location of the source of taste and odor production as determined by monitoring. For each application event, a map will be submitted in the annual report to the Regional Board showing the application area, treatment area, and water bodies receiving treatment water (where applicable).

Monitoring: Refer to Table A3 for monitoring sample types, timing of sample collection, and sample location.

i. Lake Perris

Aquatic Herbicides Applied: copper-based herbicides (chelated compounds [Nautique® and Komeen®], copper sulfate pentahydrate, and EarthTec®), fluridone, imazamox, and triclopyr.

Treatment Area: The treatment area is variable and dependent on the location of the source of taste and odor production as determined by monitoring. For each application event, a map will be submitted in the annual report to the Regional Board showing the application area, treatment area, and water bodies receiving treatment water (where applicable).

Monitoring: Refer to Table A3 for monitoring sample types, timing of sample collection, and sample location.

2. Type: Aqueduct (flowing water)

a. South Bay Aqueduct (SBA)

Aquatic Herbicide Applied: copper sulfate pentahydrate and EarthTec®.

Treatment Area: Copper sulfate is applied at a maximum of three locations in the open portion of the SBA. The treatment area is defined from the Backsurge Pool at Milepost (MP) 3.3 to MP 16.0.

Monitoring: Refer to Table A3 for monitoring sample types, timing of sample collection, and sample location.

b. Coastal Branch Aqueduct

Aquatic Herbicides Applied: copper-based herbicides (chelated compounds [Nautique® and Komeen®], copper sulfate pentahydrate, and EarthTec®).

Treatment Area: The aqueduct from MP 0.2 near the confluence with the California Aqueduct to Devil's Den Pumping Plant at MP 14.9.

Monitoring: Refer to Table A3 for monitoring sample types, timing of sample collection, and sample location.

c. East Branch Aqueduct

Aquatic Herbicides Applied: copper-based herbicides (chelated compounds [Nautique® and Komeen®], copper sulfate pentahydrate, and EarthTec®) and sodium carbonate peroxyhydrate (e.g., PAK®27).

Treatment Area: The specific area is variable and dependent on the location of the source of taste and odor production as determined by monitoring and laboratory analysis of samples for MIB and geosmin. For each application event, a map will be included in the annual report to the Regional Board showing the application area, treatment area, and water bodies receiving treated water (where applicable).

Monitoring: Refer to Table A3 for monitoring sample types, timing of sample collection, and sample location.

TABLE A3

MONITORING IN THE SWP: Timing and Location

Sample Type	Timing of Sample Collection	Sample Location	
		Reservoir (non-flowing)	**Aqueduct (flowing)**
Background	Samples shown in Tables A1 and A2 will be collected within 24 hours prior to the application event.	Samples shown in Tables A1 and A2 will be collected within the application area.	Samples shown in Tables A1 and A2 will be collected within the application area.
Event	Samples shown in Tables A1 and A2 will be collected after the application event.	Samples shown in Tables A1 and A2 will be collected outside of the treatment area after the application event. For Clifton Court Forebay treatments, samples will be collected in the intake channel to Harvey O. Banks Pumping Plant downstream of the treatment area. For Lake Perris samples, the collection location will be the reservoir outlet station (PE002) in the application area.	Samples shown in Tables A1 and A2 will be collected outside of the treatment area after the application event.
Post-event	*Reservoirs*: Samples shown in Tables A1 and A2 will be collected within seven days after the application event, or when treatment is deemed complete. When treating with copper compounds, treatment will likely be complete within two – three weeks. *Aqueducts*: Samples shown in Tables A1 and A2 will be collected within seven days after the application event.	Samples shown in Tables A1 and A2 will be collected within the treatment area.	Samples shown in Tables A1 and A2 will be collected within the treatment area.

Appendix C – Air Quality Emissions Calculations

EMFAC2011 Emissions Factors & Analysis Assumptions

Region: San Joaquin Valley Unified APCD
Calendar Year: 2014
Season: Annual

Model Assumptions:

Vehicle Class	Calendar Year	Season	Fuel	MdlYr	Speed (miles/hr)
LDT2	2014	Annual	GAS	Aggregated	Aggregated
T7 Ag	2014	Annual	DSL	Aggregated	Aggregated
T6 instate small	2014	Annual	DSL	Aggregated	Aggregated
T7 tractor	2014	Annual	DSL	Aggregated	Aggregated

Emissions Factors:

Vehicle Class	Units	LDT2	T7 Ag	T6 instate small	T7 tractor
ROG_RUNEX	(gms/mile)	0.063	0.591	0.340	0.383
ROG_IDLEX	(gms/vehicle/day)	0.000	4.115	0.252	3.134
ROG_STREX	(gms/vehicle/day)	2.364	0.000	0.000	0.000
ROG_DIURN	(gms/vehicle/day)	0.740	0.000	0.000	0.000
ROG_HTSK	(gms/vehicle/day)	1.292	0.000	0.000	0.000
ROG_RUNLS	(gms/mile)	0.106	0.000	0.000	0.000
ROG_RESTL	(gms/vehicle/day)	0.484	0.000	0.000	0.000
ROG_Running	(gms/mile)	0.169	0.591	0.340	0.383
ROG_Idle	(gms/vehicle/day)	4.880	4.115	0.252	3.134
TOG_RUNEX	(gms/mile)	0.085	0.673	0.387	0.436
TOG_IDLEX	(gms/vehicle/day)	0.000	4.685	0.287	3.568
TOG_STREX	(gms/vehicle/day)	2.527	0.000	0.000	0.000
TOG_DIURN	(gms/vehicle/day)	0.740	0.000	0.000	0.000
TOG_HTSK	(gms/vehicle/day)	1.292	0.000	0.000	0.000
TOG_RUNLS	(gms/mile)	0.106	0.000	0.000	0.000
TOG_RESTL	(gms/vehicle/day)	0.484	0.000	0.000	0.000
TOG_Running	(gms/mile)	0.191	0.673	0.387	0.436
TOG_Idle	(gms/vehicle/day)	5.042	4.685	0.287	3.568
CO_RUNEX	(gms/mile)	2.118	2.829	1.093	1.778
CO_IDLEX	(gms/vehicle/day)	0.000	14.464	2.707	15.129
CO_STREX	(gms/vehicle/day)	29.796	0.000	0.000	0.000
CO_Running	(gms/mile)	2.118	2.829	1.093	1.778
CO_Idle	(gms/vehicle/day)	29.796	14.464	2.707	15.129
NOX_RUNEX	(gms/mile)	0.269	13.665	5.650	10.863

NOX_IDLEX	(gms/vehicle/day)	0.000	26.643	8.629	29.066
NOX_STREX	(gms/vehicle/day)	2.694	0.000	0.000	0.000
NOX_Running	(gms/mile)	0.269	13.665	5.650	10.863
NOX_Idle	(gms/vehicle/day)	2.694	26.643	8.629	29.066
PM10_RUNEX	(gms/mile)	0.002	0.416	0.208	0.216
PM10_IDLEX	(gms/vehicle/day)	0.000	0.630	0.060	0.248
PM10_STREX	(gms/vehicle/day)	0.022	0.000	0.000	0.000
PM10_PMTW	(gms/mile)	0.008	0.036	0.012	0.036
PM10_PMBW	(gms/mile)	0.037	0.062	0.130	0.062
PM10_Running	(gms/mile)	0.047	0.513	0.351	0.313
PM10_Idle	(gms/vehicle/day)	0.022	0.630	0.060	0.248
PM2_5_RUNEX	(gms/mile)	0.002	0.382	0.192	0.198
PM2_5_IDLEX	(gms/vehicle/day)	0.000	0.579	0.056	0.228
PM2_5_STREX	(gms/vehicle/day)	0.020	0.000	0.000	0.000
PM2_5_PMTW	(gms/mile)	0.002	0.009	0.003	0.009
PM2_5_PMBW	(gms/mile)	0.016	0.026	0.056	0.026
PM2_5_Running	(gms/mile)	0.020	0.418	0.250	0.234
PM2_5_Idle	(gms/vehicle/day)	0.020	0.579	0.056	0.228
SOX_RUNEX	(gms/mile)	0.005	0.017	0.011	0.017
SOX_IDLEX	(gms/vehicle/day)	0.000	0.022	0.007	0.029
SOX_STREX	(gms/vehicle/day)	0.007	0.000	0.000	0.000
SOX_Running	(gms/mile)	0.005	0.017	0.011	0.017
SOX_Idle	(gms/vehicle/day)	0.007	0.022	0.007	0.029

Vehicle Class LDT2 (Pickup trucks)
# of miles/day 75
# of vehicles 5

Pollutant	Running (grams/mile)	Idle (grams/ vehicle/day)	Total (grams)	Total (lbs)*
ROG	0.169	4.880	87.872	0.194
TOG	0.191	5.042	96.910	0.214
CO	2.118	29.796	943.169	2.079
NOX	0.269	2.694	114.377	0.252
PM10	0.047	0.022	17.699	0.039
PM2.5	0.020	0.020	7.489	0.017
SOX	0.005	0.007	1.812	0.004

* Shown in Table 3(a)

Vehicle Class T7 Ag (Hopper Truck)
# of miles/day 75
# of vehicles 1

Pollutant	Running (grams/mile)	Idle (grams/ vehicle/day)	Total (grams)	Total (lbs)*
ROG	0.591	4.115	48.461	0.107
TOG	0.673	4.685	55.169	0.122
CO	2.829	14.464	226.609	0.500
NOX	13.665	26.643	1051.531	2.318
PM10	0.513	0.630	39.129	0.086
PM2.5	0.418	0.579	31.914	0.070
SOX	0.017	0.022	1.279	0.003

* Shown in Table 3(a)

Vehicle Class T6 instate small (Water Truck)
# of miles/day 75
# of vehicles 1

Pollutant	Running (grams/mile)	Idle (grams/ vehicle/day)	Total (grams)	Total (lbs)*
ROG	0.340	0.252	25.778	0.057
TOG	0.387	0.287	29.347	0.065
CO	1.093	2.707	84.648	0.187
NOX	5.650	8.629	432.402	0.953
PM10	0.351	0.060	26.355	0.058
PM2.5	0.250	0.056	18.840	0.042
SOX	0.011	0.007	0.860	0.002

* Shown in Table 3(a)

Vehicle Class T7 tractor (Flatbed)
# of miles/day 75
# of vehicles 1

Pollutant	Running (grams/mile)	Idle (grams/ vehicle/day)	Total (grams)	Total (lbs)*
ROG	0.383	3.134	31.874	0.070
TOG	0.436	3.568	36.286	0.080
CO	1.778	15.129	148.486	0.327
NOX	10.863	29.066	843.796	1.860
PM10	0.313	0.248	23.755	0.052
PM2.5	0.234	0.228	17.770	0.039
SOX	0.017	0.029	1.279	0.003

* Shown in Table 3(a)

Region: South Coast AQMD
Calendar Year: 2014
Season: Annual

Model Assumptions:

Vehicle Class	Calendar Year	Season	Fuel	MdlYr	Speed (miles/hr)
LDT2	2014	Annual	GAS	Aggregated	Aggregated
T7 Ag	2014	Annual	DSL	Aggregated	Aggregated
T6 instate small	2014	Annual	DSL	Aggregated	Aggregated
T7 tractor	2014	Annual	DSL	Aggregated	Aggregated

Emissions Factors:

Vehicle Class	Units	LDT2	T7 Ag	T6 instate small	T7 tractor
ROG_RUNEX	(gms/mile)	0.052	0.551	0.208	0.365
ROG_IDLEX	(gms/vehicle/day)	0.000	4.115	0.254	3.113
ROG_STREX	(gms/vehicle/day)	1.830	0.000	0.000	0.000
ROG_DIURN	(gms/vehicle/day)	0.526	0.000	0.000	0.000
ROG_HTSK	(gms/vehicle/day)	1.096	0.000	0.000	0.000
ROG_RUNLS	(gms/mile)	0.098	0.000	0.000	0.000
ROG_RESTL	(gms/vehicle/day)	0.432	0.000	0.000	0.000
ROG_Running	(gms/mile)	0.150	0.551	0.208	0.365
ROG_Idle	(gms/vehicle/day)	3.884	4.115	0.254	3.113
TOG_RUNEX	(gms/mile)	0.074	0.627	0.236	0.415
TOG_IDLEX	(gms/vehicle/day)	0.000	4.685	0.289	3.543
TOG_STREX	(gms/vehicle/day)	1.955	0.000	0.000	0.000
TOG_DIURN	(gms/vehicle/day)	0.526	0.000	0.000	0.000
TOG_HTSK	(gms/vehicle/day)	1.096	0.000	0.000	0.000
TOG_RUNLS	(gms/mile)	0.098	0.000	0.000	0.000
TOG_RESTL	(gms/vehicle/day)	0.432	0.000	0.000	0.000
TOG_Running	(gms/mile)	0.172	0.627	0.236	0.415
TOG_Idle	(gms/vehicle/day)	4.009	4.685	0.289	3.543
CO_RUNEX	(gms/mile)	1.927	2.526	0.832	1.764
CO_IDLEX	(gms/vehicle/day)	0.000	14.464	2.698	14.885
CO_STREX	(gms/vehicle/day)	23.888	0.000	0.000	0.000
CO_Running	(gms/mile)	1.927	2.526	0.832	1.764
CO_Idle	(gms/vehicle/day)	23.888	14.464	2.698	14.885
NOX_RUNEX	(gms/mile)	0.229	13.487	4.387	10.909
NOX_IDLEX	(gms/vehicle/day)	0.000	26.643	7.775	29.032
NOX_STREX	(gms/vehicle/day)	2.329	0.000	0.000	0.000
NOX_Running	(gms/mile)	0.229	13.487	4.387	10.909
NOX_Idle	(gms/vehicle/day)	2.329	26.643	7.775	29.032

PM10_RUNEX	(gms/mile)	0.002	0.447	0.165	0.239
PM10_IDLEX	(gms/vehicle/day)	0.000	0.630	0.054	0.255
PM10_STREX	(gms/vehicle/day)	0.018	0.000	0.000	0.000
PM10_PMTW	(gms/mile)	0.008	0.036	0.012	0.036
PM10_PMBW	(gms/mile)	0.037	0.062	0.130	0.062
PM10_Running	(gms/mile)	0.047	0.545	0.307	0.337
PM10_Idle	(gms/vehicle/day)	0.018	0.630	0.054	0.255
PM2_5_RUNEX	(gms/mile)	0.002	0.411	0.152	0.220
PM2_5_IDLEX	(gms/vehicle/day)	0.000	0.579	0.050	0.235
PM2_5_STREX	(gms/vehicle/day)	0.016	0.000	0.000	0.000
PM2_5_PMTW	(gms/mile)	0.002	0.009	0.003	0.009
PM2_5_PMBW	(gms/mile)	0.016	0.026	0.056	0.026
PM2_5_Running	(gms/mile)	0.020	0.447	0.211	0.255
PM2_5_Idle	(gms/vehicle/day)	0.016	0.579	0.050	0.235
SOX_RUNEX	(gms/mile)	0.005	0.016	0.011	0.016
SOX_IDLEX	(gms/vehicle/day)	0.000	0.022	0.007	0.028
SOX_STREX	(gms/vehicle/day)	0.007	0.000	0.000	0.000
SOX_Running	(gms/mile)	0.005	0.016	0.011	0.016
SOX_Idle	(gms/vehicle/day)	0.007	0.022	0.007	0.028

Vehicle Class LDT2 (Pickup trucks)
# of miles/day 75
# of vehicles 5

Pollutant	Running (grams/mile)	Idle (grams/ vehicle/day)	Total (grams)	Total (lbs)*
ROG	0.150	3.884	75.56	0.167
TOG	0.172	4.009	84.48	0.186
CO	1.927	23.888	842.13	1.857
NOX	0.229	2.329	97.60	0.215
PM10	0.047	0.018	17.69	0.039
PM2.5	0.020	0.016	7.49	0.017
SOX	0.005	0.007	1.87	0.004

* Shown in Table 3(b)

Vehicle Class T7 Ag (Hopper Truck)
# of miles/day 75
# of vehicles 1

Pollutant	Running (grams/mile)	Idle (grams/ vehicle/day)	Total (grams)	Total (lbs)*
ROG	0.551	4.115	45.44	0.100
TOG	0.627	4.685	51.73	0.114
CO	2.526	14.464	203.95	0.450
NOX	13.487	26.643	1038.20	2.289
PM10	0.545	0.630	41.50	0.092
PM2.5	0.447	0.579	34.10	0.075
SOX	0.016	0.022	1.24	0.003

* Shown in Table 3(b)

Vehicle Class T6 instate small (Water Truck)
# of miles/day 75
# of vehicles 1

Pollutant	Running (grams/mile)	Idle (grams/ vehicle/day)	Total (grams)	Total (lbs)*
ROG	0.150	3.884	15.82	0.035
TOG	0.172	4.009	18.01	0.040
CO	1.927	23.888	65.08	0.143
NOX	0.229	2.329	336.82	0.743
PM10	0.047	0.018	23.11	0.051
PM2.5	0.020	0.016	15.85	0.035
SOX	0.005	0.007	0.81	0.002

* Shown in Table 3(b)

Vehicle Class T7 tractor (Flatbed)
# of miles/day 75
# of vehicles 1

Pollutant	Running (grams/mile)	Idle (grams/ vehicle/day)	Total (grams)	Total (lbs)*
ROG	0.551	4.115	30.47	0.067
TOG	0.627	4.685	34.69	0.076
CO	2.526	14.464	147.20	0.325
NOX	13.487	26.643	847.21	1.868
PM10	0.545	0.630	25.51	0.056
PM2.5	0.447	0.579	19.39	0.043
SOX	0.016	0.022	1.26	0.003

* Shown in Table 3(b)

Helicopter Emissions Factors & Analysis Assumptions

Aircraft_ ICAO	Aircraft_ Name	LTO NOx (g)	LTO HC (g)	LTO CO (g)	LTO PM non vol. (g)	One hour NOx (kg)	One hour HC (kg)	One hour CO (kg)	One hour PM non vol. (kg)
B06	BELL 206B	85	358	463	3	0.63	0.70	0.86	0.019

Pollutant	Total LTO (lbs.)	Total One hour (lbs.)	Total (lbs.)*
NOx	4.70	5.53	10.23
HC	19.72	6.13	25.85
CO	25.50	7.62	33.12
PM	0.17	0.17	0.34

* Shown in Tables 3(a & b)

APPENDIX D

STATE WATER PROJECT COPPER SULFATE APPLICATION

Biological Resources Technical Report

Prepared for
California Department of Water Resources

March 2014

STATE WATER PROJECT COPPER SULFATE APPLICATION

Biological Resources Technical Report

Prepared for
California Department of Water Resources

March 2014

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STATE WATER PROJECT AQUATIC PESTICIDE APPLICATION

Biological Resources Technical Report

Executive Summary

The California Department of Water Resources (DWR) proposes to apply copper sulfate to four water bodies to control aquatic weeds and algal blooms that include O'Neill Forebay, Quail Lake, Pyramid Lake, and Silverwood Lake. Copper sulfate would be applied at Quail Lake, Pyramid Lake, Silverwood Lake, and O'Neill Forebay using helicopters and at Quail Lake and O'Neill Forebay via boat.

ESA biologists conducted biological resource field reconnaissance surveys at each of the four water bodies in January and February 2014 to document existing conditions, describe vegetation communities, and identify sensitive biological resources present or potentially present at the sites that could be directly or inadvertently affected by the copper sulfate applications. Additionally, a literature and database search was conducted to identify sensitive plant, animal, or natural communities previously recorded within the vicinity of the water bodies.

Based on an analysis of habitat present at each of the four water bodies, 12 special-status plants and 19 special-status animals were determined to have potential to occur within open water, wetland and/or riparian forest habitat. Special-status animals include fish, amphibian, reptile, and bird species. Additionally, the four water bodies each contain riparian habitats that are considered sensitive natural communities by the California Department of Fish and Wildlife (CDFW).

Following the field assessments, ESA analyzed the potential for copper sulfate applications to impact sensitive biological resources in the project area. Copper sulfate would be applied by helicopter and/or boat to open water areas, away from the immediate shoreline and would target algal blooms and aquatic weeds. Therefore, impacts to special-status plant species, wetlands, riparian habitats, and/or other sensitive natural communities found within upland areas would not be anticipated.

Impacts to special-status wildlife species as the result of copper sulfate applications are expected to be less than significant. There is a concern about disruptions to the breeding cycle of nesting birds; therefore, the implementation of the proposed mitigation measures (including application timing, pre-application nesting bird surveys, and establishment of nesting buffers and implementation of an Aquatic Pesticides Application Plan) would avoid and minimize potential impacts to wildlife.

The proposed project would not conflict with sensitive habitats, wildlife movement, or any local policies or Habitat Conservation Plans/Natural Conservation Community Plans.

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CHAPTER 1
Introduction

This report analyzes impacts to biological resources that would result from the application of copper sulfate into four bodies of water located within the State Water Project (SWP) of California. Below is a description of the project, relevant laws regulating biological resources in the region, the existing environmental conditions within the project footprint and surrounding areas, and identification of potential impacts to biological resources that may result from implementation of the project. Mitigation measures are recommended to avoid or reduce potential impacts to a less-than-significant level.

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CHAPTER 2
Project Description

The California Department of Water Resources (DWR) proposes to apply copper-based herbicides O'Neill Forebay, Quail Lake, Pyramid Lake, and Silverwood Lake to control aquatic weeds and algal blooms under the new statewide National Pollutant Discharge Elimination System (NPDES) permit. The locations of the reservoirs and forebay are shown in **Figure 1** and described in **Section 5**. Applications of copper sulfate would be carried out only as needed, that is, when other control options have been exhausted.

Applications of copper-based herbicides would be made to Quail Lake, Pyramid Lake, Silverwood Lake, and O'Neill Forebay using agricultural spreaders suspended from helicopters. The spreaders would be operated over areas identified for treatment. Existing disturbed areas located at Quail Lake, Pyramid Lake, Silverwood Lake, and O'Neill Forebay would be used as equipment staging areas intended to also be used as heliports or landing pads during copper sulfate applications. Application areas may vary in size based on blooms, but would not exceed 145 acres at Quail Lake, 650 acres at Pyramid Lake, 490 acres at Silverwood Lake, or 1,350 acres at O'Neill Forebay. The applicator would be properly licensed for the applications and ground crews would wear appropriate personal protective equipment to reduce exposure to copper sulfate. During application, the water bodies would be closed for recreational use.

Quail Lake and O'Neill Forebay copper treatments would also be conducted by boat. Application areas would vary in size, but would not exceed 145 acres at Quail Lake or 1,350 at O'Neill Forebay. Quail Lake and O'Neill Forebay would be closed for recreational use during applications.

2.1 Implementation of DWR, Aquatic Pesticides Application Plan (APAP), 2013

State water quality regulators require persons using aquatic pesticides to apply for coverage under the general NPDES permit, No. 2013-0002-DWQ. To obtain coverage under this permit, applicants are required to demonstrate either that its discharges comply with the water quality criteria for priority pollutants under the California Toxics Rule (CTR) and National Toxics Rule (NTR) or that it qualifies for an exception from compliance with such criteria, pursuant to section 5.3 of the SWRCB's Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California. Furthermore, the permit requires applicants to develop and submit an Aquatic Pesticides Application Plan (APAP) describing their pesticide application, including best management practices (BMPs), and water quality monitoring programs.

DWR has developed an APAP (DWR, 2013a) for copper sulfate applications that includes comprehensive BMPs to avoid and minimize the potential for copper toxicities to sensitive biological resources and a monitoring program intended to detect copper concentrations in water and any potential effects to wildlife, including fish.

The following BMPs are included in DWR's APAP for copper sulfate application:

- **Application:** Copper sulfate is applied under the supervision of a certified pesticide applicator. Delta Field Division has one licensed Pest Control Advisor (PCA) who also works in the San Luis Field Division and a total of seven Certified Qualified Applicators (QAC). Southern Field Division has two licensed PCAs and six to eight certified QACs. These individuals are trained to ensure that algaecides and aquatic herbicides are applied at rates consistent with label requirements and in a manner that avoids potential adverse effects including, but not limited to, fish kills. Copper sulfate has been used since the early 1970s to control filter clogging algae and taste and odor producing cyanobacteria.
- **Notification:** State water contractors, who also provide treated municipal water to customers, are notified by email at least 48 hours prior to a treatment. The notification includes date, start and end time of the treatment, and travel time of copper sulfate by milepost. Additionally, a PCA will submit a written recommendation for the use of aquatic herbicides to the County Agricultural Commissioner.
- **Treatment:** The copper is applied during daylight hours of maximum photosynthetic activity to optimize copper uptake by the algal community.
- **Spill Prevention and Cleanup:** Staff will apply copper sulfate according to label instructions in order to prevent spills. In the event of a spill, staff will follow the field division's established emergency response procedures and refer to the applicable material safety data sheet (MSDS) for instructions on containing and cleaning up the spill. Emergency response and MSDS procedures will be reviewed regularly. A copy of the emergency response procedures and material safety data sheets will be available during each treatment. Cleanup equipment will be kept in good working order and will be readily available at each application site.
- **Monitoring:** Water quality is monitored before, during, and after treatments. Parameters measured are water temperature, turbidity, pH, specific conductance, active ingredient (copper), dissolved oxygen (DO), and hardness as required by the NPDES general permit and stated in the APAP (Appendix A).
- **Access:** Depending on the facility, public access is temporarily closed or restricted in order to avoid exposure.
- **Post-Treatment:** The efficacy of the treatment is evaluated at about one week after the application. Algae are surveyed to determine the effectiveness of the treatment at reducing biomass, and taste and odor compounds are monitored weekly throughout the year.

Monitoring data collected as part of the APAP are used to:

- Identify water quality improvements or degradation;
- detect fish (and other wildlife) kills through visual fish and wildlife monitoring;
- recommend improvements to the APAP; and
- compare monitoring data to water quality standards.

SOURCE: ESRI

Aquatic Pesticides Application Plan . 130044.04

Figure 1

Project Vicinity Map

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CHAPTER 3
Regulatory Framework

The Project is subject to federal and state regulations regarding biological resources. A summary of the regulations pertaining to the proposed Project is provided below.

3.1 Federal

3.1.1 Federal Endangered Species Act

Under the federal Endangered Species Act (FESA), the Secretary of the Interior and the Secretary of Commerce jointly have the authority to list a species as threatened or endangered (16 USC 1533(c)). Pursuant to the requirements of FESA, an agency reviewing a proposed project within its jurisdiction must determine whether any federally listed or proposed species may be present in the project region and determine whether the proposed project would have a potentially significant impact on such species. In addition, the agency is required to determine whether the project is likely to jeopardize the continued existence of any species proposed to be listed under FESA or result in the destruction or adverse modification of critical habitat proposed to be designated for such species (16 USC 1536(3), (4)). Project-related impacts to these species or their habitats would be considered "significant." Section 7 of FESA contains a "take" prohibition which prohibits any action conducted, funded, or approved by a federal agency that adversely affects a member of an endangered or threatened species without prior formal consultation with the United State Fish and Wildlife Service (USFWS). Formal consultation with the USFWS would result in the issuance of a Biological Opinion (BO) that includes either a jeopardy or non-jeopardy decision issued by the USFWS to the consulting federal agency. The BO would also include the possible issuance of an "incidental take" permit. If such authorization is given, the project proponent must provide the USFWS with a Habitat Conservation Plan (HCP) for the affected species and publish notification of the application for a permit in the Federal Register.

Section 4(a)(3) and (b)(2) of the FESA requires the designation of critical habitat to the maximum extent possible and prudent based on the best available scientific data and after considering the economic impacts of any designations. Critical habitat is defined in section 3(5)(A) of the FESA as (1) areas within the geographic range of a species that are occupied by individuals of that species and contain the primary constituent elements (physical and biological features) essential to the conservation of the species, thus warranting special management consideration or protection, and (2) areas outside of the geographic range of a species at the time of listing but that are considered essential to the conservation of the species.

3.1.2 Migratory Bird Treaty Act

The Migratory Bird Treaty Act (MBTA), first enacted in 1918, domestically implements a series of treaties between the United States and Great Britain (on behalf of Canada), Mexico, Japan, and the former Soviet Union that provide for international migratory bird protection. The MBTA authorizes the Secretary of the Interior to regulate the taking of migratory birds; the act provides that it shall be unlawful, except as permitted by regulations, "to pursue, take, or kill any migratory bird, or any part, nest or egg of any such bird…" (16 USC 703). This prohibition includes both direct and indirect acts, although harassment and habitat modification are not included unless they result in direct loss of birds, nests, or eggs. The current list of species protected by the MBTA includes several hundred species and essentially includes all native birds. Permits for take of nongame migratory birds can be issued only for specific activities, such as scientific collecting, rehabilitation, propagation, education, taxidermy, and protection of human health and safety and personal property.

3.1.3 Waters of the United States, Including Wetlands

Wetlands are a subset of "waters of the United States" and receive protection under Section 404 of the Clean Water Act (CWA). The term "waters of the U.S." as defined in Code of Federal Regulations (33 CFR 328.3(a); 40 CFR 230.3(s)), includes all waters which are currently used, were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters subject to the ebb and flow of the tide. Wetlands are defined by the federal government (CFR, Section 328.3(b), 1991) as those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Waters of the U.S. do not include prior converted cropland. Notwithstanding the determination of an area's status as prior converted cropland by any other federal agency, for the purposes of the FCWA, the final authority regarding CWA jurisdiction remains with U.S. Environmental Protection Agency (EPA) (328.3(a)(8) added 58 FR 45035, August 25, 1993. The United State Army Corps of Engineers (USACE) regulates the discharge of dredged or fill material into waters of the U.S. under Section 404 of the CWA.

3.1.4 Clean Water Act

In accordance with Section 404 of the CWA, the USACE regulates discharge of dredged or fill material into waters of the U.S. Waters of the U.S. and their lateral limits are defined in 33 CFR 328.3(a) and includes navigable waters of the U.S., interstate waters, all other waters where the use or degradation or destruction of the waters could affect interstate or foreign commerce, tributaries to any of these waters, and wetlands that meet any of these criteria or that are adjacent to any of these waters or their tributaries. Waters of the U.S. are often categorized as "jurisdictional wetlands" (i.e., wetlands over which the USACE exercises jurisdiction under Section 404) and "other waters of the United States" when habitat values and characteristics are being described. "Fill" is defined as any material that replaces any portion of a water of the U.S. with dry land or that changes the bottom elevation of any portion of a water of the U.S. Any activity resulting in the placement of dredged or fill material within waters of the United States

requires a permit from USACE. In accordance with Section 401 of the CWA, projects that apply for a USACE permit for discharge of dredged or fill material must obtain water quality certification from the appropriate Regional Water Quality Control Board (RWQCB) indicating that the proposed project would uphold State of California water quality standards.

3.2 State

3.2.1 California Fish and Game Codes

Section 2080 of the California Fish and Game Code states, "No person shall import into this state [California], export out of this state, or take, possess, purchase, or sell within this state, any species, or any part or product thereof, that the commission [California Fish and Game Commission] determines to be an endangered species or threatened species, or attempt any of those acts, except as otherwise provided in this chapter, or the Native Plant Protection Act, or the California Desert Native Plants Act." Pursuant to Section 2081 of the Code, the California Department of Fish and Wildlife (CDFW) may authorize individuals or public agencies to import, export, take, or possess, any state-listed endangered, threatened, or candidate species. These otherwise prohibited acts may be authorized through permits or Memoranda of Understanding if: (1) the take is incidental to an otherwise lawful activity; (2) impacts of the authorized take are minimized and fully mitigated; (3) the permit is consistent with any regulations adopted pursuant to any recovery plan for the species; and (4) the applicant ensures adequate funding to implement the measures required by CDFW. The CDFW makes this determination based on available scientific information and considers the ability of the species to survive and reproduce. Due to the potential presence of state-listed rare, threatened, or endangered species on the project site, Sections 2080 and 2081 of the Code were considered in this evaluation.

Section 3503 of the California Fish and Game Code states that it is unlawful to take, possess, or needlessly destroy the nest or eggs of any bird. Section 3503.5 specifically states that it is unlawful to take, possess, or destroy any raptors (i.e., species in the orders Falconiformes and Strigiformes), including their nests or eggs. Typical violations of these codes include destruction of active nests resulting from removal of vegetation in which the nests are located. Violation of Section 3503.5 could also include failure of active raptor nests resulting from disturbance of nesting pairs by nearby project construction. This statute does not provide for the issuance of any type of incidental take permit.

Protection of fully protected species is described in Sections 3511, 4700, 5050, and 5515 of the California Fish and Game Code. These statutes prohibit take or possession of fully protected species. CDFW is unable to authorize incidental take of fully protected species when activities are proposed in areas inhabited by those species. CDFW has informed nonfederal agencies and private parties that they must avoid take of any fully protected species in carrying out projects.

Section 1602 of the California Fish and Game Code requires a Streambed Alteration Agreement for any activity that may alter the bed and/or bank of a lake, stream, river, or channel. Typical activities that require a Streambed Alteration Agreement include excavation or fill placed within

a channel, vegetation clearing, structures for diversion of water, installation of culverts and bridge supports, cofferdams for construction dewatering, and bank reinforcement.

3.2.2 California Endangered Species Act

Under the California Endangered Species Act (CESA), the CDFW is responsible for maintaining a list of threatened and endangered species, candidate species, and species of special concern. Pursuant to the requirements of CESA, an agency reviewing a proposed project within its jurisdiction must determine whether any state listed endangered or threatened species may be present on the project region and determine whether the proposed project would have a potentially significant impact on such species. In addition, the CDFW encourages informal consultation on any proposed project that may impact a candidate species. If there were project-related impacts to species on the CESA threatened and endangered list, they would be considered "significant." Impacts to "species of concern" would be considered "significant" under certain circumstances, discussed below.

3.2.3 Native Plant Protection Act

The Native Plant Protection Act (NPPA) includes measures to preserve, protect, and enhance rare and endangered native plants. The list of native plants afforded protection pursuant to the NPPA includes those listed as rare and endangered under the CESA. The NPPA provides limitations on take as follows: "No person will import into this State, or take, possess, or sell within this State" any rare or endangered native plant, except in compliance with provisions of the act. Individual landowners are required to notify the CDFW at least 10 days in advance of changing land uses to allow the CDFW to salvage any rare or endangered native plant material. Due to the absence of state-listed rare, threatened, or endangered plant species on the project site, the NPPA was not considered in this evaluation.

3.2.4 CEQA Guidelines Section 15380

Although threatened and endangered species are protected by specific federal and state statutes, *CEQA Guidelines* Section 15380(b) provides that a species not listed on the federal or state list of protected species may be considered rare or endangered if the species can be shown to meet certain specified criteria. These criteria have been modeled after the definition in FESA and the section of the California Fish and Game Code dealing with rare or endangered plants or animals. This section was included in CEQA primarily to deal with situations in which a public agency is reviewing a project that may have a significant effect on, for example, a candidate species that has not been listed by either USFWS or CDFW. Thus, CEQA provides an agency with the ability to protect a species from the potential impacts of a project until the respective government agencies have an opportunity to designate the species as protected, if warranted. CEQA also calls for the protection of other locally or regionally significant resources, including natural communities. Although natural communities do not at present have legal protection of any kind, CEQA calls for an assessment of whether any such resources would be affected, and requires findings of significance if there would be substantial losses. Natural communities listed by the California Natural Diversity Database (CNDDB) as sensitive are considered by CDFW to be

significant resources and fall under the *CEQA Guidelines* for addressing impacts. Local planning documents such as general plans often identify these resources as well.

3.2.5 Porter-Cologne Water Quality Control Act

Under the Porter-Cologne Water Quality Control Act, waters of the state fall under the jurisdiction of the appropriate RWQCB. Under the act, the RWQCB must prepare and periodically update water quality control basin plans. Each basin plan sets forth water quality standards for surface water and groundwater, as well as actions to control nonpoint and point sources of pollution to achieve and maintain these standards. Projects that affect wetlands or waters must meet waste discharge requirements of the RWQCB, which may be issued in addition to a water quality certification or waiver under Section 401 of the CWA.

3.3 Local

Based on a review of local regulations and policies conducted for the four water bodies, no local regulations or policies apply to the proposed project.

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CHAPTER 4
Methods

4.1 Literature Review and Database Search

ESA conducted a thorough review of available existing information about the present or prior biological conditions of the project site and of the surrounding area. The following resources were referenced for the analyses of this report:

- CDFW California Natural Diversity Data Base (CNDDB) (CDFW, 2014);
- CDFW State and federally listed endangered and threatened animals of California (CDFW, 2014);
- California Native Plant Society (CNPS) Inventory of Rare and Endangered Vascular Plants of California (CNPS, 2014);
- National Resources Conservation Service Web Soil Survey Database (USDA NRCS, 2014);
- Topographic imagery and aerial photographs of the Project location and vicinity; and
- Annual Water Quality Monitoring Reports (DWR, 2011, 2012, 2013a and 2013b)

4.2 Biological Resource Reconnaissance

ESA biologists Matthew South, Robert Sweet, Rachel Brownsey, and Michelle Giolli conducted a biological resource field reconnaissance survey at the reservoirs and forebay in January and February 2014 (see **Table 1**). The reconnaissance surveys at both Pyramid Lake and Silverwood Lake were conducted from a boat and the surveys at Quail Lake and O'Neill Forebay were conducted on foot and/or motor vehicle. The biologists had one hundred percent visual coverage of each water body and the vegetation along each shoreline to accurately identify and characterize vegetation and habitats.

TABLE 1
DETAILS OF SITE RECONNAISSANCE

Water Body	Date	Biologists
Pyramid Lake	January 29, 2014	Matthew South and Robert Sweet
Quail Lake	January 29, 2014	Matthew South and Robert Sweet
Silverwood Lake	January 31, 2014	Matthew South and Robert Sweet
O'Neill Forebay	February 5, 2014	Rachel Brownsey and Michelle Giolli

During the reconnaissance survey, ESA biologists identified natural resources present, including any having a potential to occur based on habitat types or the overall condition of the site. Prior to the reconnaissance, the CDFW California Natural Diversity Database (CNDDB) were queried for the United States Geologic Survey (USGS) 7.5′ Quadrangle for which the water body is located, including the surrounding eight quadrangles, which included the following: Crevison Peak, Howard Ranch, Ingomar, Pacheco Pass, San Luis Dam, Volta, Mariposa Peak, Los Banos Valley, Ortigalita Peak NW, Lebec, Frazier Mountain, La Liebre Ranch, Alamo Mountain, Black Mountain, Liebre Mountain, Devils Heart Peak, Cobblestone Mountain, Whitaker Peak, Pastoria Creek, Winters Ridge, Liebre Twins, Neenach School, Burnt Peak, Baldy Mesa, Hesperia, Apple Valley South, Cajon, Silverwood Lake, Lake Arrowhead, Devore, San Bernardino North, and Harrison Mountain. The databases provided a list of recorded occurrences of sensitive plants, animals and sensitive natural communities within each quadrangle, which provides the basis for determining which sensitive species or communities could be present within the project site. During the reconnaissance survey, biologists described and characterized on-site plant communities and documented any wildlife species observed. The information obtained during the reconnaissance survey and literature and database reviews were used to determine the potential for sensitive biological resources to occur within or along the shoreline of each water body.

CHAPTER 5
Environmental Setting

This section describes the environmental setting within and around the reservoirs and forebay. A description of the climate, soils, topography, jurisdictional resources, plant communities and cover types, and habitat connectivity and wildlife migration corridors within each water body is described below.

5.1 Pyramid Lake

Pyramid Lake is a reservoir formed by Pyramid Dam located on Piru Creek and is located within the Angeles and Los Padres National Forests, approximately 16 miles north of the town of Castaic in Los Angeles County, immediately west of Interstate 5. **Figure 2** shows an aerial photograph of the lake and details the location of the boat launch area, which would be used as an equipment staging area and helipad during the application of copper sulfate. **Appendix B** contains representative site photographs of the lake. Pyramid Lake stored water from the West Branch of the California Aqueduct and is the upper reservoir for the Castaic Power Plant, a pumped storage hydroelectric plant to the south of the lake. Upper Piru Creek flows naturally into the lake and controlled releases from the lake are discharged into Middle Piru Creek located downstream, which eventually flows into Piru Lake. Additionally, Cañada de los Alamos flows into the northern tip of Pyramid Lake. Pyramid Lake provides a source of emergency water deliveries, incidental flood protection, and recreational opportunities such as fishing and boating.

5.1.1 Climate

The climate in the region of Pyramid Lake is characterized by hot, dry summers and cool winters, with an average temperature range between 44 and 76 degrees Fahrenheit (NOAA, 2014). Summer high temperatures are consistently in the 90s, while winter highs are typically in the 60s. Mean annual rainfall is 18.63 inches per year with the heaviest rains occurring in January and February (NOAA, 2014).

5.1.2 Soils and Topography

The water level within Pyramid Lake is at approximately 2,500 feet above mean sea level (amsl). Steep mountains surround the lake and the elevation increase approximately 1,000 feet within approximately 0.5 mile west of the lake's edge. A small island is located in the middle of the lake. The soils along the shore range from well-drained to excessively drained and occur between 30 and 100 percent slopes. According to the National Resources Conservation Service (NRCS) Online Soil Survey, there are three soil types surrounding Pyramid Lake, and each is described in detail below (USDA NRCS, 2014).

SOURCE: NAIP Imagery

Figure 2

Pyramid Lake Location Map

Trigo-Calleguas Families – Haploxeralfs Complex

Trigo-Calleguas families-Haploxeralfs complex, 30 to 70 percent slopes, is mapped as occurring along the shore of Pyramid Lake. These soils are well drained to somewhat excessively drained, and are typically found on moderately steep mountain slopes. The soils consist of silt loam on a majority of the surface layer, and a composition of 15 percent gravelly loam soils throughout the soil profile.

Trigo-Calleguas Families - Rock Outcrop Complex

Trigo-Calleguas families-Rock outcrop complex, 60 to 100 percent slopes are mapped as occurring along the shore of Pyramid Lake. These soils are well drained to excessively drained, and are typically found on steep mountain slopes. The soils consist of silt loam on the surface layer and a composition of 25 percent rock outcrops.

Trigo-Lodo Families – Haploxerolls, Warm Complex

Trigo-Lodo families-Haploxerolls, warm complex, 50 to 90 percent slopes are mapped as occurring along the shore of Pyramid Lake. These soils are well drained to somewhat excessively well-drained and are typically found on steep mountain slopes. The soils composition is a mixture of silt loam and gravelly loam.

5.1.3 Jurisdictional Resources

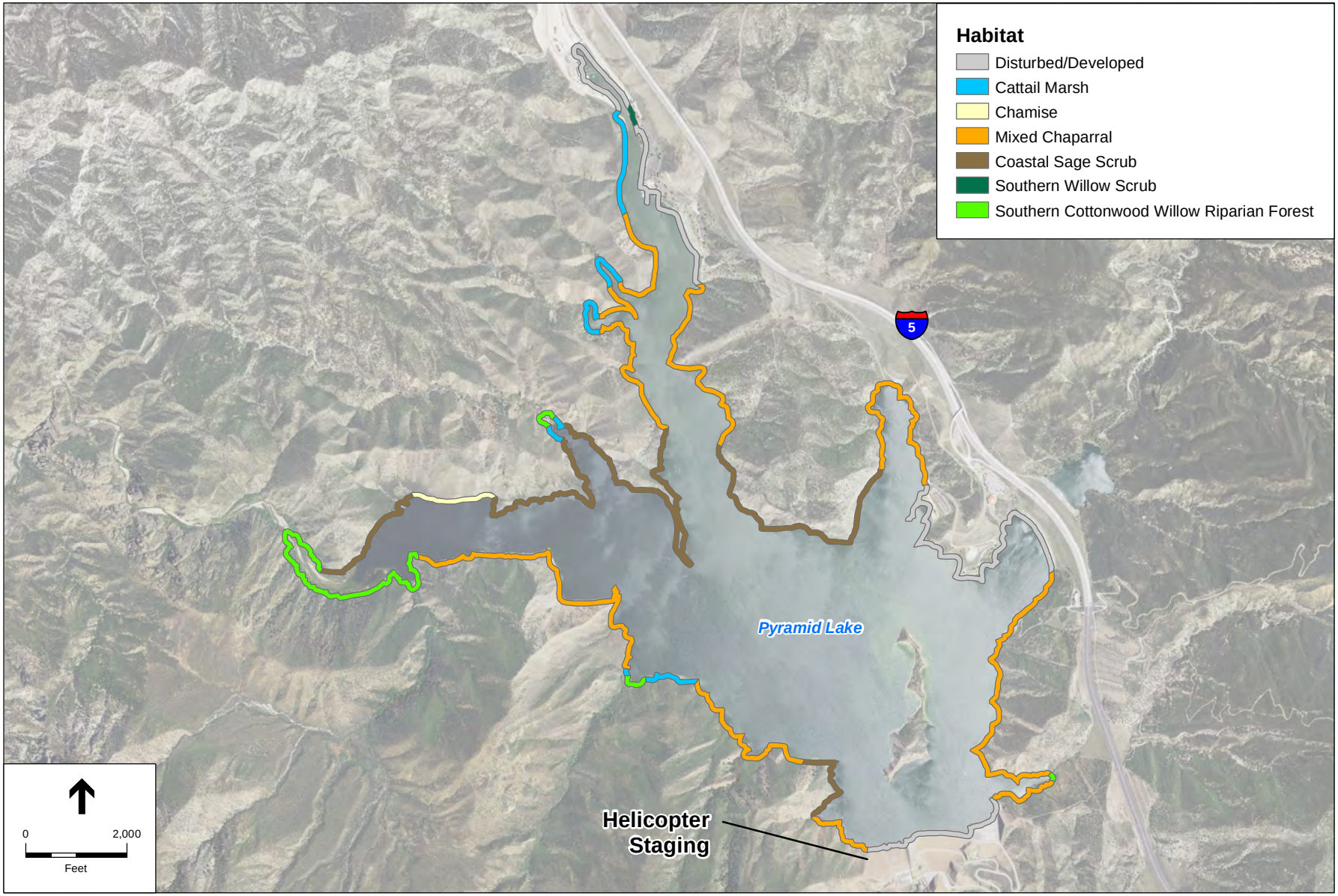
Pyramid Lake is a 222,000-acre-foot reservoir that is maintained and operated by DWR. Piru Creek, a perennial stream, flows into the northwestern portion of the lake. Outflow from the dam is regulated by DWR into Piru Creek south of the lake and is also transported south to Castaic Lake, which is the terminus for the west branch of the aqueduct. Pyramid Lake, the drainages that ingress and egress to/from the lake, and adjacent wetlands are regulated by the USACE, RWQCB and CDFW.

5.1.4 Plant Communities and Cover Types

The vegetation surrounding Pyramid Lake consists primarily of upland chaparral and scrub communities. Riparian forest and wetland vegetation communities dominate in areas where ephemeral/perennial drainages and the California Aqueduct empty into the lake. Developed areas such as picnic areas, the dam and boat launch occur along the lake perimeter. **Figure 3** below shows a map of the vegetation types along the edge of the lake.

Cattail Marsh

Cattail marsh is present throughout the perimeter of the lake, extending into the water where emergent vegetation is able to establish. The vegetation in this community is dominated by broadleaf cattail (*Typha latifolia*), with common reed (*Phragmites australis*) as an occasional dominant. Due to the constant inundation of water and the presence of hydric soils within these areas, plant species diversity is low.



SOURCE: NAIP Imagery

Figure 3

Pyramid Lake Plant Communities

Mixed Chaparral

Chaparral is the dominant vegetation community observed along the perimeter of the lake. Two species dominate the community at this site - chamise (*Adenostoma fasciculatum*) and tucker oak (*Quercus john-tuckeri*). Other shrub species observed interspersed within the chaparral community include bigpod ceanothus (*Ceanothus megacarpus* var. *megacarpus*), mountain mahogany (*Cercocarpus montanus*), and our lord's candle (*Hesperoyucca whipplei*).

Riparian Forest

Riparian forest occurs sporadically along the perimeter of the lake where natural drainages from the surrounding hills reach the lake. Dominant trees in this community include Fremont cottonwood (*Populus fremontii*) and arroyo willow (*Salix lasiolepis*). Cottonwoods tend to be the dominant species along drainages upstream of the lake water's edge, whereas willows tend to be the dominant species along the drainage at or below the lake water's edge. The overall understory within the riparian forest is dominated by other willow species (*Salix* spp.) and mulefat (*Baccharis salicifolia*). Riparian forest transitions into the adjacent cattail marsh at the lake. This transition is common throughout the lake where drainages terminate into the lake.

This vegetation community is classified by the CDFW as Southern Cottonwood Willow Riparian Forest where cottonwood is the dominant species, and classified as Southern Willow Scrub where willow is the dominant species. These communities are designated by the CDFW as Sensitive Natural Communities, and are discussed in further detail in Section 6.3.

Coastal Sage Scrub

Coastal Sage Scrub is also very common throughout the banks of the reservoir. There are two dominant species within community, California buckwheat (*Eriogonum fasciculatum*) and purple sage (*Salvia leucophylla*), which are both common to coastal sage scrub communities. While the chaparral communities are typically dominated by large shrub/tree species, the scrub vegetation communities are typically dominated by small subshrubs, providing room for relatively dense herbaceous understory, which is dominated by annual grasses and forbs. Other shrub species interspersed throughout the scrub community include big sagebrush (*Artemisia tridentata*), our lord's candle, white sage (*Salvia apiana*), and black sage (*Salvia mellifera*).

Developed

Developed areas include all man-made infrastructure or areas permanently altered by the construction and continued maintenance of the reservoir and recreation areas. Developed features include (but are not limited to) the dam, boat launch area, parking lot, trails, and the day use picnic areas interspersed throughout the lakeshore. These areas are frequented by the public on a regular basis, causing them to remain disturbed and/or altered and many of these areas consist of impermeable surfaces. This area supports little vegetation other than annual non-native grasses and ornamental tree species.

5.1.5 Connectivity and Migration Corridors

Habitat linkages are contiguous areas of open space that connect two larger habitat areas. Linkages provide for dispersal for a variety of species within the landscape. In addition, linkages can serve as primary habitat for some smaller species. Corridors are linear linkages between two or more habitat patches and provide for wildlife movement and dispersal.

Pyramid Lake is situated between the Los Padres and Angeles National Forests. Several species of medium to large mammals are expected to use the shorelines and upland habitats of the lake for foraging and movement between the forests. Piru Creek and other drainages flowing into Pyramid Lake provide movement and migrations opportunities for both aquatic and terrestrial species. In addition, this area of California is within the Pacific Flyway, a significant bird migration path in the western United States. Pyramid Lake provides a stopover area for migratory birds, which is particularly valuable to waterfowl.

5.1.6 Common Wildlife

A diversity of native and non-native wildlife use Pyramid Lake either seasonally or year-round. The lake is regularly utilized by waterfowl and shorebirds as a temporary refuge during migration or for breeding purposes. Various migratory and resident species of songbirds utilize the riparian habitat as well, for both breeding and wintering purposes. Numerous waterfowl and other avian species were observed using the lake or immediate upland areas for foraging during the site visit. The most common species observed include western scrub-jay (*Aphelocoma californica*), bufflehead (*Bucephala albeola*), American coot (*Fulica americana*), dark-eyed junco (*Junco hyemalis*) and Bewick's wren (*Thryomanes bewickii*). Numerous other species were also observed, and likely frequent the lake as well, such as red-winged blackbird (*Agelaius phoeniceus*), hermit thrush (*Catharus minimus*), common raven (*Corvus corax*), ruddy duck (*Oxyura jamaicensis*), double-crested cormorant (*Phalacrocorax auritus*) and pied-billed grebe (*Podilymbus podiceps*). It should be noted that dozens of other resident and migratory birds are expected to use the lake throughout the year.

While no amphibians or reptiles were observed during the reconnaissance survey, habitat present within and surrounding the lake suggests that many common species are likely present. Areas most likely to support amphibians include the riparian and wetland habitat present along the shorelines and common reptilian species are expected to occur within upland habitats (i.e., chaparral and coastal sage scrub). The habitats around the lake provide a necessary transition between upland and aquatic communities necessary for many amphibians and reptiles. Common species most likely to utilize the wet transition zones include western toad (*Anaxyrus boreas*) and Baja California tree frog (*Pseudacris hypochondriaca hypochondriaca*). Terrestrial species likely to utilize upland zones include the western rattlesnake (*Crotalus viridis*), gopher snake (*Pituophis catenifer*), side-blotched lizard (*Uta stansburiana*), and western fence lizard (*Sceloporus occidentalis*); however, several other common species likely occur as well.

Although none were observed, numerous mammal species are expected to occur around the lake. Top tier species likely to utilize the site include mountain lion (*Felis concolor*) and black bear (*Ursus americanus*); while other species such as the coyote (*Canis latrans*), Virginia opossum

(*Didelphis virginiana*), California ground squirrel (*Otospermophilus beecheyi*), and raccoon (*Procyon lotor*) are likely present as well.

Pyramid Lake is a popular recreational fishing destination. Fish species that occur in the lake include, but are not limited to catfish (*Ictalurus* spp.), rainbow trout (*Oncorhynchus mykiss*), small-mouth bass (*Micropterus dolomieu*), largemouth bass (*Micropterus salmoides*), bluegill (*Lepomis macrochirus*), and crappie (*Poxomis* spp.) The lake is periodically stocked to support recreational fishing, and the lake was being stocked with rainbow trout during the reconnaissance survey performed by ESA biologists in January 2014.

Special-status wildlife species with the potential to occur at Pyramid Lake are discussed in Section 6 below.

5.2 Silverwood Lake

Silverwood Lake is a reservoir formed by Cedar Springs Dam, and is located on the west fork of the Mojave River within the San Bernardino Mountains, approximately 8 miles southwest of the town of Hesperia in San Bernardino County. **Figure 4** includes an aerial photograph of the lake and shows the location of the dam, which is where the helicopter would be staged during the application of copper sulfate at the lake. Appendix B contains representative site photographs of Silverwood Lake. The lake is fed by water from the East Branch of the California Aqueduct, and provides drinking water to communities in the region and is used for recreational opportunities such as fishing and boating.

5.2.1 Climate

The climate in the region of Silverwood Lake is characterized by warm, dry summers and cold, windy winters, with an average temperature range between 39 and 62 degrees Fahrenheit (NOAA, 2014). Summer high temperatures are consistently in the upper 70s and low 80s, while winter highs are typically in the 40s. Average annual precipitation is 37.5 inches per year with the heaviest precipitation occurring January through March (NOAA, 2014).

5.2.2 Soils and Topography

The water level within Silverwood Lake is located at approximately 3,400 feet amsl. Moderately steep mountains surround the lake. The soils along the shore of Silverwood Lake range from well-drained to excessively drained. According to the NRCS Web Soil Survey online mapper, there are eight soil types surrounding Silverwood Lake, and each is described in detail below (USDA NRCS, 2014).

Avawatz-Oak Glen, Dry Families Association

Avawatz-Oak Glen, dry families association, 2 to 15 percent slopes, is mapped as occurring along the shore of Silverwood Lake. These soils range from well-drained to excessively drained and typically occur in floodplains and alluvial fans. The soils composition is a mixture of gravelly loamy coarse sand and sandy loam.

SOURCE: NAIP Imagery

Aquatic Pesticides Application Plan . 130044.04

Figure 4

Silverwood Lake Location Map

Modesto-Osito Families Association

Modesto-Osito families association, 15 to 30 percent slopes, is mapped as occurring along the shore of Silverwood Lake. These soils are well-drained and are typically found on hill slopes. The soils composition is a mixture of fine and coarse sandy loams.

Morical-Wind River Families Complex

Morical-Wind River families complex, 15 to 30 percent slopes, is mapped as occurring along the shore of Silverwood Lake. These soils are well-drained and typically occur on mountain slopes. The soils composition is a mixture of loam and sandy loam.

Pacifico-Wapi Families Complex

Pacifico-Wapi families complex, 30 to 50 percent slopes, is mapped as occurring along the shore of Silverwood Lake. These soils are somewhat excessively drained, and are typically found on mountain slopes. The soils consist of loamy coarse sand and loamy sand.

Soboba-Hanford Families Association

Soboba-Hanford families association, 2 to 15 percent slopes, is mapped as occurring along the shore of Silverwood Lake. These soils range from well-drained to excessively drained, and are typically found in floodplains and alluvial fans. The soil composition is a mixture of very cobbly loamy sand and sandy loam.

Trigo Family-Lithic Xerorthents, Warm Complex

Trigo family-Lithic Xerorthents, warm complex, 50 to 75 percent slopes and 30 to 50 percent slopes, are both mapped as occurring along the shore of Silverwood Lake. These soils range from somewhat excessively drained to excessively drained, and are typically found on moderately sloped hills. The soils consist of gravelly or coarse sandy loam.

Wapi-Pacifico Families – Rock Outcrop Complex

Wapi-Pacifico families – rock outcrop complex, 50 to 75 percent slopes, is mapped as occurring along the shore of Silverwood Lake. These soils are somewhat excessively drained and are typically found on mountain slopes. The soils composition is a mixture of loamy coarse sand, loamy sand, and 15 percent rock outcrops.

5.2.3 Jurisdictional Resources

Silverwood Lake is a 73,000-acre-foot lake that is part of the SWP and is created along the west fork of the Mojave River behind the Cedar Springs Dam. The main natural water flow is supported by the Mojave River and Miller Creek, both of which are regulated by the USACE, RWQCB and CDFW. Because the lake supports commerce and has a direct nexus to the Mojave River and Miller Creek, the lake and adjacent wetlands fall under these agencies' jurisdiction as well.

5.2.4 Plant Communities and Cover Types

The vegetation surrounding Silverwood Lake consists primarily of upland chaparral and scrub communities. Riparian forest and wetland communities occur in areas where ephemeral drainages empty into the lake. Open water sections of the reservoir support very little, if any, emergent vegetation. **Figure 5** shows the mapped plant communities surrounding Silverwood Lake. Appendix B contains representative site photographs.

Black Oak Woodland

Black oak woodland is present in one area along the southern perimeter of the lake along a north-facing slope. The overstory of this vegetation community consists entirely of black oak (*Quercus kellogii*), while the understory consists primarily of greenbark ceanothus (*Ceanothus spinosus*). Little herbaceous vegetation persists in this area due to the dense shrub layer.

Cattail Marsh

Cattail marsh is present sporadically throughout the perimeter of the lake, extending into the water where emergent vegetation can take hold and establish. This community is generally a continuation of riparian forest, extending upstream. The vegetation in this community is dominated by cattail interspersed throughout with common reed. Due to the constant inundation of water and hydric soils within these areas, vegetation diversity appears to remain relatively low.

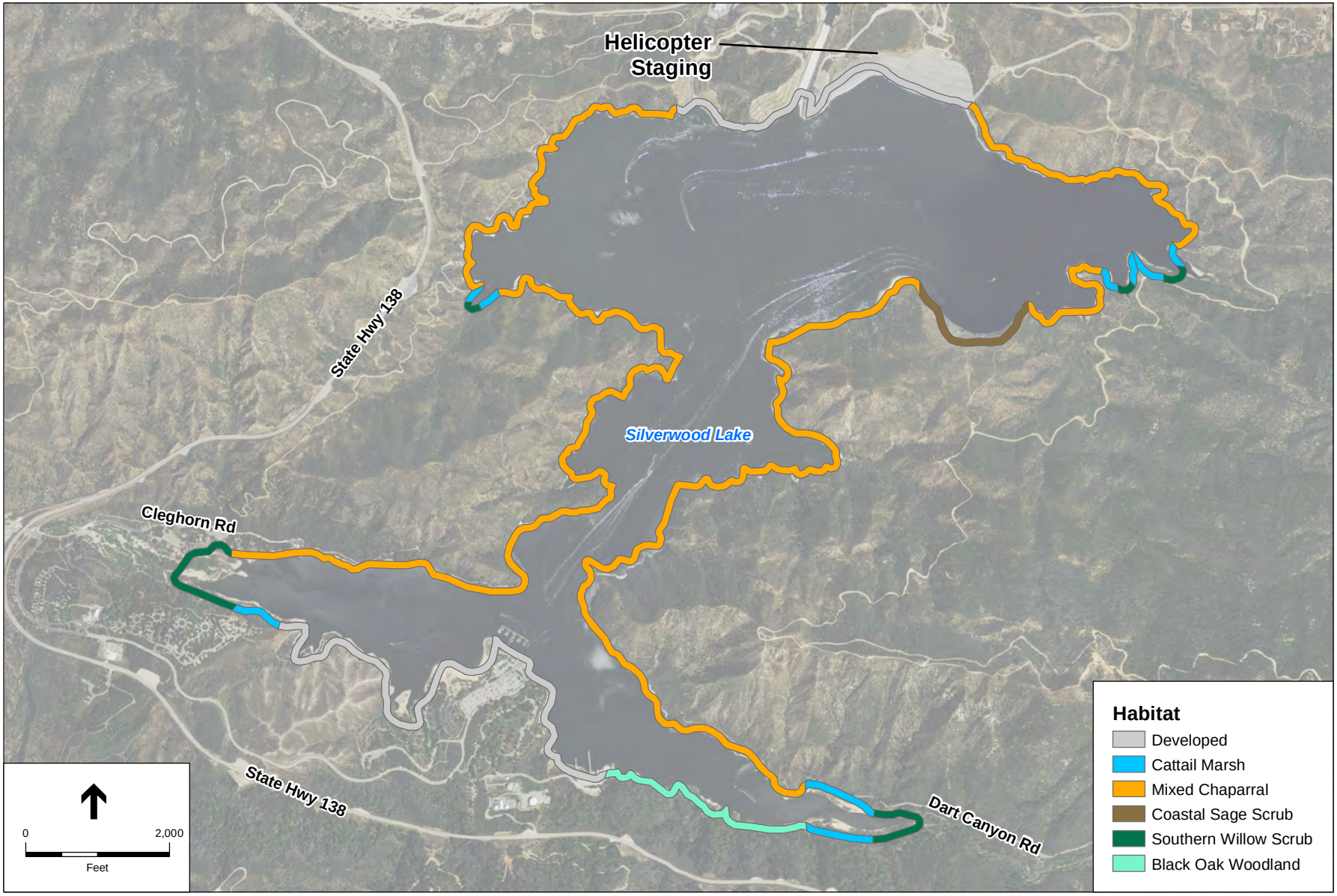
Mixed Chaparral

Chaparral is the dominant vegetation community observed throughout the perimeter of the water body. Three species tend to dominate the landscape within these areas- chamise, interior live oak (*Quercus wislizeni* var. *frutescens*) and greenbark ceanothus. Other species observed within this community include bigpod ceanothus, mountain mahogany and our lord's candle.

Riparian Forest

Riparian forest was observed sporadically throughout the perimeter of the lake and along the drainages of the surrounding hills. This community includes a dominance of Fremont cottonwood, western sycamore (*Platanus racemosa*) and arroyo willow within the overstory at different locations and to varying degrees along the lake. The overall understory of these communities tended to be dominated by other willow species and mulefat. This community generally follows the drainages and transitions into cattail marsh at the lake water's edge. This transition is common throughout the lake where drainages outlets terminate into the lake.

One section of riparian forest dominated by western sycamore was observed within the northwest corner of the lake, at the mouth of an ephemeral drainage. This portion of the riparian forest consists of Southern Sycamore Alder Riparian Woodland, a CDFW classified sensitive natural community. The remainder of riparian forest occurring throughout the perimeter of the lake would be described as either Southern Cottonwood Willow Riparian Forest or Southern Willow Scrub, which are both designated by the CDFW as sensitive natural communities. These sensitive vegetation communities are discussed in further detail in Section 6.3.



SOURCE: NAIP Imagery

Figure 5

Silverwood Lake Plant Communities

Coastal Sage Scrub

Coastal Sage Scrub is also very common throughout the banks of the reservoir. There are two dominant species within this community, California buckwheat and purple sage, which are both common to coastal sage scrub communities. While the chaparral communities are typically dominated by large shrub species, scrub communities are typically dominated by small subshrubs with a dense annual grass and forbs understory. Other subshrub species interspersed throughout the scrub community include big sagebrush, our lord's candle, white sage, and black sage.

Developed

Developed areas include all man-made infrastructure or areas permanently altered by the construction and continued maintenance of the reservoir or recreation activities. Many of these features consist of impermeable surfaces and include the dam, boat launch area, parking lot, and the day use and camping areas. These areas are frequented by the public on a regular basis causing them to remain disturbed and/or altered. Native and ornamental tree species are present within many of the disturbed areas around the lake.

5.2.5 Connectivity and Migration Corridors

Silverwood Lake is located in the San Bernardino Mountains along the Mojave River, which provides access to other undisturbed areas of the mountains and access to the Mojave Desert. Many medium to large mammal species are expected to use the shores and upland habitats around the lake for foraging, shelter and movement between the mountains and desert. Locally, Miller Creek and the Mojave River provide movement for both aquatic and terrestrial species, and this connection is vital for the survival of many species occurring both upstream and downstream of the lake. In addition, the lake is located within the Pacific Flyway, a significant bird migration path in the western United States. Silverwood Lake provides a stopover area for migratory birds and is particularly valuable to waterfowl.

5.2.6 Common Wildlife

Silverwood Lake and its surrounding habitat are relatively undisturbed and used by a diversity of wildlife either seasonally or year-round. Avian species were the most commonly observed wildlife during the reconnaissance survey. Numerous waterfowl and other avian species were observed using the lake and immediate upland areas for foraging. The most common species observed include eared grebe (*Podiceps nigricollis*), American coot, mallard (*Anas platyrhynchos*), and great blue heron (*Ardea herodias*), which have a known rookery along the southern shore of the lake. Raptors such as red-tailed hawk (*Buteo jamaicensis*) and bald eagle (*Haliaeetus leucocephalus*) were observed in the upland areas surrounding the lake. Dozens of additional resident and migratory avian species are expected to use the lake and its upland habitats throughout the year. Other common wildlife such as bobcat, mountain lion, black bears, and coyote are expected to use the upland habitats that connect with the Mojave River.

Silverwood Lake is a popular recreational fishing destination. Fish species present in the lake include rainbow trout, tule perch (*Hysterocarpus traskii*), largemouth bass, bluegill, tui chub

(*Gila bicolor*), channel catfish (*Ictalurus punctatus*), blackfish (*Tautoga onitis*), and striped bass (*Morone saxatilis*). The lake is periodically stocked to support recreational fishing.

Special-status fish and wildlife species with the potential to occur at Silverwood Lake are discussed in Section 6.

5.3 Quail Lake

Quail Lake is an artificial lake that is used as a reservoir for the SWP. Its water source is from the California Aqueduct and water flows out from the lake into the aqueduct to Pyramid Lake approximately six miles to the southwest. The lake is located along State Highway 138 approximately two miles east of Interstate 5. **Figure 6** shows an aerial photograph of the lake and the location of the helicopter staging area and boat launch area. Appendix B contains representative site photographs.

5.3.1 Climate

The climate in the region of Quail Lake is characterized by hot, dry summers and cool winters, with an average temperature range between 44 and 76 degrees Fahrenheit (NOAA, 2014). Summer high temperatures are consistently in the 90s, while winter highs are typically in the 60s. Mean annual rainfall is 18.63 inches per year with the heaviest rains occurring in January and February (NOAA, 2014).

5.3.2 Soils and Topography

The water level within Quail Lake is at approximately 3,300 feet amsl. Rolling hills are north of the lake and relatively flat ground south of the lake. The soils along the shore of Quail Lake range from well-drained to excessively drained with only a slight slope. According to the NRCS Online Soil Survey, there are six soil types along the shore of Quail Lake, and each is described in detail below (USDA NRCS, 2014).

Oak Glen Series

Three soils from this series are mapped as occurring along the shore of Quail Lake:

- Oak Glen sandy loam, 2 to 9 percent slopes
- Oak Glen gravelly sandy loam, 2 to 9 percent slopes
- Oak Glen loam, 2 to 9 percent slopes

Soils in this series are well-drained and are found in alluvial fans and toe slopes. The soils consist of sandy loam, gravelly sandy loam, and loam with moderately rapid permeability and slow to rapid runoff.

SOURCE: NAIP Imagery

Figure 6

Quail Lake Location Map

Ramona Series

Ramona sandy loam, 9 to 30 percent slopes, eroded, is mapped as occurring along the shore of Quail Lake. These soils are well-drained and are typically found on terraces. The soils consist of sandy loam on an eroded surface, with moderately slow permeability and slow to rapid runoff.

Chino Series

Chino loam is mapped as occurring along the shore of Quail Lake. These soils are excessively drained and are typically found in valleys. The soils consist of loam with moderately slow permeability and slow to very slow runoff.

Gaviota Series

Gaviota rocky sandy loam, 15 to 30 percent slopes, eroded, is mapped as occurring along the shore of Quail Lake. These soils are well-drained and are typically found in hills. The soils consist of rocky sandy loam with moderately rapid permeability and very low to very high runoff.

5.3.3 Jurisdictional Resources

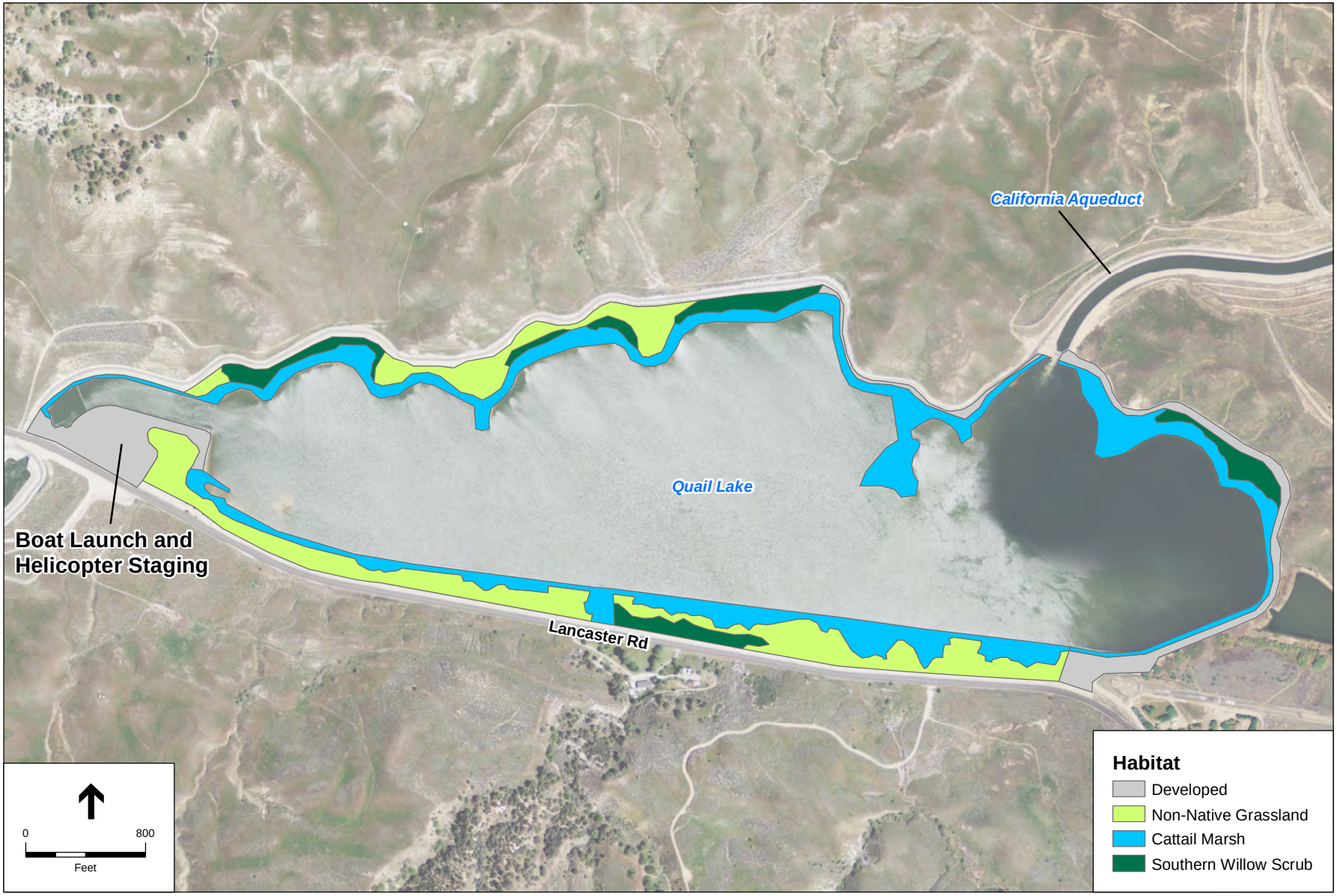
Quail Lake is a 5,654-acre-foot reservoir created as a regulatory storage body for the West Branch of the California Aqueduct, which is the sole source of inflow to the artificial lake. The California Aqueduct is also the only outflow for Quail Lake, which continues to Pyramid Lake to the south. Similar to Pyramid Lake, this lake and its adjacent wetlands are regulated by the USACE, RWQCB and CDFW.

5.3.4 Plant Communities and Cover Types

Quail Lake is surrounded by an asphalt access road, effectively separating the shoreline from the upland vegetation to the north and Highway 138 to the south. The upland vegetation to the north and surrounding areas consists of rubber rabbitbrush (*Ericameria nauseosa*) scrub. However this vegetation is disconnected from the shoreline of the lake and likely has a limited connection to the lake's ecology, and it is so sporadic that it is not identified as a stand-alone community; rather it is included in the upland plant communities described below. The shoreline of the lake consists of interspersed riparian tree species along the north and east side and emergent wetland vegetation on the shoreline edges. Non-native grassland dominates the southern perimeter of the lake. Open water sections of the reservoir support very little, if any, emergent vegetation. **Figure 7** shows the mapped plant communities surrounding Quail Lake.

Cattail Marsh

Cattail marsh is present sporadically throughout the perimeter of the lake, extending into the water where emergent vegetation can take hold and establish. The vegetation in this community is dominated by cattail interspersed with common reed and rush (*Juncus* sp.). Due to the constant inundation of water and presence of hydric soils within these areas, vegetation diversity appears to be relatively low.



SOURCE: NAIP Imagery

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Figure 7

Quail Lake Plant Communities Map

Riparian Forest/Scrub

Riparian forest/scrub was observed sporadically along the lake perimeter, but most notably in the southeastern corner, outside of the access road. This community is dominated by arroyo willow. The overall understory of this community was typically dominated by other willow species and mulefat. Fremont cottonwood was also occasionally observed along the perimeter of the lake; the frequency was not enough to merit its own plant community designation.

The small patch of riparian forest/scrub in the southeast corner of the lake would be described as Southern Willow Scrub and is designated by CDFW as a sensitive natural community. This community is discussed in more detail in Section 6.3, Sensitive Natural Communities.

Non-Native Grassland

Non-native grassland is located along the southern perimeter of the lake. Vegetation in this community is dominated by brome species (*Bromus* spp.) and wild oats (*Avena fatua*). This area supports very little species diversity and was likely disturbed in the recent past.

Developed

Developed areas include all man-made infrastructure or areas permanently altered by the construction and continued maintenance of the water body. These developed features include the impermeable concrete lining around the lake and the access road surrounding its perimeter. These areas create a permanent barrier between the vegetation within the lake and the surrounding vegetation communities.

5.3.5 Connectivity and Migration Corridors

Quail Lake is at the transition zone between the Mojave Desert and mountains of the Los Padres and Angeles National Forests. The margins of the lake may support local and regional wildlife movement and the lake itself may be used as a water source. Quail Lake is situated between the desert and mountain habitats in the region. In addition, the lake is located within the Pacific Flyway and provides a stopover area for migratory birds.

5.3.6 Common Wildlife

While it is small in size and its water source is exclusively from the SWP, Quail Lake is regularly utilized by waterfowl and shorebirds as a temporary refuge during migration or for breeding purposes. Various migratory and resident species of songbirds also utilize the riparian habitat for both breeding and wintering purposes. Waterfowl and other avian species were observed using the lake during the site visit and dozens of other species are expected to be present throughout the year. Species observed include greater scaup (*Aythya marila*), bufflehead, Brewer's blackbird (*Euphagus carolinus*), American coot, dark-eyed junco, and Bewick's wren.

No amphibians or reptiles were observed during surveys; however habitat present within and surrounding the lake suggests that common species may be present. Areas most likely to support these species include the wetland and riparian habitat present along the shorelines as well as the

non-native grassland areas. Common species most likely to utilize the wet transition zones include (but are not limited to) western toad and Baja California tree frog and terrestrial species likely to utilize upland zones include (but are not limited to) the western rattlesnake, gopher snake, side-blotched lizard and western fence lizard.

Numerous mammal species are expected to utilize the lake as a resource for foraging and water, such as mountain lion, black bear, coyote, Virginia opossum, California ground squirrel, and raccoon.

Fish species present in the lake include (but are not limited to) threadfin shad (*Dorosoma petenense*), tule perch, channel catfish, and blackfish. The lake is periodically stocked to support recreational fishing.

Special-status wildlife species with the potential to occur at Quail Lake are discussed in Section 6 below.

5.4 O'Neill Forebay

O'Neill Forebay is located at the base of San Luis Reservoir and is approximately six miles southwest of the City of Gustine in Merced County. **Figure 8** includes an aerial photograph of the forebay and shows the proposed location of helicopter staging during the application of copper sulfate at the forebay. Appendix B contains representative site photographs. The forebay receives water from both the California Aqueduct and the Delta Mendota Canal and provides recreational opportunities such as fishing and boating.

5.4.1 Climate

The climate in the region of O'Neill Forebay is characterized by warm summers and cool winters, with an average temperature range between 51 and 73 degrees Fahrenheit (NOAA, 2014). Summer high temperatures are consistently in the upper 80s, while winter highs are typically in the 40s. Mean annual precipitation is 10.36 inches per year with the heaviest rains occurring in January and February (NOAA, 2014).

5.4.2 Soils and Topography

The water level within O'Neill Forebay is approximately 250 feet amsl and moderately hilly topography surrounds the water body. The soils along the shore of O'Neill Forebay are mapped as slightly sloped. According to the NRCS Online Soil Survey, there are nine soil types along the shore of the forebay, and each is described in detail below (USDA NRCS, 2014).

Wisflat-Rock Outcrop-Arburua Complex

Wisflat - rock outcrop - Arburua complex, 15 to 30 percent slopes, is mapped as occurring along the shore of O'Neill Forebay. These soils are well drained and are typically found in hills. The soils consist of loam and sandy loam with 30 percent rock outcrops.

SOURCE: NAIP Imagery

Aquatic Pesticides Application Plan . 130044.04

Figure 8

O'Neill Forebay Location Map

O'Neill Silt Loam

O'Neill silt loam 15 to 30 percent slopes, is also mapped as occurring along the shore of O'Neill Forebay. These soils are well-drained and are typically found in hills. The soil has medium to high runoff and moderately slow permeability.

Xerofluvates

Extremely gravelly Xerofluvates and channeled Mollic Xerofluvates are mapped as occurring along the shore of O'Neill Forebay. These soils are poorly drained and are typically found in alluvial fans. The soil is mainly composed of gravelly alluvium.

Damluis Series

Damluis clay loam, 2 to 8 percent slopes and 0 to 2 percent slopes, are also mapped as occurring along the shore of O'Neill Forebay. These soils are well drained and typically found in terraces. These soils range from negligible to high runoff with slow permeability.

Bapos Series

Bapos clay loam, 2 to 8 percent slopes, is mapped as occurring along the shore of O'Neill Forebay. These soils are well drained and are typically found in terraces. These soils have medium to high runoff and very slow permeability.

Ayar Series

Ayar Clay, 5 to 8 percent slopes and 15 to 30 percent slopes, are mapped as occurring along the shore of O'Neill Forebay. These soils are well drained and are typically found in hills. These soils have very high runoff and slow permeability.

Apollo Series

Apollo clay loam, 2 to 8 percent slopes is mapped as occurring along the shore O'Neill Forebay. These soils are well drained and are typically found in hills. These soils have medium runoff and moderately slow permeability.

Anela Series

Anela gravelly loam, 0 to 2 percent slopes is mapped as occurring along the shore of O'Neill Forebay. These soils are well-drained and are typically found in floodplains. These soils have slow and medium runoff and moderate permeability.

Oquin Series

Oquin fine sandy loam, 2 to 8 percent slopes, is mapped as occurring along the shore of O'Neill Forebay. These soils are well-drained and are typically found in hills. These soils have medium to rapid runoff and moderately rapid permeability.

5.4.3 Jurisdictional Resources

O'Neill Forebay is an approximately 56,430-acre-foot forebay to the larger, approximately 2,027,840-acre-foot, San Luis Reservoir. Both the forebay and reservoir are maintained and operated by DWR. O'Neill Forebay is located 'off-stream' in that it is filled with water pumped from a source other than its natural watershed. Water from the Sacramento-San Joaquin Delta is pumped into the California Aqueduct (as part of the SWP) and the Delta Mendota Canal (as part of the federal Central Valley Project) and then flows or is pumped into the O'Neill Forebay. Water is then pumped from the O'Neill Forebay into San Luis Reservoir via the Gianelli Pumping-Generating Plant. When water is needed for either the State or federal water project, water is released back into the forebay and into either the Aqueduct or Canal. Water is occasionally released from the forebay through culverts into artificial waterways and riparian habitat within the adjacent O'Neill Forebay Wildlife Area. Two small drainages flow into the southern edge of the forebay. These two drainages, along with the forebay and adjacent wetlands, are regulated by the USACE, RWQCB and CDFW.

5.4.4 Plant Communities and Cover Types

O'Neill Forebay is predominately surrounded by non-native grassland dominated hillsides with occasional patches of scrub vegetation. The O'Neill Dam, located on the eastern edge of the forebay, consists of unvegetated riprap, while the remaining shoreline within the forebay is either barren (due to wind and wave action) or dominated by a variety of vegetation communities including freshwater marsh, scrub and riparian forest. The majority of the forebay is too deep to support emergent vegetation, but some emergent freshwater marsh vegetation occurs within the edge of the water. **Figure 9** shows the mapped plant communities surrounding O'Neill Forebay.

Freshwater Marsh

Freshwater marsh occurs along the western and southwestern edges of the forebay. Emergent freshwater marsh forms dense stands within the water's edge and is dominated by California bulrush (*Schoenoplectus californicus*) with occasional patches of cattail (*Typha angustifolia*). Other areas of freshwater marsh occur at or just above the water line and are dominated by a mix of cattail, marsh baccharis (*Baccharis glutinosa*), iris (*Iris pseudacorus*), rumex (*Rumex* sp.), tall flat sedge (*Cyperus eragrostis*), Baltic rush (*Juncus balticus*), barnyard grass (*Echinochloa* sp.) and saltgrass (*Distichlis spicata*).

A small pond surrounded by freshwater marsh, and riparian forest described below, is located immediately adjacent to the southern edge of the forebay and is likely hydrologically connected to the forebay.

Southern Riparian Scrub

Southern Riparian Scrub communities occur in small patches along the southern edge of the forebay and larger expanses along the southwestern, western, and northern edges of the forebay. The scrub communities at the forebay are dominated by two main species: mulefat and sandbar willow (*Salix exigua*). In the western portion of the forebay, one small area of California

SOURCE: NAIP Imagery

Figure 9

O'Neill Forebay Plant Communites Map

sagebrush (*Artemisia californica*) scrub is present on a southwest facing slope directly above the water line and one small area of coyote brush (*Baccharis pilularis*) is located on a northeast facing slope above the water line. Southern Riparian Scrub is designated by CDFW as a sensitive natural community and is discussed in further detail in Section 6.3

Riparian Forest

Riparian forest is located along the southwestern, western, and northern edges of the forebay. Dominant trees in this community vary between Fremont cottonwood, arroyo willow and red willow (*Salix laevigata*). Western sycamore trees are also present along the upland edges of some areas of riparian forest. The understory in this community includes scrub species such as mulefat, sandbar willow and coyote brush. Some Baltic rush and other rushes (*Juncus* spp.) are also present within the understory.

Willow-dominated riparian forest is also present along the edge of the small pond located immediately adjacent to the forebay described above.

Some areas of the riparian forest dominated by Fremont cottonwood would be classified as Great Valley Cottonwood Riparian Forest, designated by CDFW as a sensitive natural community. This sensitive community is discussed in further detail in Section 6.3.

Non-Native Grassland

Non-native grassland occurs throughout the majority of the hillsides surrounding the forebay. Within the vicinity of the forebay, grassland occurs at the top of steep banks that line portions of the southern edge of the forebay. Dominant species within the grassland include typical non-native grasses such as brome species and wild oats. Some areas abutting the forebay also include native species such as saltgrass and gumplant (*Grindelia* sp.) and invasive species such as pepperweed (*Lepidium latifolium*) and yellow star thistle (*Centaurea solstitialis*).

Developed

Developed areas are comprised of man-made areas along the edge of the forebay and include the rip-rapped dam, parking lots, beaches, picnic areas, and installed trees. These areas are heavily utilized by campers, recreational fisherman, boaters and DWR personnel. The majority of these areas contain little to no vegetation, except for the camping and recreational areas that contain stands of installed trees such as eucalyptus (*Eucalyptus* sp.), pine (*Pinus* sp.), and sycamore, among others.

5.4.5 Connectivity and Migration Corridors

O'Neill Forebay is located within relatively open grassland hills that are bound on the west by the Diablo Mountain Range and on the east by agricultural lands associated with the San Joaquin Valley. Wildlife migrating north-south through central California may pass through the O'Neill Forebay area. Additionally, the forebay is located approximately 12 miles southwest of the San Luis National Wildlife Refuge, and though agricultural fields provide some barrier to wildlife movement between the forebay and the Refuge, many wildlife species may travel between the

two areas via other undisturbed wetland and wildlife areas such as Volta State Wildlife Area. As with the other water bodies within the project area, the forebay is located within the Pacific Flyway and serves as a stopover for migratory birds. Several species of ducks were observed utilizing the forebay during the site survey.

The California Aqueduct and Delta Mendota Canal, which connect to the forebay, do not provide high quality aquatic or riparian habitat for fish or other aquatic wildlife and likely do not provide a significant migration corridor between the Delta and the forebay.

5.3.6 Common Wildlife

O'Neill Forebay is utilized by a variety of wildlife both seasonally and year-round. During the reconnaissance survey, many common avian species were observed within the open water and adjacent riparian and wetland habitat and numerous other species (not observed) are expected to be present throughout the year. Species observed within the open water included American coot, bufflehead, ruddy duck, and canvasback (*Aythya valisineria*). Other birds observed within the adjacent riparian habitat included red-winged blackbird, black phoebe (*Sayornis nigricans*), great egret (*Ardea alba*), and yellow-rumped warbler (*Setophaga coronata*). Red-tailed hawk and osprey (*Pandion haliaetus*) were also observed flying overhead. Common mammal species, or sign of these species, were also observed and included deer, raccoon, and ground squirrel.

O'Neill Forebay supports several species of native and non-native fish that have become established within the system either by direct introduction or from the Sacramento-San Joaquin Delta (Delta) system via pumping from the California Aqueduct and Delta-Mendota Canal. Common fish species that may occur in the Forebay include tule perch, blackfish, Sacramento sucker (*Catostomus occidentalis*), hardhead (*Mylopharodon conocephalus*), striped bass, largemouth bass, smallmouth bass, crappie, channel catfish, bluegill, threadfin shad, and golden shiner (*Notemigonus crysaleucas*). Striped bass are an especially important recreational species; two of the record catches for striped bass are listed as coming from O'Neill Forebay (National Fresh Water Fishing Hall of Fame, 2004).

CHAPTER 6
Special-Status Species and Sensitive Natural Communities

6.1 Special-Status Plants

Special-status plants are defined as those plants that, because of their recognized rarity or vulnerability to various causes of habitat loss or population decline, are recognized by federal, state, or other agencies as under threat from human-associated developments. Some of these species receive specific protection that is defined by federal or state endangered species legislation. Others have been designated as special-status on the basis of adopted policies and expertise of state resource agencies or organizations with acknowledged expertise, or policies adopted by local governmental agencies such as counties, cities, and special districts to meet local conservation objectives. Special-status plants are defined as follows:

- Plants listed or proposed for listing as threatened or endangered, or are candidates for possible future listing as threatened or endangered, under the federal Endangered Species Act or the California Endangered Species Act;
- Plants that meet the definitions of rare or endangered under *CEQA Guidelines* Section 15380;
- Plants considered by the California Native Plant Society (CNPS) to be rare, threatened, or endangered (Rank 1A, 1B and 2 plants) in California;
- Wildlife designated as "Sensitive" by the United States Forest Service (USFS).
- Plants listed by the CNPS as plants in which more information is needed to determine their status and plants of limited distribution (Rank 3 and 4 plants);
- Plants listed as rare under the California Native Plant Protection Act (Fish and Game Code 1900 et seq.); and
- Plants covered under an adopted NCCP/HCP.

A review of the CNDDB (CDFW, 2014) and the CNPS Inventory of Rare and Endangered Plants (CNPS, 2014) was conducted for each of the four water bodies to determine the potential for special-status species to occur within the project area. The potential to occur is based on on-site vegetation and habitat quality, topography, elevation, soils, surrounding land uses, habitat preferences, and geographic ranges. The original search revealed numerous special-status plant species known to occur in the vicinity; however, a total of 44 special-status plant species have the potential to occur within and surrounding the water bodies based on the criteria previously stated. A complete list of special-status plant species with potential to occur within the project area is provided in **Table 2**. The species listed in Table 2 include species that could either occur within

TABLE 2
RARE AND SPECIAL-STATUS PLANTS WITH POTENTIAL TO OCCUR IN THE PROJECT VICINITY

Species	Status/ CNPS Rank	Growth Habit/ Flowering Period	Elevation (ft (m))	Habitat	Water Body with Suitable Habitat in the Project Vicinity
forked fiddleneck (*Amsinckia furcat*a)	None/4.2	Annual herb/February-May	164-3,281 (50-1000)	Found in cismontane woodland and valley and foothill grassland habitat.	O'Neill Forebay Potential to occur in upland areas surrounding reservoir.
California androsace (*Androsace elongata* ssp. *acuta*)	None/4.2	Annual herb/March-June	492-3,937 (150-1,200)	Found throughout many different habitats including chaparral, cismontane woodland, coastal scrub, meadows and seeps, pinyon and juniper woodland and valley and foothill grassland.	Pyramid Lake Quail Lake Silverwood Lake Potential to occur in upland areas surrounding reservoir.
Horn's milkvetch (*Astragalus hornii var. hornii*)	None/1 B.1	Annual herb/May-October	197-2,789 (60-850)	Found in alkali playas, meadow's, seeps and wetlands.	Pyramid Lake Potential to occur in wetland areas surrounding reservoir.
heartscale (*Atriplex cordulata* var. *cordulata*)	None/1B.1	Annual herb/ April-October	0-1837 (0-560)	Found throughout chenopod scrub, meadows and seeps and valley and foothill grasslands.	O'Neill Forebay Potential to occur in upland areas surrounding reservoir.
crownscale (*Atriplex coronata* var. *coronata*)	None/4.2	Annual herb/March-October	3.28-1,936 (1-590)	Found throughout chenopod scrub, meadows and seeps and valley and foothill grasslands.	O'Neill Forebay Potential to occur in upland areas surrounding reservoir.
Lost Hills crownscale (*Atriplex coronata* var. *vallicola*)	None/1B.2	Annual herb/April-August	164-2083 (50-635)	Found in chenopod scrub, valley and foothill grassland, vernal pools and grasslands.	O'Neill Forebay Potential to occur in upland areas surrounding reservoir.
thread-leaved brodiaea (*Brodiaea filifolia*)	FT/SE/1B.1	Perennial bulbiferous herb/March-June	82-3,675 (25-1120)	Found in chaparral, cismontane woodland, coastal scrub, valley and foothill grasslands and vernal pool habitats.	Silverwood Lake Potential to occur in upland areas surrounding reservoir.
round-leaved filaree (*California macrophylla*)	None/1B.1	Annual herb/March-May	33-3937 (10-1200)	Found in cismontane woodland and valley and foothill grassland.	O'Neill Forebay Quail Lake Potential to occur in upland areas surrounding reservoir.
club-haired mariposa- lily (*Calochortus clavatus* var. *clavatus*)	None/4.3	Perennial bulbiferous herb/May-June	246-4,265 (75-1300)	Found in chaparral, cismontane woodland, coastal scrub and valley and foothill grassland habitats.	Pyramid Lake Potential to occur in upland areas surrounding reservoir.
Slender mariposa-lily (*Calochortus clavatus* var. *gracilis*)	None/1B.2	Perennial bulbiferous herb/March-June	1,050-3,281 (320-1,000)	Found in chaparral and coastal scrub habitats. Shaded foothill canyons; often on grassy slopes within other habitat.	Pyramid Lake Quail Lake Potential to occur in upland areas surrounding reservoir.
late-flowered mariposa-lily (*Calochortus fimbriata*	None/1B.3	Perennial bulbiferous herb/June-August	902-6,250 (275-1905)	Found within chaparral, cismontane woodland and riparian woodland habitats.	Quail Lake Potential to occur in upland areas surrounding reservoir.

TABLE 2
RARE AND SPECIAL-STATUS PLANTS WITH POTENTIAL TO OCCUR IN THE PROJECT VICINITY

Species	Status/ CNPS Rank	Growth Habit/ Flowering Period	Elevation (ft (m))	Habitat	Water Body with Suitable Habitat in the Project Vicinity
Palmer's mariposa-lily (*Calochortus palmeri* var. *palmeri*)	None/1B.2	Perennial bulbiferous herb/April-July	3,281-7,841 (1,000-2,390)	Found in chaparral, lower montane coniferous forest and meadows and seeps.	Quail Lake Silverwood Lake Potential to occur in upland areas surrounding reservoir.
Plummer's mariposa-lily (*Calochortus plummerae*)	None/4.2	Perennial bulbiferous herb/May-July	329-5,577 (100-1,700)	Found on granitic, rocky substrate within chaparral, cismontane woodland, coastal scrub, lower montane coniferous forests and valley and foothill grassland habitats.	Pyramid Lake Silverwood Lake Potential to occur in upland areas surrounding reservoir.
Peirson's morning-glory (*Calystegia peirsonii*)	None/4.2	Perennial rhizomatous herb/April-June	98-4,920 (30-1,640)	Found in chaparral, chenopod scrub, cismontane woodland, coastal scrub, lower montane coniferous forest, and valley and foothill grassland habitats.	Pyramid Lake Quail Lake Potential to occur in upland areas surrounding reservoir.
white pygmy-poppy (*Canbya candida*)	None/4.2	Annual herb/March-June	1,969-4,790 (600-1,460)	Found on sandy, gravelly, and granitic substrates in Joshua tree woodland, Mojavean desert scrub, and pinyon and juniper woodland habitats.	Silverwood Lake Potential to occur in upland areas surrounding reservoir.
Lemmon's jewelflower (*Caulanthus lemmonii*)	None/1B.2	Annual herb/March-May	263-4003 (80-1220)	Found in within Pinyon and juniper woodlands and valley and foothill grasslands.	O'Neill Forebay Potential to occur in upland areas surrounding reservoir.
hispid birds-beak (*Chloropyron molle* ssp*. hispidum*)	None/1B.1	Annual herb (hemiparasitic)/June-September	3.28-509 (1-155)	Found in meadows and seeps, playas and valley and foothill grassland habitat.	O'Neill Forebay Potential to occur in upland areas surrounding reservoir.
San Fernando Valley spineflower (*Chorizanthe parryi* var*. parryi*)	FSS/1B.1	Annual herb/	902-4,003 (275-1220)	Found in sandy or rocky openings within coastal scrub and chaparral.	Silverwood Lake Potential to occur in upland areas surrounding reservoir.
Monkey-flower savory (*Clinopodium mimuloides*)	None/4.2	Perennial herb/June-October	1,001-5,906 (305-1,800)	Found along stream banks within chaparral and North Coast coniferous forest habitats.	Pyramid Lake Potential to occur in stream bank areas in the vicinity of the reservoir.
small-flowered morning glory (*Convolvulus simulans*)	None/4.2	Annual herb/March-July	98.4-2,297 (30-700)	Found in clay soils within chaparral, coastal scrub and valley and foothill grassland habitats	O'Neill Forebay Potential to occur in upland areas surrounding reservoir.
Mojave tarplant (*Deinandra mohavensis*)	SE, FSS/1B.3	Annual herb/May-January	2100-5249 (640-1600)	Found within chaparral and riparian scrub habitats.	Silverwood Lake Potential to occur in upland areas surrounding reservoir.
spiny-sepaled button-celery (*Eryngium spinosepalum*)	None/1B.2	Annual/Perennial herb/April-May	262-837 (80-255)	Generally found within vernal pools in valley and foothill grasslands.	O'Neill Forebay Potential to occur in vernal pool wetlands in the reservoir vicinity.

TABLE 2
RARE AND SPECIAL-STATUS PLANTS WITH POTENTIAL TO OCCUR IN THE PROJECT VICINITY

Species	Status/ CNPS Rank	Growth Habit/ Flowering Period	Elevation (ft (m))	Habitat	Water Body with Suitable Habitat in the Project Vicinity
Stinkbells (*Fritillaria agrestis*)	None/4.2	Perennial bulbiferous herb/March-June	32.8-5,102 (10-1555)	Found on clay soils within chaparral, cismontane, pinyon and juniper woodland and valley and foothill grassland habitats.	O'Neill Forebay Potential to occur in upland areas surrounding reservoir.
Los Angeles sunflower (*Helianthus nuttallii* ssp. *parishii*)	None/1A	Perennial rhizomatous herb/August-October	33-5,495 (10-1675)	Found in freshwater and alkaline marshes and swamps in Southern California.	Pyramid Lake Unlikely to occur in freshwater marsh surrounding reservoir; Los Angeles sunflower is presumed extirpated in California.
California satintail (*Imperata brevifolia*)	None/2B.1	Perennial rhizomatous herb/September-May	0-3,986 (0-1215)	Found within chaparral, coastal scrub, Mojavean desert scrub, Meadows and seeps and riparian scrub habitats.	Silverwood Lake Potential to occur in upland or riparian areas surrounding reservoir.
ocellated Humboldt lily (*Lilium humboldtii* ssp. *ocellatum*)	None/4.2	Perennial bulbiferous herb/March-August	100-5,905 (30-1,800)	Found in openings within chaparral, cismontane woodland, coastal scrub, lower montane coniferous forest, and riparian woodland habitats.	Pyramid Lake Potential to occur in upland or riparian areas surrounding reservoir.
sylvan microseris (*Microseris sylvatica*)	None/4.2	Perennial herb/March-June	148-4,921 (45-1500)	Found in chaparral, cismontane woodland, Great Basin scrub, pinyon and juniper woodland and valley and foothill woodland.	Pyramid Lake Quail Lake Potential to occur in upland areas surrounding reservoir.
Hall's monardella (*Monardella macrantha* ssp. *hallii*)	FSS/1B.3	Perennial rhizomatous herb/June to October	2395-7,201) (730-2,195)	Found in broadleaved upland forest, chaparral, cismontane woodland, lower montane coniferous forest and valley and foothill grassland.	Silverwood Lake Potential to occur in upland areas surrounding reservoir.
California muhly (*Muhlenbergia californica*)	None/4.3	Perennial rhizomatous herb/June-September	328-6,562 (100-2,000)	Found along seeps and stream banks within chaparral, coastal scrub, lower montane coniferous forest habitats.	Silverwood Lake Potential to occur in upland areas surrounding reservoir.
shining navarretia *(Navarretia nigelliformis* ssp. *radians*)	None/1B.2	Annual herb/April-July	249-3,281 (76-1000)	Found within cismontane woodland, valley and foothill grassland, vernal pools and marshes.	O'Neill Forebay Potential to occur in vernal pool wetlands or grasslands in the reservoir vicinity.
Piute Mountains navarretia (*Navarretia setiloba)*	FSS/None	Annual herb/April-July	918-4,068 (280-1240)	Found in cismontane woodland, pinyon and juniper woodlands and valley and foothill grassland.	Quail Lake Potential to occur in upland areas surrounding reservoir
Robbins' nemacladus (*Nemacladus secundiflorus* var. *robbinsii*)	None/1B.2	Annual herb/April-June	1,148-5,577 (350-1700)	Found in chaparral and valley and foothill grassland habitats.	Quail Lake Pyramid Lake Potential to occur in upland areas surrounding reservoir

TABLE 2
RARE AND SPECIAL-STATUS PLANTS WITH POTENTIAL TO OCCUR IN THE PROJECT VICINITY

Species	Status/ CNPS Rank	Growth Habit/ Flowering Period	Elevation (ft (m))	Habitat	Water Body with Suitable Habitat in the Project Vicinity
short-joint beavertail (*Opuntia basilaris* var. *brachyclada*)	None/1B.2	Perennial stem succulent/April-August	3,937-5,905 (1,200-1,800)	Found in chaparral, Joshua tree woodland, Mojavean desert scrub, and pinyon and juniper woodland habitats.	Silverwood Lake Potential to occur in upland areas surrounding reservoir
short-joint beavertail (*Opuntia basilaris* var. *treleasei)*	None/1B.2	Perennial stem succulent/April-August	393-3,740 (120-1,140)	Found in chenopod scrub, cismontane woodland, valley and foothill grassland habitats.	Quail Lake Potential to occur in upland areas surrounding reservoir
adobe yampah (*Perideridia pringle*i)	None/4.3	Perennial herb/April-July	984-5,906 (300-1800)	Found within chaparral, cismontane woodland, coastal scrub and pinyon and juniper woodland habitats.	Quail Lake Pyramid Lake Potential to occur in upland areas surrounding reservoir
Sanford's arrowhead (*Sagittaria sanfordii*)	None/1B.2	Perennial rhizomatous herb/May-October	0-2,132 (0-650)	Found in wetland communities.	O'Neill Forebay Potential to occur in shoreline areas and adjacent wetlands.
Southern mountain's skullcap (*Scutellaria bolanderi* ssp. *austromontana*)	FT, FSS/1B.2	Perennial rhizomatous herb/June-August	1394-6,562 (425-2000)	Found throughout chaparral, lower cismontane woodlands and lower montane coniferous forests.	Silverwood Lake Potential to occur in upland areas surrounding reservoir
San Gabriel ragwort (*Senecio astephanus*)	None/4.3	Perennial herb/May-July	1,312-4921 (400-1,500)	Found on rocky slopes within coastal bluff scrub and chaparral habitats.	Lake Pyramid Potential to occur in upland areas surrounding reservoir
black bogrush (*Schoenus nigricans*)	FSS/2B.2	Perennial herb/August-September	492-6,562 (150-2000)	Found in marshes and swamps, often alkaline.	Silverwood Lake Potential to occur in shoreline areas and adjacent wetlands
Laguna Mountains jewelflower (*Streptanthus bernardinus*)	None/4.3	Perennial herb/May-August	2,198-8,202 (670-2500)	Found throughout chaparral, lower montane coniferous forest and upper montane coniferous forest habitats.	Silverwood Lake Potential to occur in upland areas surrounding reservoir
Southern jewelflower (*Streptanthus campestris*)	FSS/1B.3	Perennial herb/April-July	2,952-7,546 (900-2300)	Found within chaparral, lower montane coniferous forest and pinyon-juniper forest habitats.	Silverwood Lake Potential to occur in upland areas surrounding reservoir
Greata's aster (*Symphyotrichum greatae*)	None/1B.3	Perennial rhizomatous herb/June-October	984-6,594 (300-2,010)	Found on mesic substrates within broadleafed upland forest, chaparral, cismontane woodland, lower montane coniferous forest, and riparian woodland habitats.	Lake Pyramid Quail Lake Potential to occur in upland areas surrounding reservoir
San Bernardino aster (*Symphyotrichum defoliatum*)	FSS/1B.2	Perennial rhizomatous herb/July-November	0-4,500 (0-1,406)	Found in wetlands, meadows and seeps, marshes and swamps as well as upland areas including cismontane woodland, valley and foothill grassland, lower montane coniferous forest and coastal scrub.	Pyramid Lake Quail Lake Silverwood Lake Potential to occur in shoreline areas and adjacent wetlands

TABLE 2
RARE AND SPECIAL-STATUS PLANTS WITH POTENTIAL TO OCCUR IN THE PROJECT VICINITY

Species	Status/ CNPS Rank	Growth Habit/ Flowering Period	Elevation (ft (m))	Habitat	Water Body with Suitable Habitat in the Project Vicinity
Lemmon's syntrichopappus (*Syntrichopappus lemmonii*)	None/4.3	Annual herb/April-June	1,640-6,004 (500-1,830)	Found on sandy or gravelly substrate within chaparral, Joshua tree woodland and pinyon and juniper woodland habitats.	Lake Pyramid Potential to occur in upland areas surrounding reservoir

1. Federal status: USFWS Listing, other non-CA specific listing
   FE = Listed as endangered under the federal Endangered Species Act (ESA)
   FC = Candidate for listing (threatened or endangered) under Federal Endangered Species Act.
   FSS = Listed as sensitive by the United States Forest Service
2. State status: CDFW Listing
   SE = Listed as endangered under the California Endangered Species Act (CESA)
   CR = Rare in California
3. Habitat description:
   Habitat description information from the California Wildlife Habitat Relationships System maintained by the CDFW

1 CNPS: CNPS Ranking
Rank 1B = Plant species that are rare, threatened, or endangered in California and elsewhere.
Rank 2 = Plant species that are rare, threatened, or endangered in California, but more common elsewhere.
Rank 4 = Plants of limited distribution - a watch list

2 Habitat description: Habitat description adapted from CNPS online inventory (CNPS 2010)
Threat Ranks
0.1 – Seriously threatened in California (high degree/immediacy of threat)
0.2 – Fairly threatened in California (moderate degree/immediacy of threat)
0.3 – Not very threatened in California (low degree/immediacy of threats or no current threats known)

SOURCES: USFWS 2012; CDFG 2013; CNPS 2013

the riparian or wetland areas in the water bodies or in adjacent uplands. A comprehensive list of all species included in the CNDDB and CNPS database searches is provided as Appendix B at the end of this report.

Based on an analysis of the habitat present at each of the four water bodies, 12 special-status plants were determined to have potential to occur within the riparian forest or wetland communities occurring along the shoreline or adjacent to the water bodies. The species with potential to occur along the shoreline or adjacent to each water body, and therefore with potential to be impacted by the proposed project, are listed below:

Pyramid Lake

- Horn's milkvetch (*Astragalus hornii* ssp. *hornii*)
- Monkey-flower savory (*Clinopodium mimuloides*)
- Mojave tarplant (*Deinandra mohavensis*)
- Los Angeles sunflower (*Helianthus nuttallii* ssp. *parishii)*
- California satintail (*Imperata brevifolia*)
- Ocellated Humboldt lily (*Lilium humboldtii* ssp. *ocellatum*)
- San Bernardino aster (*Symphyotrichum defoliatum*)

Silverwood Lake

- Palmer's mariposa-lily (*Calochortus palmeri*)
- San Bernardino aster
- Black bogrush (*Schoenus nigricans*)

Quail Lake

- Late-flowered mariposa-lily (*Calochortus fimbriata*)
- Palmer's mariposa-lily
- San Bernardino aster

O'Neill Forebay

- Hispid birds-beak (*Chloropyron molle* ssp. *hispidum*)
- Sanford's arrowhead (*Sagittaria sanfordii*)

6.2 Special-Status Wildlife

Special-status wildlife are defined as those animals that, because of their recognized rarity or vulnerability to various causes of habitat loss or population decline, are recognized by federal, state, or other agencies as under threat from human-associated developments. Some of these species receive specific protection that is defined by federal or state endangered species legislation. Others have been designated as special-status on the basis of adopted policies and expertise of state resource agencies or organizations with acknowledged expertise, or policies adopted by local governmental agencies such as counties, cities, and special districts to meet local conservation objectives. Special-status wildlife is defined as follows:

- Wildlife listed or proposed for listing as threatened or endangered, or are candidates for possible future listing as threatened or endangered, under the federal Endangered Species Act or the California Endangered Species Act;
- Wildlife that meet the definitions of rare or endangered under *CEQA Guidelines* Section 15380.
- Wildlife covered under an adopted NCCP/HCP;
- Wildlife designated by CDFW as "species of special concern";
- Wildlife designated as "Sensitive" by the United States Forest Service (USFS).
- Wildlife "fully protected" in California (Fish and Game Code Sections 3511, 4700, and 5050); and
- Wildlife protected by the MBTA.

A review of the most recent CNDDB (CDFW, 2014) records within the 9 USGS 7.5 Minute Quadrangle for each of the four water bodies included numerous special-status wildlife species that have been recorded as occurring within the general vicinity of the project, and most commonly within upland habitats. A list of these species is provided as Appendix B. The list was reviewed to determine which species have potential to occur within the water or in the habitat immediately surrounding each water body based on factors such as the vegetation and habitat quality, topography, elevation, soils, surrounding land uses, habitat preferences, and geographic ranges. A total of 51 special-status wildlife species have the potential to occur within the vicinity of the project area and these species are provided in **Table 3**. Special-status species observed during surveys are noted in Table 3 below. Table 3 includes species that could either occur within the riparian or wetland areas within the water bodies or in adjacent upland habitats. Based on analysis of the habitat present at each of the four water bodies, 19 special-status wildlife species were determined to have a potential to occur within the wetland communities or deep water habitats of at least one of the water bodies. The water body for which a species was determined to have a potential to occur is indicated in Table 3. The project area is not located within designated critical habitat for any federally- or state-listed species.

Pyramid Lake

- Arroyo toad (*Anaxyrus californicus*)
- Bald eagle (*Haliaeetus leucocephalus*)
- Foothill yellow-legged frog (*Rana boylii*)
- Northern harrier (*Circus cyaneus*)
- Tricolored blackbird (*Agelaius tricolor*)
- Two-striped garter snake (*Thamnophis hammondii*)
- Western pond turtle (*Emys marmorata*)
- Western spadefoot (*Spea hammondii*)

Silverwood Lake

- Arroyo toad
- California red-legged frog (*Rana draytonii*)

- San Bernardino ring-necked snake (*Diadophis punctatus* ssp. *modestus*)
- Southern mountain yellow-legged frog (*Rana muscosa*)
- Two-striped garter snake
- Western pond turtle
- Bald eagle

Quail Lake

- Northern harrier
- Foothill yellow-legged frog (*Rana boylii*)
- Western pond turtle
- Bald eagle

O'Neill Forebay

- California tiger salamander (*Ambystoma californiense*)
- Cackling goose (*Branta hutchinsii* ssp. *leucopareia*)
- Northern harrier
- Western pond turtle
- California red-legged frog
- Western spadefoot
- Giant garter snake (*Thamnophis gigas*)
- Tricolored blackbird
- Yellow warbler (*Dendroica petechia brewsteri*)

As discussed above, O'Neill Forebay is connected to the Delta via the California Aqueduct and Delta-Mendota Canal. As a result, fish species present in the Delta, including several special-status species, can be transported into O'Neill Forebay after being entrained through the Banks Pumping Plant (part of the SWP) and/or the Tracy Pumping Plant (part of the CVP) in the south Delta. While most fish entrained into the pumping plants do not survive, there is a small fraction that can potentially survive. Once fish have been transported into O'Neill Forebay, it is not possible for them to return to the Delta. Because of issues associated with continued fish passage (i.e., upstream to potential spawning habitat for adults and downstream rearing and emigration to ocean for juveniles) and survival (i.e., pump mortality, high water temperatures, and fish predation), special-status fish species are not able to persist in O'Neill Forebay and the habitat is considered to be unsuitable for fish.

Special-status wildlife species with records of occurrences in the region, as provided by the CNDDB, are listed below in **Table 3**, **Special-Status Wildlife Species with Potential to Occur in the Project Vicinity**.

TABLE 3
SPECIAL-STATUS WILDLIFE SPECIES WITH POTENTIAL TO OCCUR IN THE PROJECT VICINITY

Species	Status: Federal/State	Preferred Habitat	Water Body with Suitable Habitat in the Project Vicinity
Fish			
Santa Ana sucker (*Catostomas santaanae*)	FT/SSC	Prefers small to medium streams with higher gradients, clear water, and coarse substrates.	Pyramid Lake Requires stream habitat; unlikely to occur in reservoir.
Mohave tui chub (*Siphateles bicolor*. *mohavensis*)	FE/SE/FP	Historically endemic to the Mojave river, however, was thought to be extirpated prior to its federal listing in 1970. It has now been re-introduced at three locations throughout the Mojave River.	Silverwood Lake Only found in Mojave River; unlikely to occur in reservoir.
Amphibians			
California tiger salamander (*Ambystoma californiense*)	FT/ST,SSC	Known to occur throughout the woodlands throughout the foothills of the California coast ranges and the grasslands of the Central and coastal valleys. This species requires standing water in the form of vernal pools, cattle stock tanks or natural wetlands for breeding.	O'Neill Forebay Occurs in small ponds and streams; unlikely to occur in reservoir shoreline areas.
arroyo toad (*Anaxyrus californicus*)	FE/SSC	Sandy/gravelly areas of permanent and intermittent rivers, creeks and standing water with sandy banks.	Pyramid Lake Silverwood Lake Requires stream habitat; unlikely to occur in reservoir shoreline areas.
California red-legged frog (*Rana draytonii*)	FT/SSC	Requires 11 to 20 weeks of permanent water for larval development; must have access to aestivation habitat. Occurs in lowlands and foothills in or near permanent sources of deep water with dense, shrubby, or emergent riparian vegetation.	O'Neill Forebay Silverwood Lake Occurs in small ponds and streams; unlikely to occur in reservoir shoreline areas.
Foothill yellow-legged frog (*Rana boylii*)	None, SSC	Inhabits small lakes, ponds, meadow streams, isolated pools, and riverbanks in the southern Sierra Nevada Mountains. In the mountains of Southern California, inhabits rocky streams in narrow canyons and chaparral habitats. Isolated populations of this species occur within the San Gabriel and San Bernardino mountains.	Pyramid Lake Quail Lake Occurs in small ponds and streams; unlikely to occur in reservoir shoreline areas.
Southern mountain yellow-legged frog (*Rana muscosa*)	FEFSS/SE/SSC	Inhabits small lakes, ponds, meadow streams, isolated pools, and riverbanks in the southern Sierra Nevada Mountains. In the mountains of Southern California, inhabits rocky streams in narrow canyons and chaparral habitats. Isolated populations of this species occur within the San Gabriel and San Bernardino mountains.	Silverwood Lake Occurs in small ponds and streams; unlikely to occur in reservoir shoreline areas.
Tehachapi slender salamander (*Batrachoseps stebbinsi*)	None/Threatened	Inhabits the damp leaf litter under trees within cismontane and riparian woodlands.	Pyramid Lake Low potential for occurrence.
Reptiles			
silvery legless lizard (*Anniella pulchra pulchra*)	None/SSC	Sandy or loose loamy soils in chaparral, coastal dunes, and coastal scrub. Requires soils with high moisture content.	Pyramid Lake Silverwood Lake Low potential for occurrence.
orangethroat whiptail (*Aspidoscelis hyperythra*)	FSS/None	Found in chaparral, cismontane woodland and coastal scrub.	Silverwood Lake Low potential for occurrence.

TABLE 3
SPECIAL-STATUS WILDLIFE SPECIES WITH POTENTIAL TO OCCUR IN THE PROJECT VICINITY

Species	Status: Federal/State	Preferred Habitat	Water Body with Suitable Habitat in the Project Vicinity
Reptiles (cont.)			
coastal western whiptail (*Aspidoscelis tigris stejnegeri*)	None/None	Found in deserts & semiarid areas with sparse vegetation and open areas. Also found in woodland & riparian areas. Ground may be firm soil, sandy, or rocky.	Pyramid Lake Quail Lake Silverwood Lake Low potential for occurrence.
Rosy boa (*Charina trivirgata*)	None/None	Found in chaparral, Mojavean desert scrub and Sonoran desert scrub.	Silverwood Lake Low potential for occurrence.
Southern rubber boa (*Charina umbratica*)	FSS/None	Found in rocky areas within upper montane coniferous forests. This species is also known to occur near water sources.	Silverwood Lake Low potential for occurrence.
San Bernardino ring-necked snake (*Diadophis punctatus* ssp. *modestus*)	FSS/None	Found in moist habitats including wet meadows within the vicinity of rocky hillsides, gardens, farmland, chaparral and mixed conifer forests.	Silverwood Lake Low potential for occurrence.
Western pond turtle (*Emys marmorata*)	None/SSC	Slow-moving permanent or intermittent streams, ponds, small lakes, reservoirs with emergent basking sites; adjacent uplands used during winter.	O'Neill Forebay Pyramid Lake Quail Lake Silverwood Lake Could occur near shoreline areas.
San Joaquin whipsnake (*Masticophis flagellum ruddocki*)	None/SSC	Inhabit chenopod scrub and grassland of the central valley.	O'Neill Forebay Low potential for occurrence.
Coast horned lizard (*Phyrnosoma blainvillii*)	None/SSC	A wide variety of habitats, most common in sandy washes with scattered, low bushes. Requires open areas for sunning, bushes for cover, patches of loose soil for burial, and abundant supply of ants and other insects.	Pyramid Lake Silverwood Lake Low potential for occurrence.
western spadefoot (*Spea hammondii*)	None/SSC	Inhabits Cismontane woodland, coastal scrub, valley and foothill grassland, vernal pools and wetlands.	O'Neill Forebay Pyramid Lake Potential to occur in upland areas
two-striped garter snake (*Thamnophis hammondii*)	None/SSC	Known to occur in marshes, meadows, sloughs, ponds, and slow-moving water courses.	Pyramid Lake Silverwood Lake Could occur near shoreline areas.
giant garter snake (*Thamnophis gigas*)	FT/ST	Inhabits freshwater marshes and swamps of the Central Valley. This species historically ranged throughout the San Joaquin Valley, however due to habitat loss and fragmentation, the current distribution is restricted to the Sacramento Valley.	O'Neill Forebay Could occur near shoreline areas.
Birds			
Cooper's hawk *(Accipiter cooperii)*	None/WL	Nests in woodlands and sometimes suburban settings if mature trees are present. Broken woodlands or near habitat edges with the exception of their desert occurrences; seldom found in areas that do not have dense, or patchy, wooded areas. Occurs in dense stands of live oak, riparian, deciduous, or other forest habitats near water.	O'Neill Forebay Pyramid Lake Quail Lake Silverwood Lake Low potential for occurrence.

TABLE 3
SPECIAL-STATUS WILDLIFE SPECIES WITH POTENTIAL TO OCCUR IN THE PROJECT VICINITY

Species	Status: Federal/State	Preferred Habitat	Water Body with Suitable Habitat in the Project Vicinity
Birds (cont.)			
tricolored blackbird (*Agelaius tricolor*)	None/SSC	Highly colonial species, requiring open water, protected nesting substrate and foraging areas with insect prey in the vicinity of the colony.	O'Neill Forebay Pyramid Lake Quail Lake Could occur near shoreline areas.
grasshopper Sparrow (*Ammodramus savannarum*)	None/ SSC	Species is known to forage and nest throughout valley and foothill grassland.	Pyramid Lake Quail Lake Low potential for occurrence.
Bell's sage sparrow (*Artomisiospiza belli belli*)	None/WL	Nests on the ground beneath shrubs or in shrubs 6 to 18 inches above the ground within chaparral communities dominated by fairly dense stands of chamise or in coastal scrub in southern part of its range.	Silverwood Lake Low potential for occurrence.
Golden eagle (*Aquila chrysaetos*)	None/FP, WL	This species is known to nest in the region on cliff ledges or in trees on very steep slopes. They typically forage over open scrubland and grassland habitats.	Pyramid Lake Quail Lake Low potential for occurrence.
long-eared owl (*Asio otus*)	None/SSC	This species is known to occur in cismontane woodland, Great Basin scrub, riparian forest, riparian woodland and upper montane coniferous forest habitats within California. It is known to winter within the region.	Silverwood Lake Low potential for occurrence.
burrowing owl (*Athene cunicularia*)	None/SSC	Open, dry annual or perennial grasslands, deserts, and scrublands characterized by low-growing vegetation. A subterranean nester dependent upon burrowing mammals, particularly the California ground squirrel.	O'Neill Forebay Pyramid Lake Quail Lake Low potential for occurrence.
cackling goose (*Branta hutchinsii* ssp. *Leucopareia)*	Delisted/None	This species is known to roost and forage in natural and artificial water bodies throughout the state of California during migration. This species is known to breed in the Canadian tundra.	O'Neill Forebay Potential for seasonal presence in reservoir.
ferruginous hawk (*Buteo regalis*)	None/None	Known to occur within Great Basin grassland, Great Basin scrub, pinyon and juniper woodlands and valley and foothill grasslands. This species generally winters in California and breeds elsewhere, within the western United States.	O'Neill Forebay Low potential for occurrence.
Swainson's hawk (*Buteo swainsoni*)	None/ST	Within California, the species is strongly associated with riparian areas within desert, shrubsteppe, grassland, and agricultural habitats. Primary stronghold of the species is concentrated in two disjunct populations, one in the Central Valley, and the other in the Great Basin.	O'Neill Forebay Low potential for occurrence.
Northern harrier (*Circus cyaneus*)	None/SSC	Generally breeds in low vegetation generally within close proximity to saltwater, brackish or freshwater marshes.	O'Neill Forebay Pyramid Lake Quail Lake Observed during surveys at Pyramid Lake

TABLE 3
SPECIAL-STATUS WILDLIFE SPECIES WITH POTENTIAL TO OCCUR IN THE PROJECT VICINITY

Species	Status: Federal/State	Preferred Habitat	Water Body with Suitable Habitat in the Project Vicinity
Birds (cont.)			
yellow warbler (*Dendroica petechia brewsteri*)	None/SSC	Summer resident found in riparian deciduous habitats featuring cottonwoods, willows, alders, and other small trees and shrubs typical of low, open-canopy riparian woodland.	Pyramid Lake Quail Lake Silverwood Lake O'Neill Forebay Could occur.
southwestern willow flycatcher (*Empidonax trailii extimus*)	FE/SE	Neotropical migrant. Breeds in Southern California in willow-dominated riparian habitat.	Pyramid Lake Quail Lake Silverwood Lake Low potential for occurrence.
California horned lark (*Eremophila alpestris* ssp. *actia*)	None/WL	Occurs within the vicinity of marine intertidal and splash zone communities, meadows and seeps.	O'Neill Forebay Silverwood Lake Low potential for occurrence.
bald eagle (*Haliaeetus leucocephalus*)	FD/SE, FP, FSS, BCC	Known to occur throughout lower montane coniferous forests, generally utilizing old growth trees for nesting. This species is strongly associated with water bodies for foraging purposes.	O'Neill Forebay Pyramid Lake (Observed during surveys) Quail Lake Silverwood Lake (Observed during surveys) Observed during surveys at Pyramid Lake and Silverwood Lake. Has been observed at Quail Lake.
loggerhead shrike (*Lanius ludovicianus*)	None/SSC	Lowlands and foothills throughout California. Prefers open habitats with scattered shrubs, trees, posts, fences, and other perches.	Pyramid Lake Quail Lake Silverwood Lake O'Neill Forebay Low potential for occurrence.
least Bell's vireo (*vireo bellii pusillus*)	FE/SE	Riparian forest, scrub, and woodland habitats. Nests primarily in willow riparian habitats.	Pyramid Lake Quail Lake Silverwood Lake Low potential for occurrence.
gray vireo (*Vireo vicinior)*	BCC/SSC	Known to breed in chaparral habitats of Southern California.	Low potential for occurrence.
Mammals			
pallid bat (*Antrozous pallidus*)	None/SSC	Occurs throughout California and occupies a wide variety of habitats including grasslands, shrublands, woodland's, and coniferous forests; most common in open, dry habitats with rocky areas for roosting.	Pyramid Lake Quail Lake Low potential for occurrence.
Northwestern San Diego (*Chaetodipus fallax* ssp. *fallax)*	None/SSC	Occurs in chaparral and coastal scrub communities throughout the coastal and arid regions up to 1200 meters in elevation.	Silverwood Lake Low potential for occurrence.

TABLE 3
SPECIAL-STATUS WILDLIFE SPECIES WITH POTENTIAL TO OCCUR IN THE PROJECT VICINITY

Species	Status: Federal/State	Preferred Habitat	Water Body with Suitable Habitat in the Project Vicinity
Mammals (cont.)			
Townsend's big-eared bat (*Corynorhinus townsendii*)	FSS/SC	This species occurs throughout a large variety of habitats including deserts, foothills and mountains. Micro-habitats for the species include riparian corridors, meadows and seeps, wetlands, lakes and ponds.	Silverwood Lake Low potential for occurrence.
Western mastiff bat (*Eumops perotis californicus*)	None/SSC	Occurs throughout California and occupies a wide variety of habitats including grasslands, shrublands, cismontane woodland's; most common in open, dry habitats with rocky areas for roosting.	Silverwood Lake Low potential for occurrence.
San Bernardino flying squirrel (*Glaucomys sabrinus californicus*)	FSS/SSC	Occurs within broadleaved upland and lower montane coniferous forest communities.	Silverwood Lake Low potential for occurrence.
southern grasshopper mouse (*Onychomys torridus ramona*)	None/SSC	Known to occur in lower montane coniferous forest, desert scrub, desert wash, riparian areas, chaparral and pinyon-juniper woodlands.	Silverwood Lake Low potential for occurrence.
Tehachapi pocket mouse (*Perognathus alticolus inexpectatus*)	FSS/SSC	Known to occur in chaparral, Joshua tree woodland and valley and foothill grassland.	Quail Lake Low potential for occurrence.
San Joaquin pocket mouse (*Perognathus inornatus* ssp. *inornatus*)	None/None	Occurs within coastal scrub and valley and foothill grassland.	O'Neill Forebay Quail Lake Low potential for occurrence.
American badger (*Taxidea taxus*)	None/SSC	Known to occur in a variety of habitats elevations ranging from brackish to freshwater marshes and montane to cismontane forests, etc. This species can be found throughout California.	O'Neill Forebay Pyramid Lake Quail Lake Silverwood Lake Low potential for occurrence.
San Joaquin kit fox (*Vulpes macrotis mutica*)	FE/ST	Occurs throughout the California Central Valley and is generally found within chenopod scrub and valley and foothill grassland habitats.	O'Neil Forebay Low potential for occurrence.
Invertebrates			
valley elderberry longhorn beetle (*Desmocerus californicus* ssp. *dimorphus*)	FT/None	Known to occur within the California central valley generally near riparian corridors or wetlands. This species requires the presence of blue elderberry, its host plant for all life stages.	O'Neill Forebay Low potential for occurrence.
Westfork shoulderband (*Helminthoglypta taylori*)	None/None	Known to occur in riparian woodland.	Silverwood Lake Low potential for occurrence.
Kern River Pyrg (*Pyrgulopsis greggi*)	None/None	Aquatic species of gastropod inhabiting slow flowing waterways. Sole remaining known habitat is located within the Grapevine creek in Kern County.	Pyramid Lake Only found in Grapevine Creek; unlikely to occur in reservoir.

Key:

1. Federal status: USFWS Listing, other non-CA specific listing	2. State status: CDFW Listing	3. Habitat description
BCC = Federal bird of conservation concern	SE = Listed as endangered under the California Endangered Species Act (CESA)	Habitat description information from the California Wildlife Habitat Relationships System maintained by the CDFW
FE = Listed as endangered under the federal Endangered Species Act (ESA)	ST = Listed as threatened under the CESA	
FT = Listed as threatened under ESA	SC = Candidate for listing (threatened or endangered) under CESA	
FD = Delisted in accordance with the ESA	SD = Delisted in accordance with the CESA	
FSS= Listed as Sensitive with the United States Forest Service	SSC = Species of Special Concern as identified by the CDFW	
	FP = Listed as fully protected under Fish and Game Code	
	WL = Watch Listed	

SOURCES: USFWS 2012; CDFG 2013

6.3 Sensitive Natural Communities

Sensitive natural communities are those that are considered by the CDFW to be imperiled due to their decline in the region and/or their ability to support special-status plant and/or wildlife species. These communities include those that, if eliminated or substantially degraded, would sustain a significant adverse impact as defined under CEQA. Sensitive natural communities are important ecologically because their degradation and destruction could threaten populations of dependent plant and wildlife species, including special-status species, and significantly reduce the regional distribution and viability of the community. Loss of sensitive natural communities also can remove or reduce important ecosystem functions, such as water filtration by wetlands or bank stabilization by riparian woodlands.

A review of the most recent CNDDB (CDFW, 2014) records revealed a full list of sensitive natural communities known to occur on each water body and in the vicinity. Details of these natural communities are provided in **Table 4** below. Five sensitive natural communities (Great Valley Cottonwood Riparian Forest, Southern Cottonwood Willow Riparian Forest, Southern Sycamore Alder Riparian Woodland, Southern Willow Scrub, and Southern Riparian Scrub) were reported to the CNDDB along the shoreline of the four water bodies and/or in the vicinity of the project area.

6.3.1 Great Valley Cottonwood Riparian Forest

CDFW describes Great Valley Cottonwood Riparian Forest as a tall, open, broad-leaved winter-deciduous riparian forests dominated by *Populus* species. Understory vegetation is usually dominated by various willow species and other upland and riparian obligate shrubs.

This community was observed sporadically along the edges of O'Neill Forebay with dominants ranging between Fremont cottonwood and various willow species.

6.3.2 Southern Cottonwood Willow Riparian Forest

CDFW describes Southern Cottonwood Willow Riparian Forest as a tall, open, broad-leaved winter-deciduous riparian forests dominated by *Populus* species, and several willow trees. Understory vegetation is usually dominated by willow shrubs.

This community was observed sporadically throughout the shoreline of both Pyramid and Silverwood Lakes.

6.3.3 Southern Sycamore Alder Riparian Woodland

CDFW describes Southern Sycamore Alder Riparian Woodland as a tall, open, broad-leaved, winter-deciduous streamside woodland dominated by western sycamore stands that seldom form closed canopy forests, and even may appear as trees scattered in a shrubby thicket of sclerophyllous[1] and deciduous species.

[1] A woody plant with small leathery evergreen leaves

TABLE 4
SPECIAL-STATUS NATURAL COMMUNITIES WITH POTENTIAL TO OCCUR IN THE PROJECT VICINITY

Community Name	CNDDB Element Rank: Global/State	Community Description	Water Body with Suitable Habitat in the Project Vicinity
Great Valley Cottonwood Riparian Forest	G2/S2.1	Tall, open, broadleafed winter-deciduous riparian forests dominated by *Populus* species. Understories usually are dominated by various willow species and other upland and riparian obligate shrubs.	**O'Neill Forebay**
Southern Cottonwood Willow Riparian Forest	G3/S3.2	Tall, open, broadleafed winter-deciduous riparian forests dominated by *Populus* species, and several tree willows. Similar to Central Coast Cottonwood-Sycamore Riparian Forest, although apparently with less coast live oak or *Alnus* species. Understories usually are dominated by shrubby willows.	**Pyramid Lake** **Silverwood Lake**
Southern Sycamore Alder Riparian Woodland	G4/S4	A tall, open, broadleafed, winter-deciduous streamside woodland dominated by Western sycamore. These stands seldom form closed canopy forests, and even may appear as trees scattered in a shrubby thicket of sclerophyllous and deciduous species. This habitat type is similar to Sycamore Alluvial Woodland.	**Silverwood Lake**
Southern Willow Scrub	G3/S2.1	Dense, broadleafed, winter-deciduous riparian thickets dominated by several *Salix* species, with scattered emergent *populus* sp. and Western sycamore. Most stands are too dense to allow much understory development.	**Pyramid Lake** **Quail Lake** **Silverwood Lake**

Global Ranking
The global rank (G-rank) is a reflection of the overall condition of an element throughout its global range

G2 = 6-20 EOs OR 1,000-3,000 individuals OR 2,000-10,000 acres.
G3 = 21-80 EOs OR 3,000-10,000 individuals OR 10,000-50,000 acres.
G4 = Apparently secure; this rank is clearly lower than G3 but factors exist to cause some concern; i.e., there is some threat, or somewhat narrow habitat.

State Ranking
The state rank (S-rank) is assigned much the same way as the global rank, except state ranks in California often also contain a threat designation attached to the S-rank.

S2 = 6-20 EOs OR 1,000-3,000 individuals OR 2,000-10,000 acres
  S2.1 = very threatened
S3 = 21-80 EOs or 3,000-10,000 individuals OR 10,000-50,000 acres
  S3.2 = threatened
S4 = Apparently secure within California; this rank is clearly lower than S3 but factors exist to cause some concern; i.e. there is some threat, or somewhat narrow habitat. NO THREAT RANK.

This community was observed in one location at the mouth of an ephemeral drainage at the northwest corner of Silverwood Lake.

6.3.4 Southern Willow Scrub

CDFW describes Southern Willow Scrub as a dense, broad-leaved, winter-deciduous riparian thicket dominated by several *Salix* species, with scattered emergent *Populus* species and western sycamore. Most stands are too dense to allow much understory development.

This community was observed sporadically throughout the shoreline of both Pyramid and Silverwood Lakes. In addition, this community was observed outside of the shoreline, adjacent to the paved access road surrounding the lake.

6.3.5 Southern Riparian Scrub

Southern Riparian Scrub is often found in very dense thickets adjacent to creeks and ponded areas. This community is associated with areas of loose, sandy alluvium, and requires frequent flooding or scouring to prevent succession to a riparian forest dominated by cottonwoods and sycamores. Dominant species observed include mulefat and sandbar willow, and in the western portion of the forebay, California sagebrush and coyote brush are present.

This community was observed in small patches along the southern edge of the O'Neill Forebay and larger expanses along the southwestern, western, and northern edges of the forebay.

CHAPTER 7
Impact Analysis

The potential for the project to impact sensitive biological resources was assessed by examining the existing conditions of the site and determining whether any confirmed or potentially occurring sensitive biological resources could be affected by implementation of the proposed project. The analysis considered Appendix G of the CEQA Guidelines (i.e., the Initial Study Checklist) to determine if any significant impacts could occur. Below are the biological resource issues that were considered.

a) Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special status species in local or regional plans, policies, or regulations, or by the CDFW or USFWS.

b) Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, and regulations, or by the CDFW or USFWS.

c) Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the CWA (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means.

d) Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites.

e) Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance.

f) Conflict with the provisions of an adopted HCP, NCCP, or other approved local, regional, or state habitat conservation plan.

This section analyzes the impacts from copper sulfate application at the four water bodies.

7.1 Special Status Species

This section describes the potential impacts to special-status species that may occur within or along the shoreline of each water body. No critical habitat, as designated by USFWS, occurs in the project area. The staging areas for the herbicide application are developed to accommodate SWP operational activities and do not contain special-status plant or animal species.

7.1.1 Special-Status Plants

This section describes the potential impact to special-status plant species that may occur along the shore of each water body.

The following seven special-status plants have the potential to occur along the shoreline of Pyramid Lake:

- Horn's milkvetch
- Monkey-flower savory
- Mojave tarplant
- Los Angeles sunflower
- California satintail
- Ocellated Humboldt lily
- San Bernardino aster

The following three special-status plants have the potential to occur along the shoreline of Silverwood Lake:

- Palmer's mariposa-lily
- San Bernardino aster
- Black bogrush

The following three special-status plants have the potential to occur along the shoreline of Quail Lake:

- Late-flowered mariposa-lily
- Palmer's mariposa-lily
- San Bernardino aster

The following two special-status plants have the potential to occur along the shoreline of O'Neill Forebay:

- Hispid birds-beak
- Sanford's arrowhead

Plants Potentially Occurring in Upland Areas

The copper sulfate would be applied using a helicopter that would depart from previously developed areas, away from native habitats where special-status plants potentially occurring in upland areas (i.e., Horn's milkvetch, monkey-flower savory, Mojave tarplant, Los Angeles sunflower, California satintail, ocellated Humboldt lily, San Bernardino aster, Palmer's mariposa-lily, late-flowered mariposa-lily, and hispid birds-beak) could be present. Project activities would include unloading pallets of copper sulfate from a truck to the helicopter pad area, loading the copper sulfate into bins and depositing the material into the reservoir using a helicopter or boat. No copper sulfate would be dispersed within upland habitat areas where these plants could be present, and the helicopter pad areas are generally devoid of vegetation. As a result, potential

impacts to special-status plants potentially occurring in upland areas (i.e., Horn's milkvetch, monkey-flower savory, Mojave tarplant, Los Angeles sunflower, California satintail, ocellated Humboldt lily, San Bernardino aster, Palmer's mariposa-lily, late-flowered mariposa-lily, and hispid birds-beak) would be less than significant.

Plants Potentially Occurring in Open Water Areas

The copper sulfate would be applied to control planktonic algae by helicopter and/or boat to open water areas of the lake away from the immediate shoreline. Applications would be dispersed on the lake using a boat targeting nuisance algal blooms and submerged aquatic weeds. No special-status plant species would be present within the open water areas of the lake/forebay where applications would be primarily targeted, and therefore, there would be no special-status plants impacted directly or indirectly during the applications in open water areas.

Plants Potentially Occurring in Shoreline Areas

There is potential for two special-status plants to occur within the shoreline areas of the reservoirs where copper sulfate applications would be conducted to reduce nuisance algae. Special-status species with the potential to occur in shoreline areas of the reservoirs are wetland plants and include black bogrush and Sanford's arrowhead. Black bullrush and Sanford's arrowhead, if present, would occur in seasonally or perennially saturated areas along the shorelines of Silverwood Lake (black bogrush) and O'Neill Forebay (Sanford's arrowhead). Sanford's arrowhead also has the potential to occur in inundated areas at O'Neill Forebay.

The use of copper sulfate for weed and algae management is limited to aquatic environments and affected vegetation generally includes algae and submerged and floating broadleaf plants (DiTomaso 2012). The US Environmental Protection Agency ascertains that their assessment of the ecological effects of copper sulfate "does not indicate a risk of concern to freshwater vascular plants or estuarine/marine plants" (United States Environmental Protection Agency [USEPA], 2008).

Only plant tissues present in water would potentially come in contact with copper sulfate. Wetland habitats with saturated soils but no standing water are considered to be outside of the area where applications would be targeted and these are the areas most likely to support black bogrush. Copper sulfate is not likely to be taken up through roots in soil substrate. Copper is generally considered to be biologically inactive in sediments (Gettys, Haller, and Bellaud, 2009) because it becomes strongly adsorbed to the soil (DiTomaso et al 2013). Therefore, even in inundated areas, plants rooted in soil are unlikely to take up toxic levels of copper via the root system.

Black bogrush and Sanford's arrowhead, if present, are unlikely to be negatively affected by the application of copper sulfate because the majority of the above-ground tissue is typically present outside of the water column and limited plant tissue would come in contact with copper sulfate resulting in limited exposure. Black bogrush and Sanford's arrowhead would be unlikely to accumulate enough copper sulfate to result in toxicity. As a result, potential impacts to special-status plants potentially occurring in shoreline areas would be less than significant.

7.1.2 Special-Status Wildlife

Several special-status species have the potential to occur within the reservoirs or along the immediate shoreline areas and a list of special-status species by reservoir is provided below. A discussion of potential impacts to these species is also provided below. The discussion is organized into two sections based on habitat types used by the different species – impacts to aquatic habitat and impacts to upland habitat.

The following eight special-status wildlife species have the potential to occur within Pyramid Lake or along the immediate shoreline:

- Western pond turtle
- Arroyo toad
- Foothill yellow-legged frog
- Western spadefoot
- Two-striped garter snake
- Tricolored blackbird
- Northern harrier
- Bald eagle

The following seven special-status wildlife species have the potential to occur within Silverwood Lake or along the immediate shoreline:

- Arroyo toad
- California red-legged frog
- San Bernardino ring-necked snake
- Southern mountain yellow-legged frog
- Two-striped garter snake
- Western pond turtle
- Bald eagle

The following four special-status wildlife species have the potential to occur within Quail Lake or along the immediate shoreline:

- Northern harrier
- Foothill yellow-legged frog
- Western pond turtle
- Bald eagle

The following nine special-status wildlife species have the potential to occur within O'Neill Forebay or along the immediate shoreline:

- California tiger salamander
- Cackling goose
- Northern harrier
- Western pond turtle

- California red-legged frog
- Western spadefoot
- Giant garter snake
- Tricolored blackbird
- Yellow warbler

Impacts to Aquatic Habitat

Impacts to aquatic habitat could occur through immediate exposure and toxicity, long-term exposure and bioaccumulation, and through post-application decreases in dissolved oxygen. Each of these impact mechanisms is described below.

Immediate Exposure and Toxicity

Wildlife species that utilize aquatic habitats associated with the lakes, including fish, amphibians, reptiles, and birds, could be exposed to copper sulfate, the active ingredient in aquatic herbicides being used, if they are present in the application areas during periods when applications are taking place. Studies have shown that the application of copper sulfate to surface waters for nuisance algae control in reservoirs have no apparent negative effects for most adult game fish (Anderson et al., 2001). However, copper sulfate has been shown to be toxic to larval fish and aquatic invertebrates (Diamond, et al., 1997; TOXNET, 1975-1986.). CDFW laboratory tests have shown that concentrations of 1,000 parts per billion (ppb) are many times below the toxicity values for delta smelt (California Department of Boating and Waterways [DBW], 2001). Salmonids tend to be more sensitive to copper sulfate than other fish species but tests for rainbow trout have also shown toxicity values many times higher than the application concentrations that would occur with this project (DBW, 2001). Copper concentrations would be applied according to the label to achieve a maximum concentration of 1,000 ppb, well below any known concentrations that may be toxic to fish in the project area.

Copper sulfate exposure poses less of a threat to birds than to other animals, with the lowest lethal dose for this material in pigeons and ducks being 1,000 parts per million (ppm) (Tucker and Crabtree, 1970).This toxicity value is many times higher than the application concentrations that would occur for this project.

The potential for special-status amphibians to be exposed to copper applications is low because habitat within the reservoirs is generally not suitable and these species would not be expected to occur where applications would be targeted. Arroyo toad inhabits washes, arroyos, sandy riverbanks, and riparian areas. Southern mountain yellow-legged frog and foothill yellow-legged frog also inhabit small streams with sandy banks and would not be expected to occur within the reservoirs. California red-legged frog is principally a pond frog that can be found in quiet permanent waters of ponds, pools, streams, springs, and marshes. Similarly, California tiger salamander are typically found occupying habitat in small stock ponds and would not be expected to occur in any of the reservoirs.

The potential for two-striped garter snakes to be exposed to copper applications is also low because this species is generally found around pools, creeks, cattle tanks, and other water sources,

often in rocky areas, in oak woodland, chaparral, brushland, and coniferous forest. The potential for giant garter snakes to be exposed to applications is also low because this species generally inhabits freshwater marshes and swamps of the Central Valley. Western pond turtles are typically found in ponds, lakes, rivers, streams, creeks, marshes, and irrigation ditches, with abundant vegetation, and either rocky or muddy bottoms, in woodland, forest, and grasslands. While it is possible that they could be present in areas exposed to applications of copper sulfate, it is unlikely. If they are present in areas where copper applications would be conducted, the effects would be expected to be negligible due to the small amount of copper that would be applied. Lastly, with implementation of the Aquatic Pesticides Application Plan (see Chapter 2: Project Description), fish (and other wildlife) distress and/or kills would be detected through visual fish and wildlife monitoring during and after applications. If distressed turtles are observed during monitoring, these results would be reported and application procedures would be refined in order to avoid any potential harm.

Because the potential for special-status species exposure to copper sulfate applications is low and because targeted application concentrations of copper sulfate are substantially lower than toxicity thresholds for sensitive fish and wildlife, impacts associated with immediate exposure and toxicity would be less than significant.

Long-term Exposure and Bioaccumulation

Although copper sulfate is highly water soluble; that is, it dissolves very easily in water, the copper ions are strongly adsorbed by soil (lake-bottom sediment) particles when it is applied (TOXNET, 1975-1986). Copper compounds, or precipitates, also settle out of solution, in a process called precipitation. Copper that is absorbed by sediments and copper precipitates are biologically inactive, meaning that they do not undergo further biological changes (Gangstad, 1986). Additionally, copper that is not in a soluble form (i.e., absorbed by sediment or copper precipitate) is less available for uptake into the food web and less toxic (Moffett et al., 1998). Because copper sulfate applications are expected to be rapidly absorbed by lake sediments (TOXNET, 1975-1986) and/or form precipitates and fall out of solution, and these forms are much less bio-available and toxic, impacts associated with long-term exposure and bioaccumulation of copper are less than significant.

Post-application Decreases in Dissolved Oxygen

While not associated with direct copper toxicity, aquatic herbicides, including copper sulfate have the potential to result in temporary decreases in dissolved oxygen (DO) concentrations in water if large blooms of algae are treated at one time or through frequent treatments that occur over a relatively short duration. Low DO concentrations (< 5 to 6 mg/L) can occur when the decomposition of organic matter (dead algal matter) results in high biological oxygen demand (BOD). Sudden increases in BOD and associated decreases in DO (below 5 to 6 mg/L for warmwater fish and below 6 to 8 mg/L for coldwater fish, including salmonids) can result in conditions that are unsuitable for fish and lead to fish kills (State Water Resources Control Board [SWRCB], 2004). Substantial decreases in DO are not expected to result from copper sulfate applications because DWR has developed and implements an APAP describing their copper sulfate applications, including best management practices (BMPs), and water quality monitoring

programs. Therefore, with the implementation of the APAP, this impact is less-than-significant. Additionally, at O'Neill Forebay, water would not be released from the forebay into the adjacent O'Neill Forebay Wildlife Area during copper sulfate application.

Based on a review of past monitoring reports (DWR, 2011, 2012, and 2013b), there have been no reported periods of prolonged water quality degradation, distressed fish, or fish kills associated with these past copper sulfate applications.

In summary, based on a review of copper concentration toxicities to fish and birds, the concentrations of copper that would be achieved with applications of copper, and bioavailability of copper in lake sediments, impacts resulting from copper sulfate exposure would be **less than significant**. DWR's adherence to the APAP would further ensure that water quality and sensitive biological resources within the lakes would not be impacted by the application of copper sulfate. Additionally, copper sulfate applications may reduce the potential for fish kills, and reduce risks to other animals, by killing algal biomass which can produce toxins that are toxic to all animals.

Impacts to Upland Habitats

As discussed above for special-status plants, the proposed project would not affect upland native habitat areas and, as a result, would not be anticipated to affect any terrestrial wildlife species utilizing those habitats, including special-status species such as western spadefoot. However, there are a number of resident and seasonally present bird species that have the potential to nest and/or forage in the vicinity of the proposed project site in trees and adjacent vegetation along the shoreline. These species include tricolored blackbird, northern harrier, bald eagle, cackling goose, and yellow warbler. Depending on the timing of application, repeated noise and wind disturbance from helicopters and drift of copper sulfate during aerial applications could affect habitats close to the shoreline where birds may nest. Repeated noise and wind disturbance from helicopters and copper sulfate drift could also cause a nesting bird to abandon a nest resulting in loss of eggs or chicks, or affect the nest directly is eggs or chicks are present. Such impacts to active nests would be a violation of the MBTA and Fish and Game Code (see Section 3.2.1 above). Implementation of the mitigation measure recommended below would reduce the potential for injury or mortality of nesting birds during helicopter applications through application timing, pre-application nesting bird surveys, and establishment of nesting buffers.

Mitigation Measure BIO-1: Impact Avoidance to Nesting Birds

The following mitigation measures are recommended to reduce potential impacts to nesting birds during application of copper sulfate by helicopters:

- If a copper sulfate application is scheduled to occur during the breeding season (February 1–August 31), it is recommended that a qualified biologist conduct pre-application surveys of all potential nesting habitats within 500 feet of proposed helicopter application activities. At least one survey should be conducted no more than three days prior to these activities. If the application is scheduled to occur during the non-nesting season (September 1 through January 31), a pre-application survey is not necessary and no additional measures are recommended.

- If active nests are found, no-disturbance buffers shall be implemented around each nest based on the species and location of the nest as determined by a qualified biologist, or the nest should be closely monitored during applications to ensure that helicopter does not create physical disturbance and copper sulfate does not inadvertently drift into the nest. If a buffer is preferred, a general buffer distance typically includes 500 feet around any confirmed active raptor nest or a 300-foot buffer around nests of passerine bird species protected in accordance with the MBTA and/or Fish and Game Code. Additionally, helicopters shall not fly vertically over trees with active nests unless an adequate elevation can be achieved to ensure that downward wind generated by the propulsion would not physically disturb the tree. However, buffer distances can be determined by the biologist based on location, vegetation cover, species, and other factors. The buffers should be implemented until it is determined by a qualified wildlife biologist that young have fledged and the nest is determined to be inactive.

With implementation of the proposed mitigation measure, impacts to uplands habitat and terrestrial species, including nesting birds, would be **less than significant**.

7.2 Wetlands, Riparian Habitat, and Sensitive Natural Communities

All four water bodies contain wetland features that may be considered jurisdictional by the USACE under Section 404 of the Clean Water Act, by the RWQCB under Section 401 of the Clean Water Act, and by CDFW under the Fish and Game Code (including riparian habitat, and/or other vegetation communities considered sensitive by CDFW).

Potential wetlands and/or sensitive communities within Pyramid Lake include cattail marsh and riparian forest (which in some locations is classified as Southern Cottonwood Willow Riparian Forest and Southern Willow Scrub, two sensitive natural communities defined by CDFW). Potential wetlands and/or sensitive communities within Silverwood Lake include cattail marsh and riparian forest (which in some locations is classified as Southern Sycamore Alder Riparian Woodland, Southern Cottonwood Riparian Forest or Southern Willow Scrub; all of which are sensitive natural communities defined by CDFW). Potential wetlands and/or sensitive communities within Quail Lake include cattail marsh and riparian forest/scrub (which in some locations is classified as Southern Willow Scrub, a sensitive natural community defined by CDFW). Potential wetlands and/or sensitive communities within O'Neill Forebay include freshwater marsh, riparian forest (which in some locations is classified as Great Valley Cottonwood Riparian Forest), and Southern Riparian Scrub.

No loss of wetland features that may be considered jurisdictional by the USACE, RWQCB, or CDFW; nor the loss of riparian habitat, or other communities considered sensitive by CDFW, would occur as a result of the proposed project. The project does not propose to remove, fill, or alter the existing wetland or riparian features within any of the water bodies. Therefore, it is not anticipated that a permit would be required from the USACE, RWQCB, or CDFW for impacts to wetlands or riparian habitat as a result of the proposed project.

As noted in *Section 7.1.1 Special-Status Plants*, the helicopter and/or boat used for copper sulfate application at all four water bodies would be staged at existing developed areas. Copper sulfate application to control planktonic algae would be limited to open water areas away from the shoreline and would not impact wetlands, riparian habitats, or other sensitive natural communities. The helicopter would be staged at existing developed areas as shown in Figures 2, 4, 6, and 8 for Pyramid Lake, Silverwood Lake, Quail Lake, and O'Neill Forebay, respectively.

7.3 Wildlife Movement Corridors

All four water bodies are situated within relatively undisturbed habitat and provide habitat for migratory species. All four sites are located within the Pacific Flyway and provide a stopover for a variety of migratory birds, notably waterfowl. Pyramid Lake is situated between the Los Padres and Angeles National Forests and provides linkage for terrestrial wildlife between the two natural areas. Piru Creek and other drainages that flow into Pyramid Lake provide movement for both aquatic and terrestrial species. Silverwood Lake is located along the Mojave River, which provides access to other undisturbed areas of the San Bernardino Mountains and access to the Mojave Desert. Quail Lake is located within the transition zone between the Mojave Desert and mountains of the Los Padres and Angeles National Forests. O'Neill Forebay is located within the base of the Diablo Mountain Range and provides habitat for wildlife migrating north-south through central California.

The project would not affect movement of wildlife species. The project would not remove any existing habitat nor would it add any fill or structures that would impede wildlife movement. The helicopter and/or boat applying the copper sulfate would be operated for only a short duration in areas away from native terrestrial habitats. Migrating waterfowl or other avian species utilizing the water bodies would be able to utilize other areas of the water body located away from the noise of the helicopter and/or boat.

Implementation of DWR's APAP will ensure impacts to migratory corridors are **less than significant**.

7.4 Local Policies or Ordinances Protecting Biological Resources

The Project would consist of applying copper sulfate to the water of existing reservoirs and would not conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance. **No impact** would occur.

7.5 Conflict with Habitat Conservation Plans

Select upland areas around Pyramid Lake, Silverwood Lake, Quail Lake, and O'Neil Forebay are designated as reserves and managed under various conservation and/or resource management plans. The proposed project would be conducted entirely within the existing reservoir open water areas, outside of upland habitat, and would not affect any Multiple Species Habitat Conservation

Plan, or Natural Community Conservation Plan or other Conservation Plan. Therefore, the proposed project would not conflict with any provisions of such adopted plans, or other approved local, regional, or state habitat conservation plan. **No impact** would occur.

CHAPTER 8
References

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Appendix A
Photo Log

ESA

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Pyramid Lake

Photo 1. Facing northeast. Photo depicts open water and characteristic scrub and chaparral communities along the northern shoreline of the lake in the distance.

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Photo 2. Facing northwest. Photo depicts Southern Cottonwood Willow Riparian Scrub, a CDFW "Sensitive Community" located at the west extent of one of the "fingers" of the lake.

Silverwood Lake

Photo 1. Facing north. Photo depicts open water and characteristic scrub and chaparral communities along the northern shoreline in the distance.

Photo 2. Facing northeast. Photo depicts Southern Cottonwood Willow Scrub, a CDFW "Sensitive Community" located at the southwestern corner of the lake. Cattail marsh can be seen in the foreground, where the riparian forest meets the open water.

Quail Lake

Photo 1. Facing southeast. Photo depicts the dense cattail marsh common along the shoreline of the lake.

Photo 2. Facing east. Photo depicts the Southern Willow Scrub, A CDFW "Sensitive Community" located outside of the lake, adjacent to the access road.

O'Neill Forebay

Photo 1. Facing north. Photo depicts the eastern shoreline of the forebay lined with crushed rock, greatly limiting the potential for vegetation or suitable plant and wildlife habitat to establish.

Photo 2. Facing north. Photo depicts freshwater wetland located along the western shoreline of the forebay. While a portion of the eastern shoreline is lined with crushed rock, most other areas do provide a suitable medium for vegetation to grow.

Appendix B
CNDBB and CNPS Database Searches

- Pyramid Lake
- Silverwood Lake
- Quail Lake
- O'Neill Forebay

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Pyramid Lake

ESA

Selected Elements by Scientific Name

California Department of Fish and Wildlife

California Natural Diversity Database

Query Criteria: Quad is (Lebec (3411877) or Frazier Mtn. (3411878) or La Liebre Ranch (3411876) or Alamo Mountain (3411868) or Black Mtn. (3411867) or Liebre Mtn. (3411866) or Devils Heart Peak (3411858) or Cobblestone Mtn. (3411857) or Whitaker Peak (3411856))

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Acanthoscyphus parishii var. abramsii Abrams' oxytheca	PDPGN0J041	None	None	G4?T2	S2	1B.2
Agelaius tricolor tricolored blackbird	ABPBXB0020	None	None	G2G3	S2	SSC
Ammodramus savannarum grasshopper sparrow	ABPBXA0020	None	None	G5	S2	SSC
Anaxyrus californicus arroyo toad	AAABB01230	Endangered	None	G2G3	S2S3	SSC
Antrozous pallidus pallid bat	AMACC10010	None	None	G5	S3	SSC
Aquila chrysaetos golden eagle	ABNKC22010	None	None	G5	S3	FP
Aspidoscelis tigris stejnegeri coastal whiptail	ARACJ02143	None	None	G5T3T4	S2S3	
Astragalus hornii var. hornii Horn's milk-vetch	PDFAB0F421	None	None	G4G5T2T3	S1	1B.1
Athene cunicularia burrowing owl	ABNSB10010	None	None	G4	S2	SSC
Batrachoseps stebbinsi Tehachapi slender salamander	AAAAD02090	None	Threatened	G2	S2	
Buteo regalis ferruginous hawk	ABNKC19120	None	None	G4	S3S4	WL
California macrophylla round-leaved filaree	PDGER01070	None	None	G2	S2	1B.1
Calochortus clavatus var. gracilis slender mariposa-lily	PMLIL0D096	None	None	G4T2	S2	1B.2
Calochortus palmeri var. palmeri Palmer's mariposa-lily	PMLIL0D122	None	None	G2T2	S2.1	1B.2
Calystegia peirsonii Peirson's morning-glory	PDCON040A0	None	None	G3	S3.2	4.2
Canyon Live Oak Ravine Forest Canyon Live Oak Ravine Forest	CTT61350CA	None	None	G3	S3.3	
Castilleja gleasoni Mt. Gleason paintbrush	PDSCR0D140	None	Rare	G2Q	S2.2	1B.2
Catostomus santaanae Santa Ana sucker	AFCJC02190	Threatened	None	G1	S1	SSC
Ceratochrysis longimala Desert cuckoo wasp	IIHYM71040	None	None	G1	S1	

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Chorizanthe parryi var. fernandina San Fernando Valley spineflower	PDPGN040J1	Candidate	Endangered	G2T1	S1	1B.1
Coastal and Valley Freshwater Marsh Coastal and Valley Freshwater Marsh	CTT52410CA	None	None	G3	S2.1	
Emys marmorata western pond turtle	ARAAD02030	None	None	G3G4	S3	SSC
Ensatina eschscholtzii croceator yellow-blotched salamander	AAAAD04011	None	None	G5T2T3	S2S3	SSC
Eriogonum callistum Tehachapi buckwheat	PDPGN08790	None	None	G1	S1	1B.1
Eriophyllum lanatum var. hallii Fort Tejon woolly sunflower	PDAST3N058	None	None	G5T1	S1	1B.1
Eumops perotis californicus western mastiff bat	AMACD02011	None	None	G5T4	S3?	SSC
Falco mexicanus prairie falcon	ABNKD06090	None	None	G5	S3	WL
Gymnogyps californianus California condor	ABNKA03010	Endangered	Endangered	G1	S1	
Lanius ludovicianus loggerhead shrike	ABPBR01030	None	None	G4	S4	SSC
Monardella linoides ssp. oblonga Tehachapi monardella	PDLAM180D2	None	None	G5T2	S2	1B.3
Myotis thysanodes fringed myotis	AMACC01090	None	None	G4	S4	
Navarretia peninsularis Baja navarretia	PDPLM0C0L0	None	None	G3?	S2	1B.2
Navarretia setiloba Piute Mountains navarretia	PDPLM0C0S0	None	None	G2	S2	1B.1
Nemacladus secundiflorus var. robbinsii Robbins' nemacladus	PDCAM0F0B2	None	None	G3T2T3	S2S3	1B.2
Oncorhynchus mykiss irideus southern steelhead - southern California DPS	AFCHA0209J	Endangered	None	G5T2Q	S2	SSC
Perognathus alticolus inexpectatus Tehachapi pocket mouse	AMAFD01082	None	None	G1G2T1T2	S1S2	SSC
Perognathus inornatus inornatus San Joaquin pocket mouse	AMAFD01061	None	None	G4T2T3	S2S3	
Phrynosoma blainvillii coast horned lizard	ARACF12100	None	None	G3G4	S3S4	SSC
Plebulina emigdionis San Emigdio blue butterfly	IILEPG7010	None	None	G2G3	S2S3	
Polioptila californica californica coastal California gnatcatcher	ABPBJ08081	Threatened	None	G3T2	S2	SSC

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Pyrgulopsis greggi Kern River pyrg	IMGASJ0A10	None	None	G1	S1	
Rana boylii foothill yellow-legged frog	AAABH01050	None	None	G3	S2S3	SSC
Southern Coast Live Oak Riparian Forest Southern Coast Live Oak Riparian Forest	CTT61310CA	None	None	G4	S4	
Southern Cottonwood Willow Riparian Forest Southern Cottonwood Willow Riparian Forest	CTT61330CA	None	None	G3	S3.2	
Southern Mixed Riparian Forest Southern Mixed Riparian Forest	CTT61340CA	None	None	G2	S2.1	
Southern Sycamore Alder Riparian Woodland Southern Sycamore Alder Riparian Woodland	CTT62400CA	None	None	G4	S4	
Southern Willow Scrub Southern Willow Scrub	CTT63320CA	None	None	G3	S2.1	
Spea hammondii western spadefoot	AAABF02020	None	None	G3	S3	SSC
Symphyotrichum defoliatum San Bernardino aster	PDASTE80C0	None	None	G2	S2	1B.2
Symphyotrichum greatae Greata's aster	PDASTE80U0	None	None	G2	S2.3	1B.3
Taxidea taxus American badger	AMAJF04010	None	None	G5	S4	SSC
Thamnophis hammondii two-striped garter snake	ARADB36160	None	None	G4	S2	SSC
Valley Needlegrass Grassland Valley Needlegrass Grassland	CTT42110CA	None	None	G3	S3.1	
Valley Oak Woodland Valley Oak Woodland	CTT71130CA	None	None	G3	S2.1	
Wildflower Field Wildflower Field	CTT42300CA	None	None	G2	S2.2	

Record Count: 55

CNPS California Native Plant Society Rare and Endangered Plant Inventory

Plant List

32 matches found. *Click on scientific name for details*

Search Criteria

Rare Plant Rank is one of [1A, 1B, 2A, 2B, 3, 4], FESA is one of [Endangered, Threatened, Species of Concern, Not Listed], CESA is one of [Endangered, Threatened, Rare, Not Listed], Found in 9 Quads around 34118F7, Lifeform is one of [Tree, Shrub, Herb, Vine, Liverwort, Leaf, Moss, Stem], Duration is one of [ann, per, ephem], Bloom Time is one of [January, February, March, April, May, June, July, August, September, October, November, December]

Scientific Name	Common Name	Family	Lifeform	Rare Plant Rank	State Rank	Global Rank
Acanthoscyphus parishii var. abramsii	Abrams' oxytheca	Polygonaceae	annual herb	1B.2	S2	G4?T2
Acanthoscyphus parishii var. parishii	Parish's oxytheca	Polygonaceae	annual herb	4.2	S3.2	G4?T3
Androsace elongata ssp. acuta	California androsace	Primulaceae	annual herb	4.2	S3.2?	G5?T3T4
Astragalus hornii var. hornii	Horn's milk-vetch	Fabaceae	annual herb	1B.1	S1	G4G5T2T3
California macrophylla	round-leaved filaree	Geraniaceae	annual herb	1B.1	S2	G2
Calochortus clavatus var. clavatus	club-haired mariposa lily	Liliaceae	perennial bulbiferous herb	4.3	S3	G4T3
Calochortus clavatus var. gracilis	slender mariposa lily	Liliaceae	perennial bulbiferous herb	1B.2	S2	G4T2
Calochortus fimbriatus	late-flowered mariposa lily	Liliaceae	perennial bulbiferous herb	1B.3	S3	G3
Calochortus palmeri var. palmeri	Palmer's mariposa lily	Liliaceae	perennial bulbiferous herb	1B.2	S2.1	G2T2
Calystegia peirsonii	Peirson's morning-glory	Convolvulaceae	perennial rhizomatous herb	4.2	S3.2	G3
Castilleja gleasoni	Mt. Gleason paintbrush	Orobanchaceae	perennial herb (hemiparasitic)	1B.2	S2.2	G2Q
Chorizanthe spinosa	Mojave spineflower	Polygonaceae	annual herb	4.2	S3.2	G3
Clinopodium mimuloides	monkey-flower savory	Lamiaceae	perennial herb	4.2	S3.2	G3
Delphinium inopinum	unexpected larkspur	Ranunculaceae	perennial herb	4.3	S3.3	G3
Delphinium parryi ssp. purpureum	Mt. Pinos larkspur	Ranunculaceae	perennial herb	4.3	S3.3	G4T3
Eriogonum callistum	Tehachapi buckwheat	Polygonaceae	perennial herb	1B.1	S1	G1
Eriophyllum lanatum var. hallii	Fort Tejon woolly sunflower	Asteraceae	perennial herb	1B.1	S1	G5T1
Frasera neglecta	pine green-gentian	Gentianaceae	perennial herb	4.3	S3.3	G3
Helianthus nuttallii ssp. parishii	Los Angeles sunflower	Asteraceae	perennial rhizomatous herb	1A	SH	G5TH
Hulsea vestita ssp. gabrielensis	San Gabriel Mountains sunflower	Asteraceae	perennial herb	4.3	S3.3	G5T3
Juncus acutus ssp. leopoldii	southwestern spiny rush	Juncaceae	perennial rhizomatous herb	4.2	S3.2	G5T5
Microseris sylvatica	sylvan microseris	Asteraceae	perennial herb	4.2	S3.2	G3
Monardella linoides ssp. oblonga	Tehachapi monardella	Lamiaceae	perennial rhizomatous herb	1B.3	S2	G5T2
Navarretia peninsularis	Baja navarretia	Polemoniaceae	annual herb	1B.2	S2	G3?
Navarretia setiloba	Piute Mountains navarretia	Polemoniaceae	annual herb	1B.1	S2	G2
Nemacladus secundiflorus var. robbinsii	Robbins' nemacladus	Campanulaceae	annual herb	1B.2	S2S3	G3T2T3
Opuntia basilaris var. treleasei	Bakersfield cactus	Cactaceae	perennial stem succulent	1B.1	S1	G5T1
Perideridia pringlei	adobe yampah	Apiaceae	perennial herb	4.3	S3.3	G3
Symphyotrichum defoliatum	San Bernardino aster	Asteraceae	perennial rhizomatous herb	1B.2	S2	G2

Symphyotrichum greatae	Greata's aster	Asteraceae	perennial rhizomatous herb	1B.3	S2.3	G2
Syntrichopappus lemmonii	Lemmon's syntrichopappus	Asteraceae	annual herb	4.3	S3.3	G3
Thermopsis californica var. argentata	silvery false lupine	Fabaceae	perennial rhizomatous herb	4.3	S3.3	G3T3

Suggested Citation

California Native Plant Society (CNPS). 2014. Inventory of Rare and Endangered Plants (online edition, v8-02). California Native Plant Society. Sacramento, CA. Accessed on Thursday, January 16, 2014.

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Silverwood Lake

ESA

Selected Elements by Scientific Name

California Department of Fish and Wildlife

California Natural Diversity Database

Query Criteria: Quad is (Baldy Mesa (3411744) or Hesperia (3411743) or Apple Valley South (3411742) or Cajon (3411734) or Silverwood Lake (3411733) or Lake Arrowhead (3411732) or Devore (3411724) or San Bernardino North (3411723) or Harrison Mtn. (3411722))

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Accipiter cooperii Cooper's hawk	ABNKC12040	None	None	G5	S3	WL
Ambrosia monogyra singlewhorl burrobrush	PDAST50010	None	None	G5	S2	2B.2
Anaxyrus californicus arroyo toad	AAABB01230	Endangered	None	G2G3	S2S3	SSC
Anniella pulchra pulchra silvery legless lizard	ARACC01012	None	None	G3G4T3T4Q	S3	SSC
Arenaria paludicola marsh sandwort	PDCAR040L0	Endangered	Endangered	G1	S1	1B.1
Artemisiospiza belli belli Bell's sage sparrow	ABPBX97021	None	None	G5T2T4	S2?	WL
Asclepias nyctaginifolia Mojave milkweed	PDASC02190	None	None	G4G5	S2	2B.1
Asio otus long-eared owl	ABNSB13010	None	None	G5	S3	SSC
Aspidoscelis hyperythra orangethroat whiptail	ARACJ02060	None	None	G5	S2	SSC
Aspidoscelis tigris stejnegeri coastal whiptail	ARACJ02143	None	None	G5T3T4	S2S3	
Athene cunicularia burrowing owl	ABNSB10010	None	None	G4	S2	SSC
Batrachoseps gabrieli San Gabriel slender salamander	AAAAD02110	None	None	G2	S2	
Berberis nevinii Nevin's barberry	PDBER060A0	Endangered	Endangered	G1	S1	1B.1
Boechera dispar pinyon rockcress	PDBRA060F0	None	None	G3	S3	2B.3
Brodiaea filifolia thread-leaved brodiaea	PMLIL0C050	Threatened	Endangered	G1	S1	1B.1
Calochortus palmeri var. palmeri Palmer's mariposa-lily	PMLIL0D122	None	None	G2T2	S2.1	1B.2
Calochortus plummerae Plummer's mariposa-lily	PMLIL0D150	None	None	G4	S4	4.2
Canbya candida white pygmy-poppy	PDPAP05020	None	None	G3	S3.2	4.2
Castilleja lasiorhyncha San Bernardino Mountains owl's-clover	PDSCR0D410	None	None	G2	S2	1B.2

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Catostomus santaanae Santa Ana sucker	AFCJC02190	Threatened	None	G1	S1	SSC
Centromadia pungens ssp. laevis smooth tarplant	PDAST4R0R4	None	None	G3G4T2	S2	1B.1
Chaetodipus fallax fallax northwestern San Diego pocket mouse	AMAFD05031	None	None	G5T3	S2S3	SSC
Chaetodipus fallax pallidus pallid San Diego pocket mouse	AMAFD05032	None	None	G5T3	S3	SSC
Charina trivirgata rosy boa	ARADA01020	None	None	G4G5	S3S4	
Charina umbratica southern rubber boa	ARADA01011	None	Threatened	G2G3	S2S3	
Chloropyron maritimum ssp. maritimum salt marsh bird's-beak	PDSCR0J0C2	Endangered	Endangered	G4?T1	S1	1B.2
Chorizanthe parryi var. parryi Parry's spineflower	PDPGN040J2	None	None	G2T2	S2	1B.1
Chorizanthe xanti var. leucotheca white-bracted spineflower	PDPGN040Z1	None	None	G4T2	S2	1B.2
Corynorhinus townsendii Townsend's big-eared bat	AMACC08010	None	Candidate Threatened	G3G4	S2S3	SSC
Deinandra mohavensis Mojave tarplant	PDAST4R0K0	None	Endangered	G2G3	S2S3	1B.3
Dendroica petechia brewsteri yellow warbler	ABPBX03018	None	None	G5T3?	S2	SSC
Diadophis punctatus modestus San Bernardino ringneck snake	ARADB10015	None	None	G5T2T3Q	S2?	
Dipodomys merriami parvus San Bernardino kangaroo rat	AMAFD03143	Endangered	None	G5T1	S1	SSC
Dodecahema leptoceras slender-horned spineflower	PDPGN0V010	Endangered	Endangered	G1	S1	1B.1
Dudleya abramsii ssp. affinis San Bernardino Mountains dudleya	PDCRA04013	None	None	G3T2	S2	1B.2
Empidonax traillii extimus southwestern willow flycatcher	ABPAE33043	Endangered	Endangered	G5T1T2	S1	
Emys marmorata western pond turtle	ARAAD02030	None	None	G3G4	S3	SSC
Eremophila alpestris actia California horned lark	ABPAT02011	None	None	G5T3Q	S3	WL
Eremothera boothii ssp. boothii Booth's evening-primrose	PDONA03052	None	None	G5T4	S2	2B.3
Eriastrum densifolium ssp. sanctorum Santa Ana River woollystar	PDPLM03035	Endangered	Endangered	G4T1	S1	1B.1

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Euchloe hyantis andrewsi Andrew's marble butterfly	IILEPA5032	None	None	G3G4T1	S1	
Eumops perotis californicus western mastiff bat	AMACD02011	None	None	G5T4	S3?	SSC
Fimbristylis thermalis hot springs fimbristylis	PMCYP0B0N0	None	None	G4	S2.2	2B.2
Glaucomys sabrinus californicus San Bernardino flying squirrel	AMAFB09021	None	None	G5T2T3	S2S3	SSC
Gopherus agassizii desert tortoise	ARAAF01010	Threatened	Threatened	G3	S2	
Haliaeetus leucocephalus bald eagle	ABNKC10010	Delisted	Endangered	G5	S2	FP
Helminthoglypta taylori westfork shoulderband	IMGASC2640	None	None	G1	S1	
Heuchera parishii Parish's alumroot	PDSAX0E0S0	None	None	G3	S3	1B.3
Horkelia cuneata var. puberula mesa horkelia	PDROS0W045	None	None	G4T2	S2.1	1B.1
Imperata brevifolia California satintail	PMPOA3D020	None	None	G2	S2.1	2B.1
Ivesia argyrocoma var. argyrocoma silver-haired ivesia	PDROS0X021	None	None	G2T2	S2.2	1B.2
Lanius ludovicianus loggerhead shrike	ABPBR01030	None	None	G4	S4	SSC
Lasiurus xanthinus western yellow bat	AMACC05070	None	None	G5	S3	SSC
Lepus californicus bennettii San Diego black-tailed jackrabbit	AMAEB03051	None	None	G5T3?	S3?	SSC
Lilium parryi lemon lily	PMLIL1A0J0	None	None	G3	S3	1B.2
Loeflingia squarrosa var. artemisiarum sagebrush loeflingia	PDCAR0E011	None	None	G5T2T3	S2.2	2B.2
Lycium parishii Parish's desert-thorn	PDSOL0G0D0	None	None	G3?	S2S3	2B.3
Monardella macrantha ssp. hallii Hall's monardella	PDLAM180E1	None	None	G5T3	S3	1B.3
Neotamias speciosus speciosus lodgepole chipmunk	AMAFB02172	None	None	G4T2T3	S2S3	
Neotoma lepida intermedia San Diego desert woodrat	AMAFF08041	None	None	G5T3?	S3?	SSC
Nyctinomops femorosaccus pocketed free-tailed bat	AMACD04010	None	None	G4	S2S3	SSC

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Opuntia basilaris var. brachyclada short-joint beavertail	PDCAC0D053	None	None	G5T3	S3	1B.2
Pediomelum castoreum Beaver Dam breadroot	PDFAB5L050	None	None	G3	S2	1B.2
Perideridia parishii ssp. parishii Parish's yampah	PDAPI1N0C2	None	None	G4T3T4	S2.2?	2B.2
Perognathus alticolus alticolus white-eared pocket mouse	AMAFD01081	None	None	G1G2TH	SH	SSC
Perognathus longimembris brevinasus Los Angeles pocket mouse	AMAFD01041	None	None	G5T1T2	S1S2	SSC
Phrynosoma blainvillii coast horned lizard	ARACF12100	None	None	G3G4	S3S4	SSC
Polioptila californica californica coastal California gnatcatcher	ABPBJ08081	Threatened	None	G3T2	S2	SSC
Rana draytonii California red-legged frog	AAABH01022	Threatened	None	G2G3	S2S3	SSC
Rana muscosa southern mountain yellow-legged frog	AAABH01330	Endangered	Endangered	G1	S1	SSC
Rhinichthys osculus ssp. 3 Santa Ana speckled dace	AFCJB3705K	None	None	G5T1	S1	SSC
Ribes divaricatum var. parishii Parish's gooseberry	PDGRO020F3	None	None	G4TH	SH	1A
Riversidian Alluvial Fan Sage Scrub Riversidian Alluvial Fan Sage Scrub	CTT32720CA	None	None	G1	S1.1	
Schoenus nigricans black bog-rush	PMCYP0P010	None	None	G4	S2.2	2B.2
Scutellaria bolanderi ssp. austromontana southern mountains skullcap	PDLAM1U0A1	None	None	G4T2	S2	1B.2
Sidalcea malviflora ssp. dolosa Bear Valley checkerbloom	PDMAL110FH	None	None	G5T2T3	S2S3	1B.2
Siphateles bicolor mohavensis Mohave tui chub	AFCJB1303H	Endangered	Endangered	G4T1	S1	FP
Southern Mixed Riparian Forest Southern Mixed Riparian Forest	CTT61340CA	None	None	G2	S2.1	
Southern Riparian Forest Southern Riparian Forest	CTT61300CA	None	None	G4	S4	
Southern Sycamore Alder Riparian Woodland Southern Sycamore Alder Riparian Woodland	CTT62400CA	None	None	G4	S4	
Streptanthus bernardinus Laguna Mountains jewelflower	PDBRA2G060	None	None	G3	S3	4.3
Streptanthus campestris southern jewelflower	PDBRA2G0B0	None	None	G2	S2.3	1B.3

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Symphyotrichum defoliatum San Bernardino aster	PDASTE80C0	None	None	G2	S2	1B.2
Taxidea taxus American badger	AMAJF04010	None	None	G5	S4	SSC
Thamnophis hammondii two-striped garter snake	ARADB36160	None	None	G4	S2	SSC
Thelypteris puberula var. sonorensis Sonoran maiden fern	PPTHE05192	None	None	G5T3	S2.2?	2B.2
Toxostoma lecontei Le Conte's thrasher	ABPBK06100	None	None	G4	S3	SSC
Vireo bellii pusillus least Bell's vireo	ABPBW01114	Endangered	Endangered	G5T2	S2	
Vireo vicinior gray vireo	ABPBW01140	None	None	G4	S2	SSC
Xerospermophilus mohavensis Mohave ground squirrel	AMAFB05150	None	Threatened	G2G3	S2S3	

Record Count: 90

CNPS California Native Plant Society Rare and Endangered Plant Inventory

Plant List

67 matches found. *Click on scientific name for details*

Search Criteria

Rare Plant Rank is one of [1A, 1B, 2A, 2B, 3, 4], FESA is one of [Endangered, Threatened, Species of Concern, Not Listed], CESA is one of [Endangered, Threatened, Rare, Not Listed], Found in 9 Quads around 34117C3, Lifeform is one of [Tree, Shrub, Herb, Vine, Liverwort, Leaf, Moss, Stem], Duration is one of [ann, per, ephem], Bloom Time is one of [January, February, March, April, May, June, July, August, September, October, November, December]

Scientific Name	Common Name	Family	Lifeform	Rare Plant Rank	State Rank	Global Rank
Acanthoscyphus parishii var. parishii	Parish's oxytheca	Polygonaceae	annual herb	4.2	S3.2	G4?T3
Allium parishii	Parish's onion	Alliaceae	perennial bulbiferous herb	4.3	S3.3?	G3
Ambrosia monogyra	singlewhorl burrobrush	Asteraceae	perennial shrub	2B.2	S2	G5
Androsace elongata ssp. acuta	California androsace	Primulaceae	annual herb	4.2	S3.2?	G5?T3T4
Asclepias nyctaginifolia	Mojave milkweed	Apocynaceae	perennial herb	2B.1	S2	G4G5
Azolla microphylla	Mexican mosquito fern	Azollaceae	annual / perennial herb	4.2	S3.2?	G5
Berberis nevinii	Nevin's barberry	Berberidaceae	perennial evergreen shrub	1B.1	S1	G1
Boechera dispar	pinyon rockcress	Brassicaceae	perennial herb	2B.3	S3	G3
Brodiaea filifolia	thread-leaved brodiaea	Themidaceae	perennial bulbiferous herb	1B.1	S1	G1
Calochortus catalinae	Catalina mariposa lily	Liliaceae	perennial bulbiferous herb	4.2	S3.2	G3
Calochortus palmeri var. palmeri	Palmer's mariposa lily	Liliaceae	perennial bulbiferous herb	1B.2	S2.1	G2T2
Calochortus plummerae	Plummer's mariposa lily	Liliaceae	perennial bulbiferous herb	4.2	S4	G4
Canbya candida	white pygmy-poppy	Papaveraceae	annual herb	4.2	S3.2	G3
Castilleja lasiorhyncha	San Bernardino Mountains owl's-clover	Orobanchaceae	annual herb (hemiparasitic)	1B.2	S2	G2
Castilleja plagiotoma	Mojave paintbrush	Orobanchaceae	perennial herb (hemiparasitic)	4.3	S3.3	G3
Centromadia pungens ssp. laevis	smooth tarplant	Asteraceae	annual herb	1B.1	S2	G3G4T2
Chorizanthe parryi var. parryi	Parry's spineflower	Polygonaceae	annual herb	1B.1	S2	G2T2
Chorizanthe spinosa	Mojave spineflower	Polygonaceae	annual herb	4.2	S3.2	G3
Chorizanthe xanti var. leucotheca	white-bracted spineflower	Polygonaceae	annual herb	1B.2	S2	G4T2
Cryptantha costata	ribbed cryptantha	Boraginaceae	annual herb	4.3	S3.3	G4G5
Cymopterus deserticola	desert cymopterus	Apiaceae	perennial herb	1B.2	S2	G2
Deinandra mohavensis	Mojave tarplant	Asteraceae	annual herb	1B.3	S2S3	G2G3
Dodecahema leptoceras	slender-horned spineflower	Polygonaceae	annual herb	1B.1	S1	G1
Dudleya abramsii ssp. affinis	San Bernardino Mountains dudleya	Crassulaceae	perennial herb	1B.2	S2	G3T2
Eremothera boothii ssp. boothii	Booth's evening-primrose	Onagraceae	annual herb	2B.3	S2	G5T4
Eriastrum densifolium ssp. sanctorum	Santa Ana River woollystar	Polemoniaceae	perennial herb	1B.1	S1	G4T1
Eriogonum evanidum	vanishing wild buckwheat	Polygonaceae	annual herb	1B.1	S1	G1
		Asteraceae	perennial herb	4.3	S3.3	G5T3

Eriophyllum lanatum var. obovatum	southern Sierra woolly sunflower					
Fimbristylis thermalis	hot springs fimbristylis	Cyperaceae	perennial rhizomatous herb	2B.2	S2.2	G4
Frasera neglecta	pine green-gentian	Gentianaceae	perennial herb	4.3	S3.3	G3
Galium johnstonii	Johnston's bedstraw	Rubiaceae	perennial herb	4.3	S3.3	G3
Heuchera caespitosa	urn-flowered alumroot	Saxifragaceae	perennial rhizomatous herb	4.3	S3.3	G3
Heuchera parishii	Parish's alumroot	Saxifragaceae	perennial rhizomatous herb	1B.3	S3	G3
Hulsea vestita ssp. parryi	Parry's sunflower	Asteraceae	perennial herb	4.3	S3.3	G5T3
Imperata brevifolia	California satintail	Poaceae	perennial rhizomatous herb	2B.1	S2.1	G2
Ivesia argyrocoma var. argyrocoma	silver-haired ivesia	Rosaceae	perennial herb	1B.2	S2.2	G2T2
Juglans californica	Southern California black walnut	Juglandaceae	perennial deciduous tree	4.2	S3.2	G3
Juncus duranii	Duran's rush	Juncaceae	perennial rhizomatous herb	4.3	S3.3	G3
Lilium humboldtii ssp. ocellatum	ocellated Humboldt lily	Liliaceae	perennial bulbiferous herb	4.2	S3.2	G4T3
Lilium parryi	lemon lily	Liliaceae	perennial bulbiferous herb	1B.2	S3	G3
Loeflingia squarrosa var. artemisiarum	sagebrush loeflingia	Caryophyllaceae	annual herb	2B.2	S2.2	G5T2T3
Lycium parishii	Parish's desert-thorn	Solanaceae	perennial shrub	2B.3	S2S3	G3?
Mimulus johnstonii	Johnston's monkeyflower	Phrymaceae	annual herb	4.3	S3.3	G3
Monardella macrantha ssp. hallii	Hall's monardella	Lamiaceae	perennial rhizomatous herb	1B.3	S3	G5T3
Monardella saxicola	rock monardella	Lamiaceae	perennial rhizomatous herb	4.2	S3.2	G3
Muhlenbergia californica	California muhly	Poaceae	perennial rhizomatous herb	4.3	S3.3	G3
Muilla coronata	crowned muilla	Themidaceae	perennial bulbiferous herb	4.2	S3.2?	G3
Opuntia basilaris var. brachyclada	short-joint beavertail	Cactaceae	perennial stem succulent	1B.2	S3	G5T3
Packera ionophylla	Tehachapi ragwort	Asteraceae	perennial herb	4.3	S3.3	G3
Pediomelum castoreum	Beaver Dam breadroot	Fabaceae	perennial herb	1B.2	S2	G3
Perideridia parishii ssp. parishii	Parish's yampah	Apiaceae	perennial herb	2B.2	S2.2?	G4T3T4
Phacelia exilis	Transverse Range phacelia	Boraginaceae	annual herb	4.3	S3.3	G3Q
Phacelia mohavensis	Mojave phacelia	Boraginaceae	annual herb	4.3	S3.3	G3Q
Piperia leptopetala	narrow-petaled rein orchid	Orchidaceae	perennial herb	4.3	S3.3	G3
Quercus turbinella	shrub live oak	Fagaceae	perennial evergreen shrub	4.3	S3.3	G5
Schoenus nigricans	black bog-rush	Cyperaceae	perennial herb	2B.2	S2.2	G4
Scutellaria bolanderi ssp. austromontana	southern mountains skullcap	Lamiaceae	perennial rhizomatous herb	1B.2	S2	G4T2
Senecio astephanus	San Gabriel ragwort	Asteraceae	perennial herb	4.3	S3	G3
Sidalcea malviflora ssp. dolosa	Bear Valley checkerbloom	Malvaceae	perennial herb	1B.2	S2S3	G5T2T3
Sidotheca caryophylloides	chickweed oxytheca	Polygonaceae	annual herb	4.3	S3.3	G3
Streptanthus bernardinus	Laguna Mountains jewel-flower	Brassicaceae	perennial herb	4.3	S3	G3
Streptanthus campestris	southern jewel-flower	Brassicaceae	perennial herb	1B.3	S2.3	G2
Symphyotrichum defoliatum	San Bernardino aster	Asteraceae	perennial rhizomatous herb	1B.2	S2	G2
Syntrichopappus lemmonii	Lemmon's syntrichopappus	Asteraceae	annual herb	4.3	S3.3	G3
	Sonoran maiden fern	Thelypteridaceae		2B.2	S2.2?	G5T3

Thelypteris puberula var. sonorensis			perennial rhizomatous herb			
Trichostema micranthum	small-flowered bluecurls	Lamiaceae	annual herb	4.3	S3.3	G4
Viola purpurea ssp. aurea	golden violet	Violaceae	perennial herb	2B.2	S2S3	G5T2T3

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California Native Plant Society (CNPS). 2014. Inventory of Rare and Endangered Plants (online edition, v8-02). California Native Plant Society. Sacramento, CA. Accessed on Thursday, January 16, 2014.

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California Department of Fish and Wildlife

California Natural Diversity Database

Query Criteria: Quad is (Pastoria Creek (3411887) or Winters Ridge (3411886) or Liebre Twins (3411885) or Lebec (3411877) or La Liebre Ranch (3411876) or Neenach School (3411875) or Black Mtn. (3411867) or Liebre Mtn. (3411866) or Burnt Peak (3411865))

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Agelaius tricolor tricolored blackbird	ABPBXB0020	None	None	G2G3	S2	SSC
Ammodramus savannarum grasshopper sparrow	ABPBXA0020	None	None	G5	S2	SSC
Anaxyrus californicus arroyo toad	AAABB01230	Endangered	None	G2G3	S2S3	SSC
Antrozous pallidus pallid bat	AMACC10010	None	None	G5	S3	SSC
Aquila chrysaetos golden eagle	ABNKC22010	None	None	G5	S3	FP
Aspidoscelis tigris stejnegeri coastal whiptail	ARACJ02143	None	None	G5T3T4	S2S3	
Athene cunicularia burrowing owl	ABNSB10010	None	None	G4	S2	SSC
Batrachoseps stebbinsi Tehachapi slender salamander	AAAAD02090	None	Threatened	G2	S2	
Boechera lincolnensis Lincoln rockcress	PDBRA061M3	None	None	G4?	S2	2B.3
Buteo regalis ferruginous hawk	ABNKC19120	None	None	G4	S3S4	WL
California macrophylla round-leaved filaree	PDGER01070	None	None	G2	S2	1B.1
Calochortus clavatus var. gracilis slender mariposa-lily	PMLIL0D096	None	None	G4T2	S2	1B.2
Calochortus palmeri var. palmeri Palmer's mariposa-lily	PMLIL0D122	None	None	G2T2	S2.1	1B.2
Calystegia peirsonii Peirson's morning-glory	PDCON040A0	None	None	G3	S3.2	4.2
Canyon Live Oak Ravine Forest Canyon Live Oak Ravine Forest	CTT61350CA	None	None	G3	S3.3	
Castilleja gleasoni Mt. Gleason paintbrush	PDSCR0D140	None	Rare	G2Q	S2.2	1B.2
Ceratochrysis longimala Desert cuckoo wasp	IIHYM71040	None	None	G1	S1	
Diadophis punctatus modestus San Bernardino ringneck snake	ARADB10015	None	None	G5T2T3Q	S2?	
Emys marmorata western pond turtle	ARAAD02030	None	None	G3G4	S3	SSC

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Ensatina eschscholtzii croceator yellow-blotched salamander	AAAAD04011	None	None	G5T2T3	S2S3	SSC
Eriogonum callistum Tehachapi buckwheat	PDPGN08790	None	None	G1	S1	1B.1
Eriophyllum lanatum var. hallii Fort Tejon woolly sunflower	PDAST3N058	None	None	G5T1	S1	1B.1
Falco mexicanus prairie falcon	ABNKD06090	None	None	G5	S3	WL
Gambelia sila blunt-nosed leopard lizard	ARACF07010	Endangered	Endangered	G1	S1	FP
Githopsis tenella delicate bluecup	PDCAM07070	None	None	G2	S2.3	1B.3
Gymnogyps californianus California condor	ABNKA03010	Endangered	Endangered	G1	S1	
Haliaeetus leucocephalus bald eagle	ABNKC10010	Delisted	Endangered	G5	S2	FP
Lanius ludovicianus loggerhead shrike	ABPBR01030	None	None	G4	S4	SSC
Leptosiphon serrulatus Madera leptosiphon	PDPLM09130	None	None	G1?	S1?	1B.2
Navarretia peninsularis Baja navarretia	PDPLM0C0L0	None	None	G3?	S2	1B.2
Navarretia setiloba Piute Mountains navarretia	PDPLM0C0S0	None	None	G2	S2	1B.1
Perognathus alticolus inexpectatus Tehachapi pocket mouse	AMAFD01082	None	None	G1G2T1T2	S1S2	SSC
Perognathus inornatus inornatus San Joaquin pocket mouse	AMAFD01061	None	None	G4T2T3	S2S3	
Phrynosoma blainvillii coast horned lizard	ARACF12100	None	None	G3G4	S3S4	SSC
Plebulina emigdionis San Emigdio blue butterfly	IILEPG7010	None	None	G2G3	S2S3	
Polioptila californica californica coastal California gnatcatcher	ABPBJ08081	Threatened	None	G3T2	S2	SSC
Southern Coast Live Oak Riparian Forest Southern Coast Live Oak Riparian Forest	CTT61310CA	None	None	G4	S4	
Southern Cottonwood Willow Riparian Forest Southern Cottonwood Willow Riparian Forest	CTT61330CA	None	None	G3	S3.2	
Southern Mixed Riparian Forest Southern Mixed Riparian Forest	CTT61340CA	None	None	G2	S2.1	
Southern Riparian Forest Southern Riparian Forest	CTT61300CA	None	None	G4	S4	

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Southern Riparian Scrub	CTT63300CA	None	None	G3	S3.2	
Southern Riparian Scrub						
Southern Sycamore Alder Riparian Woodland	CTT62400CA	None	None	G4	S4	
Southern Sycamore Alder Riparian Woodland						
Southern Willow Scrub	CTT63320CA	None	None	G3	S2.1	
Southern Willow Scrub						
Symphyotrichum defoliatum	PDASTE80C0	None	None	G2	S2	1B.2
San Bernardino aster						
Symphyotrichum greatae	PDASTE80U0	None	None	G2	S2.3	1B.3
Greata's aster						
Taxidea taxus	AMAJF04010	None	None	G5	S4	SSC
American badger						
Valley Needlegrass Grassland	CTT42110CA	None	None	G3	S3.1	
Valley Needlegrass Grassland						
Valley Oak Woodland	CTT71130CA	None	None	G3	S2.1	
Valley Oak Woodland						
Vulpes macrotis mutica	AMAJA03041	Endangered	Threatened	G4T2T3	S2S3	
San Joaquin kit fox						
Wildflower Field	CTT42300CA	None	None	G2	S2.2	
Wildflower Field						

Record Count: 50

CNPS California Native Plant Society Rare and Endangered Plant Inventory

Plant List

27 matches found. *Click on scientific name for details*

Search Criteria

Rare Plant Rank is one of [1A, 1B, 2A, 2B, 3, 4], FESA is one of [Endangered, Threatened, Species of Concern, Not Listed], CESA is one of [Endangered, Threatened, Rare, Not Listed], Found in 9 Quads around 34118G6, Lifeform is one of [Tree, Shrub, Herb, Vine, Liverwort, Leaf, Moss, Stem], Duration is one of [ann, per, ephem], Bloom Time is one of [January, February, March, April, May, June, July, August, September, October, November, December]

Scientific Name	Common Name	Family	Lifeform	Rare Plant Rank	State Rank	Global Rank
Androsace elongata ssp. acuta	California androsace	Primulaceae	annual herb	4.2	S3.2?	G5?T3T4
Boechera lincolnensis	Lincoln rockcress	Brassicaceae	perennial herb	2B.3	S2	G4?
California macrophylla	round-leaved filaree	Geraniaceae	annual herb	1B.1	S2	G2
Calochortus clavatus var. gracilis	slender mariposa lily	Liliaceae	perennial bulbiferous herb	1B.2	S2	G4T2
Calochortus fimbriatus	late-flowered mariposa lily	Liliaceae	perennial bulbiferous herb	1B.3	S3	G3
Calochortus palmeri var. palmeri	Palmer's mariposa lily	Liliaceae	perennial bulbiferous herb	1B.2	S2.1	G2T2
Calystegia peirsonii	Peirson's morning-glory	Convolvulaceae	perennial rhizomatous herb	4.2	S3.2	G3
Castilleja gleasoni	Mt. Gleason paintbrush	Orobanchaceae	perennial herb (hemiparasitic)	1B.2	S2.2	G2Q
Chorizanthe spinosa	Mojave spineflower	Polygonaceae	annual herb	4.2	S3.2	G3
Clinopodium mimuloides	monkey-flower savory	Lamiaceae	perennial herb	4.2	S3.2	G3
Delphinium parryi ssp. purpureum	Mt. Pinos larkspur	Ranunculaceae	perennial herb	4.3	S3.3	G4T3
Eriogonum callistum	Tehachapi buckwheat	Polygonaceae	perennial herb	1B.1	S1	G1
Eriophyllum lanatum var. hallii	Fort Tejon woolly sunflower	Asteraceae	perennial herb	1B.1	S1	G5T1
Githopsis tenella	delicate bluecup	Campanulaceae	annual herb	1B.3	S2.3	G2
Leptosiphon serrulatus	Madera leptosiphon	Polemoniaceae	annual herb	1B.2	S1?	G1?
Lilium humboldtii ssp. ocellatum	ocellated Humboldt lily	Liliaceae	perennial bulbiferous herb	4.2	S3.2	G4T3
Microseris sylvatica	sylvan microseris	Asteraceae	perennial herb	4.2	S3.2	G3
Navarretia peninsularis	Baja navarretia	Polemoniaceae	annual herb	1B.2	S2	G3?
Navarretia setiloba	Piute Mountains navarretia	Polemoniaceae	annual herb	1B.1	S2	G2
Nemacladus secundiflorus var. robbinsii	Robbins' nemacladus	Campanulaceae	annual herb	1B.2	S2S3	G3T2T3
Opuntia basilaris var. treleasei	Bakersfield cactus	Cactaceae	perennial stem succulent	1B.1	S1	G5T1
Perideridia pringlei	adobe yampah	Apiaceae	perennial herb	4.3	S3.3	G3
Senecio astephanus	San Gabriel ragwort	Asteraceae	perennial herb	4.3	S3	G3
Symphyotrichum defoliatum	San Bernardino aster	Asteraceae	perennial rhizomatous herb	1B.2	S2	G2
Symphyotrichum greatae	Greata's aster	Asteraceae	perennial rhizomatous herb	1B.3	S2.3	G2
Syntrichopappus lemmonii	Lemmon's syntrichopappus	Asteraceae	annual herb	4.3	S3.3	G3
Thermopsis californica var. argentata	silvery false lupine	Fabaceae	perennial rhizomatous herb	4.3	S3.3	G3T3

Suggested Citation

California Native Plant Society (CNPS). 2014. Inventory of Rare and Endangered Plants (online edition, v8-02). California Native Plant Society. Sacramento, CA. Accessed on Thursday, January 16, 2014.

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ESA

Selected Elements by Scientific Name

California Department of Fish and Wildlife

California Natural Diversity Database

Query Criteria: Quad is (Crevison Peak (3712122) or Howard Ranch (3712121) or Ingomar (3712028) or Pacheco Pass (3712112) or San Luis Dam (3712111) or Volta (3712018) or Mariposa Peak (3612182) or Los Banos Valley (3612181) or Ortigalita Peak NW (3612088))

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Agelaius tricolor tricolored blackbird	ABPBXB0020	None	None	G2G3	S2	SSC
Alkali Seep Alkali Seep	CTT45320CA	None	None	G3	S2.1	
Ambystoma californiense California tiger salamander	AAAAA01180	Threatened	Threatened	G2G3	S2S3	SSC
Aquila chrysaetos golden eagle	ABNKC22010	None	None	G5	S3	FP
Athene cunicularia burrowing owl	ABNSB10010	None	None	G4	S2	SSC
Atriplex cordulata var. cordulata heartscale	PDCHE040B0	None	None	G3T2	S2	1B.2
Atriplex coronata var. vallicola Lost Hills crownscale	PDCHE04250	None	None	G4T2	S2	1B.2
Branchinecta longiantenna longhorn fairy shrimp	ICBRA03020	Endangered	None	G1	S1	
Branta hutchinsii leucopareia cackling (=Aleutian Canada) goose	ABNJB05035	Delisted	None	G5T3	S2	
Buteo regalis ferruginous hawk	ABNKC19120	None	None	G4	S3S4	WL
Buteo swainsoni Swainson's hawk	ABNKC19070	None	Threatened	G5	S2	
California macrophylla round-leaved filaree	PDGER01070	None	None	G2	S2	1B.1
Campanula exigua chaparral harebell	PDCAM020A0	None	None	G2	S2.2	1B.2
Caulanthus lemmonii Lemmon's jewelflower	PDBRA0M0E0	None	None	G3	S3	1B.2
Chloropyron molle ssp. hispidum hispid salty bird's-beak	PDSCR0J0D1	None	None	G2T2	S2.1	1B.1
Circus cyaneus northern harrier	ABNKC11010	None	None	G5	S3	SSC
Cismontane Alkali Marsh Cismontane Alkali Marsh	CTT52310CA	None	None	G1	S1.1	
Delphinium californicum ssp. interius Hospital Canyon larkspur	PDRAN0B0A2	None	None	G3T3	S3	1B.2
Delphinium recurvatum recurved larkspur	PDRAN0B1J0	None	None	G3	S3	1B.2

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Desmocerus californicus dimorphus valley elderberry longhorn beetle	IICOL48011	Threatened	None	G3T2	S2	
Emys marmorata western pond turtle	ARAAD02030	None	None	G3G4	S3	SSC
Eremophila alpestris actia California horned lark	ABPAT02011	None	None	G5T3Q	S3	WL
Eumops perotis californicus western mastiff bat	AMACD02011	None	None	G5T4	S3?	SSC
Falco mexicanus prairie falcon	ABNKD06090	None	None	G5	S3	WL
Gambelia sila blunt-nosed leopard lizard	ARACF07010	Endangered	Endangered	G1	S1	FP
Great Valley Cottonwood Riparian Forest Great Valley Cottonwood Riparian Forest	CTT61410CA	None	None	G2	S2.1	
Hesperolinon tehamense Tehama County western flax	PDLIN010C0	None	None	G3	S3	1B.3
Lepidurus packardi vernal pool tadpole shrimp	ICBRA10010	Endangered	None	G3	S2S3	
Linderiella occidentalis California linderiella	ICBRA06010	None	None	G3	S2S3	
Malacothamnus arcuatus arcuate bush-mallow	PDMAL0Q0E0	None	None	G2Q	S2.2	1B.2
Malacothamnus hallii Hall's bush-mallow	PDMAL0Q0F0	None	None	G2Q	S2	1B.2
Masticophis flagellum ruddocki San Joaquin whipsnake	ARADB21021	None	None	G5T2T3	S2?	SSC
Myotis yumanensis Yuma myotis	AMACC01020	None	None	G5	S4?	
Navarretia gowenii Lime Ridge navarretia	PDPLM0C120	None	None	G1	S1	1B.1
Navarretia nigelliformis ssp. radians shining navarretia	PDPLM0C0J2	None	None	G4T2	S2	1B.2
Perognathus inornatus inornatus San Joaquin pocket mouse	AMAFD01061	None	None	G4T2T3	S2S3	
Rana boylii foothill yellow-legged frog	AAABH01050	None	None	G3	S2S3	SSC
Rana draytonii California red-legged frog	AAABH01022	Threatened	None	G2G3	S2S3	SSC
Sagittaria sanfordii Sanford's arrowhead	PMALI040Q0	None	None	G3	S3	1B.2
Senecio aphanactis chaparral ragwort	PDAST8H060	None	None	G3?	S2	2B.2

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Spea hammondii western spadefoot	AAABF02020	None	None	G3	S3	SSC
Streptanthus insignis ssp. lyonii Arburua Ranch jewelflower	PDBRA2G0Q1	None	None	G3G4T2	S2	1B.2
Stuckenia filiformis ssp. alpina slender-leaved pondweed	PMPOT03091	None	None	G5T5	S3	2B.2
Sycamore Alluvial Woodland Sycamore Alluvial Woodland	CTT62100CA	None	None	G1	S1.1	
Taxidea taxus American badger	AMAJF04010	None	None	G5	S4	SSC
Thamnophis gigas giant garter snake	ARADB36150	Threatened	Threatened	G2G3	S2S3	
Valley Sacaton Grassland Valley Sacaton Grassland	CTT42120CA	None	None	G1	S1.1	
Valley Sink Scrub Valley Sink Scrub	CTT36210CA	None	None	G1	S1.1	
Vulpes macrotis mutica San Joaquin kit fox	AMAJA03041	Endangered	Threatened	G4T2T3	S2S3	

Record Count: 49

CNPS California Native Plant Society Rare and Endangered Plant Inventory

Plant List

28 matches found. *Click on scientific name for details*

Search Criteria

Rare Plant Rank is one of [1A, 1B, 2A, 2B, 3, 4], FESA is one of [Endangered, Threatened, Species of Concern, Not Listed], CESA is one of [Endangered, Threatened, Rare, Not Listed], Found in 9 Quads around 37121A1, Lifeform is one of [Tree, Shrub, Herb, Vine, Liverwort, Leaf, Moss, Stem], Duration is one of [ann, per, ephem], Bloom Time is one of [January, February, March, April, May, June, July, August, September, October, November, December]

Scientific Name	Common Name	Family	Lifeform	Rare Plant Rank	State Rank	Global Rank
Acanthomintha lanceolata	Santa Clara thorn-mint	Lamiaceae	annual herb	4.2	S3.2	G3
Amsinckia furcata	forked fiddleneck	Boraginaceae	annual herb	4.2	S3.2	G3
Androsace elongata ssp. acuta	California androsace	Primulaceae	annual herb	4.2	S3.2?	G5?T3T4
Atriplex cordulata var. cordulata	heartscale	Chenopodiaceae	annual herb	1B.2	S2	G3T2
Atriplex coronata var. coronata	crownscale	Chenopodiaceae	annual herb	4.2	S3.2	G4T3
Atriplex coronata var. vallicola	Lost Hills crownscale	Chenopodiaceae	annual herb	1B.2	S2	G4T2
California macrophylla	round-leaved filaree	Geraniaceae	annual herb	1B.1	S2	G2
Campanula exigua	chaparral harebell	Campanulaceae	annual herb	1B.2	S2.2	G2
Caulanthus lemmonii	Lemmon's jewelflower	Brassicaceae	annual herb	1B.2	S3	G3
Chloropyron molle ssp. hispidum	hispid bird's-beak	Orobanchaceae	annual herb (hemiparasitic)	1B.1	S2.1	G2T2
Clarkia breweri	Brewer's clarkia	Onagraceae	annual herb	4.2	S3.2	G3
Convolvulus simulans	small-flowered morning-glory	Convolvulaceae	annual herb	4.2	S3.2	G3
Cryptantha rattanii	Rattan's cryptantha	Boraginaceae	annual herb	4.3	S3.3	G3
Delphinium californicum ssp. interius	Hospital Canyon larkspur	Ranunculaceae	perennial herb	1B.2	S3	G3T3
Delphinium recurvatum	recurved larkspur	Ranunculaceae	perennial herb	1B.2	S3	G3
Eryngium spinosepalum	spiny-sepaled button-celery	Apiaceae	annual / perennial herb	1B.2	S2.2	G2
Fritillaria agrestis	stinkbells	Liliaceae	perennial bulbiferous herb	4.2	S3.2	G3
Hesperolinon tehamense	Tehama County western flax	Linaceae	annual herb	1B.3	S3	G3
Iris longipetala	coast iris	Iridaceae	perennial rhizomatous herb	4.2	S3.2	G3
Lessingia tenuis	spring lessingia	Asteraceae	annual herb	4.3	S3.3	G3
Malacothamnus arcuatus	arcuate bush-mallow	Malvaceae	perennial evergreen shrub	1B.2	S2.2	G2Q
Malacothamnus hallii	Hall's bush-mallow	Malvaceae	perennial evergreen shrub	1B.2	S2	G2Q
Navarretia gowenii	Lime Ridge navarretia	Polemoniaceae	annual herb	1B.1	S1	G1
Navarretia nigelliformis ssp. radians	shining navarretia	Polemoniaceae	annual herb	1B.2	S2	G4T2
Piperia michaelii	Michael's rein orchid	Orchidaceae	perennial herb	4.2	S3.2	G3
Senecio aphanactis	chaparral ragwort	Asteraceae	annual herb	2B.2	S2	G3?
Streptanthus insignis ssp. lyonii	Arburua Ranch jewel-flower	Brassicaceae	annual herb	1B.2	S2	G3G4T2
Stuckenia filiformis ssp. alpina	slender-leaved pondweed	Potamogetonaceae	perennial rhizomatous herb	2B.2	S3	G5T5

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Material Safety Data Sheet

Material Name: Copper Sulfate Pentahydrate ID: C1-121A

* * * Section 1 - Chemical Product and Company Identification * * *

Chemical Name: Copper Sulfate Pentahydrate
Product Use: For Commercial Use
Synonyms: Copper Sulfate Crystals, Blue Copper, Blue Stone, Blue Vitriol, Copper (II) sulfate, Cupric Sulfate, Copper Sulfate Fine 200, Fine 100, Fine 30, 20, 25 Small, Medium, Large, FCC IV, and Very High Purity

Supplier Information

Chem One Ltd.
14140 Westfair East Drive
Houston, Texas 77041-1104

Phone: (713) 896-9966
Fax: (713) 896-7540
Emergency # (800) 424-9300 or (703) 527-3887

General Comments

NOTE: Emergency telephone numbers are to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure, or accident involving chemicals. All non-emergency questions should be directed to customer service.

* * * Section 2 - Composition / Information on Ingredients * * *

CAS #	Component	Percent
7758-99-8	Copper (II) Sulfate Pentahydrate	> 99

Component Related Regulatory Information

This product may be regulated, have exposure limits or other information identified as the following: Copper (7440-50-8) and inorganic compounds, as Cu, Copper (7440-50-8) dusts and mists, as Cu and Copper fume, Cu.

Component Information/Information on Non-Hazardous Components

This product is considered hazardous under 29 CFR 1910.1200 (Hazard Communication).

* * * Section 3 - Hazards Identification * * *

Emergency Overview

Copper Sulfate Pentahydrate is a blue crystalline or powdered, odorless solid. Potentially fatal if swallowed. May cause irritation to the eyes, respiratory system and skin. Fire may produce irritating, corrosive and/or toxic fumes. Firefighters should use full protective equipment and clothing.

Hazard Statements

HARMFUL OR FATAL IF SWALLOWED. Can cause irritation of eyes, skin, respiratory tract and, in extreme cases, burns. Avoid contact with eyes and skin. Avoid breathing dusts. Wash thoroughly after handling. Keep container closed. Use with adequate ventilation. Keep from contact with clothing and other combustible materials.

Potential Health Effects: Eyes

Exposure to particulates or solution of this product may cause redness and pain. Prolonged contact may cause conjunctivitis, ulceration and corneal abnormalities.

Potential Health Effects: Skin

This product can cause irritation of the skin with pain, itching and redness. Severe overexposure can cause skin burns. Prolonged exposure may cause dermatitis and eczema.

Potential Health Effects: Ingestion

Harmful or fatal if swallowed. May cause gastrointestinal irritation with symptoms such as nausea, vomiting, and diarrhea. Ingestion may cause degeneration of liver, kidney, or renal failure. Persons who survive ingestion may develop granulomatous lesions of the kidney. Ingestion of large amounts may lead to convulsions, coma or death.

Potential Health Effects: Inhalation

May irritate the nose, throat and respiratory tract. Symptoms can include sore throat, coughing and shortness of breath. In severe cases, ulceration and perforation of the nasal septum can occur. If this material is heated, inhalation of fumes may lead to development of metal fume fever. This is a flu-like illness with symptoms of metallic taste, fever and chills, aches, chest tightness and cough. Repeated inhalation exposure can cause shrinking of the lining of the inner nose.

HMIS Ratings: Health Hazard: 2* **Fire Hazard:** 0 **Physical Hazard:** 1
Hazard Scale: 0 = Minimal 1 = Slight 2 = Moderate 3 = Serious 4 = Severe * = Chronic hazard

* * * Section 4 - First Aid Measures * * *

First Aid: Eyes

Immediately flush eyes with large amounts of room temperature water, occasionally lifting the lower and upper lids, for at least 15 minutes. If symptoms persist after 15 minutes of irrigation, seek medical attention.

* * * Section 4 - First Aid Measures (Continued) * * *

First Aid: Skin

Remove all contaminated clothing. For skin contact, wash thoroughly with soap and water for at least 20 minutes. Seek immediate medical attention if irritation develops or persists.

First Aid: Ingestion

DO NOT INDUCE VOMITING. Have victim rinse mouth thoroughly with water, if conscious. Never give anything by mouth to a victim who is unconscious or having convulsions. Contact a physician or poison control center immediately.

First Aid: Inhalation

Remove source of contamination or move victim to fresh air. Apply artificial respiration if victim is not breathing. Do not use mouth-to-mouth method if victiun ingested or inhaled the substance; induce artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device. Administer oxygen if breathing is difficult. Get immediate medical attention.

First Aid: Notes to Physician

Provide general supportive measures and treat symptomatically. Basic Treatment: Establish a patent airway. Suction if necessary. Watch for signs of respiratory insufficiency and assist ventilations if necessary. Administer oxygen by non-rebreather mask at 10 to 15 L/minutes. Monitor for shock and treat if necessary. For eye contamination, flush eyes immediately with water. Irrigate each eye continuously with normal saline during transport. Do uot use emetics. For ingestion, rinse mouth and administer 5 mL/kg up to 200 mL of water for dilution if the patient can swallow, has a strong gag reflex, and does not drool. Administer activated charcoal. Advanced Treatment: Consider orotracheal or nasotracheal intubation for airway control in the patient who is unconscious. Start an IV with lactated Ringer's SRP: "To keep open", minimal flow rate. Watch for signs of fluid overload. For hypotension with signs of hypovolemia, administer fluid cautiously. Consider vasopressors if hypotensive with a normal fluid volume. Watch for signs of fluid overload. Use proparacaine, hydrochloride to assist eye irrigation.

* * * Section 5 - Fire Fighting Measures * * *

Flash Point: Not flammable
Upper Flammable Limit (UEL): Not applicable
Auto Ignition: Not applicable
Rate of Burning: Not applicable
Method Used: Not applicable
Lower Flammable Limit (LEL): Not applicable
Flammability Classification: Not applicable

General Fire Hazards

Copper Sulfate Pentahydrate is not combustible, but may decompose in the heat of a fire to produce corrosive and/ or toxic fumes.

Hazardous Combustion Products

Sulfur oxides and copper fumes.

Extinguishing Media

Use methods for surrounding fire.

Fire Fighting Equipment/Instructions

Firefighters should wear full protective clothing including self-contained breathing apparatus. Runoff from fire control or dilution water may be corrosive and/or toxic and cause pollution.

NFPA Ratings: Health: 2 **Fire:** 0 **Reactivity:** 1 **Other:**

Hazard Scale: 0 = Mimimal 1 = Slight 2 = Moderate 3 = Serious 4 = Severe

* * * Section 6 - Accidental Release Measures * * *

Containment Procedures

Stop the flow of material, if this can be done without risk. Contain the discharged material. If sweeping of a contaminated area is necessary use a dust suppressant agent, which does not react with product (see Section 10 for incompatibility information).

Clean-Up Procedures

Wear appropriate protective equipment and clothing during clean-up. Shovel the material into waste container. Thoroughly wash the area after a spill or leak clean-up. Prevent spill rinsate from contamination of storm drains, sewers, soil or groundwater.

Evacuation Procedures

Evacuate the area promptly and keep upwind of the spilled material. Isolate the spill area to prevent people from entering. Keep materials which can burn away from spilled material. In case of large spills, follow all facility emergency response procedures.

Special Procedures

Remove soiled clothing and launder before reuse. Avoid all skin contact with the spilled material. Have emergency equipment readily available.

* * * Section 7 - Handling and Storage * * *

Handling Procedures

It is a violation of Federal Law to use this product in a manner inconsistent with its labeling, when used as a pesticide. Do not breathe dust. Avoid all contact with skin and eyes. Use this product only with adequate ventilation. Wash thoroughly after handling.

Storage Procedures

Keep in original container in locked storage area. Keep container tightly closed when not in use. Store containers in a cool, dry location, away from direct sunlight, sources of intense heat, or where freezing is possible. Material should be stored in secondary containers or in a diked area, as appropriate. Store containers away from incompatible chemicals (see Section 10, Stability and Reactivity). Storage areas should be made of fire-resistant materials. Post warning and "NO SMOKING" signs in storage and use areas, as appropriate. Use corrosion-resistant structural materials, lighting, and ventilation systems in the storage area. Floors should be sealed to prevent absorption of this material. Have appropriate extinguishing equipment in the storage area (i.e., sprinkler system, portable fire extinguishers). Empty containers may contain residual particulates; therefore, empty containers should be handled with care. Do not cut, grind, weld, or drill near this container. Never store food, feed, or drinking water in containers that held this product. Keep this material away from food, drink and animal feed. Inspect all incoming containers before storage, to ensure containers are properly labeled and not damaged. Do not store this material in open or unlabeled containers. Limit quantity of material stored. Store in suitable containers that are corrosion-resistant.

* * * Section 8 - Exposure Controls / Personal Protection * * *

Exposure Guidelines

A: General Product Information

Follow the applicable exposure limits.

B: Component Exposure Limits

The exposure limits given are for Copper & Inorganic Compounds, as Cu (7440-50-8), Copper fume as Cu or Copper dusts and mists, as Cu.

ACGIH: 1 mg/m^3 TWA (dusts & mists)
0.2 mg/m^3 TWA (fume)

OSHA: 1 mg/m^3 TWA (dusts & mists)
0.1 mg/m^3 TWA (fume)

NIOSH: 1 mg/m^3 TWA (dusts & mists)
0.1 mg/m^3 TWA (fume)

DFG MAKs 1 mg/m^3 TWA Peak, 2•MAK 15 minutes, average value, 1-hr interval (copper and inorganic copper compounds)
0.1 mg/m^3 TWA Peak, 2•MAK15 minutes, average value, 1-hr interval (fume)

Engineering Controls

Use mechanical ventilation such as dilution and local exhaust. Use a corrosion-resistant ventilation system and exhaust directly to the outside. Supply ample air replacement. Provide dust collectors with explosion vents.

The following information on appropriate Personal Protective Equipment is provided to assist employers in complying with OSHA regulations found in 29 CFR Subpart I (beginning at 1910.132). Please reference applicable regulations and standards for relevant details.

PERSONAL PROTECTIVE EQUIPMENT

Personal Protective Equipment: Eyes/Face

Wear safety glasses with side shields (or goggles) and a face shield, if this material is made into solution. If necessary, refer to U.S. OSHA 29 CFR 1910.133.

Personal Protective Equipment: Skin

Wear chemically-impervious gloves, made of any waterproof material, boots and coveralls to avoid skin contact. If necessary, refer to U.S. OSHA 29 CFR 1910.138.

* * * Section 8 - Exposure Controls / Personal Protection (Continued) * * *

Personal Protective Equipment: Respiratory

If airborne concentrations are above the applicable exposure limits, use NIOSH-approved respiratory protection. If respiratory protection is needed, use only protection authorized in the U.S. Federal OSHA Standard (29 CFR 1910.134), applicable U.S. State regulations. Oxygen levels below 19.5% are considered IDLH by OSHA. In such atmospheres, use of a full-facepiece pressure/demand SCBA or a full facepiece, supplied air respirator with auxiliary self-coutained air supply is required under OSHA's Respiratory Protection Standard (1910.134-1998). The following NIOSH Guidelines for Copper dust and mists (as Cu) are presented for further information.

Up to 5 mg/m^3: Dust and mist respirator.

Up to 10 mg/m^3: Any dust and mist respirator except single-use and quarter mask respirators or any SAR.

Up to 25 mg/m^3: SAR operated in a continuous-flow mode or powered air-purifying respirator with a dust and mist filter(s).

Up to 50 mg/m^3: Air purifying, full-facepiece respirator with high-efficiency particulate filter(s), any powered air-purifying respirator with tight-fitting facepiece and high-efficiency particulate filter(s) or full-facepiece SCBA, or full-facepiece SAR.

Up to 100 mg/ m^3: Positive pressure, full-facepiece SAR.

Emergency or Planned Entry into Unknown Concentrations or IDLH Conditions: Positive pressure, full-facepiece SCBA, or positive pressure, full-facepiece SAR with an auxiliary positive pressure SCBA.

Escape: Full-facepiece respirator with high-efficiency particulate filter(s), or escape-type SCBA.

NOTE: The IDLH concentration for Copper dusts and mists (as Cu) is 100 mg/m^3.

Personal Protective Equipment: General

Wash hands thoroughly after handling material. Do not eat, drink or smoke in work areas. Have a safety shower or eye-wash fountain available. Use good hygiene practices when handling this material including changing and lanndering work clothing after use. Discard contaminated shoes and leather goods.

* * * Section 9 - Physical & Chemical Properties * * *

Physical Properties: Additional Information

The data provided in this section are to be used for product safety handling purposes. Please refer to Product Data Sheets, Certificates of Conformity or Certificates of Analysis for chemical and physical data for determinations of quality and for formulation purposes.

Appearance:	Blne crystals or powder	**Odor:**	Odorless
Physical State:	Solid	**pH:**	3.7-4.2 (10% soln.)
Vapor Pressure:	20 torr at 22.5 deg C	**Vapor Density:**	8.6
Boiling Point:	560 deg C (1040 deg F) [decomposes]	**Freezing/Melting Point:**	150 deg C (302 deg F)
Solubility (H2O):	31.6 g/100 cc (@ 0 deg C)	**Specific Gravity:**	2.28 @ 15.6 deg C (H2O = 1)
Softening Point:	Not available	**Particle Size:**	Various
Molecular Weight:	249.68	**Bulk Density:**	Not available
		Chemical Formula:	CuSO4*5H2O

* * * Section 10 - Chemical Stability & Reactivity Information * * *

Chemical Stability

Copper Sulfate Pentahydrate is hygroscopic, but stable when kept dry, under normal temperature and pressures.

Chemical Stability: Conditions to Avoid

Avoid high temperatures, exposure to air and incompatible materials.

Incompatibility

Copper Sulfate causes hydroxylamine to ignite and the hydrated salt is vigorously reduced. Solutions of sodium hypobromite are decomposed by powerful catalytic action of cnpric ions, even as impurities. . Copper salts, including Copper Sulfate may react to form explosive acetylides when in contact with acetylene or nitromethane. Contact with reducing agents, can cause a vigorons reaction, especially in solution. This product can corrode aluminum, steel and iron. Copper Sulfate Pentahydrate is incompatible with magnesinm, strong bases, alkalines, phosphates, acetylene, hydrazine, and zirconium.

Hazardous Decomposition

Sulfur oxides and Copper oxides.

Hazardous Polymerization

Will not occur.

* * * Section 11 - Toxicological Information * * *

Acute and Chronic Toxicity

A: General Product Information

Acute toxicity is largely due to the corrosive (acidic) properties of this material. Harmful or fatal if swallowed. Product is an eye and skin irritant, and may cause burns. Product is a respiratory tract irritant, and inhalation may cause nose irritation, sore throat, coughing, and chest tightness and possibly, ulceration and perforation of the nasal septum.

Chronic: Long term skin overexposure to this product may lead to dermatitis and eczema. Prolonged or repeated eye contact may cause conjunctivitis and possibly corneal abnormalities. Chronic overexposure to this product may cause liver and kidney damage, anemia and other blood cell abnormalities.

B: Component Analysis - LD_{50}/LC_{50}

Copper Sulfate Pentahydrate (7758-99-8)

Oral-rat LD50 = 330 mg/kg (testing done Jnne 2006, Consumer Prodnct Testing Co., Inc.); Intraperitoneal-Rat LD_{50}: 18,700 mg/kg; Intraperitoneal-rat LD_{50}: 20 mg/kg; Subcutaneous-rat LD_{50}: 43 mg/kg; Intravenous-rat LD_{50}: 48900 µg/kg; Unreported-rat LD_{50}: 520 mg/kg; Oral-mouse LD_{50}: 369 mg/kg; Intraperitoneal-Mouse LD_{50}: 33 mg/kg; Intraperitoneal-mouse LD_{50}: 7182 µg/kg; Intravenous-mouse LD_{50}: 23300 µg/kg

B: Component Analysis - TDLo/LDLo

Copper Sulfate Pentahydrate (7758-99-8)

Oral-man LDLo: 857 mg/kg; Oral-Human LDLo: 50 mg/kg: Behavioral: somnolence (general depressed activity); Kidney, Urethra, Bladder: changes in tubnles (including acute renal failure, acute tubular necrosis); Blood: hemorrhage; Oral-Hnman TDLo: 11 mg/kg: Gastrointestinal: gastritis; Gastrointestinal: hypermotility, diarrhea, nausea or vomiting; Oral-Human TDLo: 272 mg/kg: liver, kidney, Blood effects; Oral-Human LDLo: 1088 mg/kg; Oral-child : 150 mg/kg: Kidney, Urethra, Bladder: changes in tubules (including acute renal failure, acute tubular ; necrosis); Blood: other hemolysis with or without anemia; unknown-Man LDLo: 221 mg/kg; Oral-Woman TDLo: 2400 mg/kg/day: Gastrointestinal tract effects; DNA Inhibition-Human: lymphocyte 76 mmol/L; Oral-woman LDLo: 100 mg/kg: Vascular: Blood pressure lowering not characterized in autonomic section; Liver: hepatitis (hepatocellular necrosis), diffuse; Kidney, Urethra, Bladder: changes in tubules (including acute renal failure, acute tubular necrosis); Oral-Human LDLo: 143 mg/kg: Pulmonary system effects, Gastrointestinal tract effects ;Oral-rat TDLo: 915 mg/kg/1 year-intermittent: Cardiac: changes in coronary arteries; Blood: changes in serum composition (e.g. TP, bilirubin, cholesterol; Oral-rat TDLo: 157 mg/kg/6 weeks-intermittent: Endocrine: changes in adrenal weight; Nutritional and Gross Metabolic: weight loss or decreased weight gain; Biochemical: Enzyme inhibition, induction, or change in blood or tissue levels: dehydrogenases; Oral-rat TDLo: 7530 mg/kg/30 days-intermittent: Blood: changes in serum composition (e.g. TP, bilirubin, cholesterol); Blood: changes in erythrocyte (RBC) count; Biochemical: Enzyme inhibition, induction, or change in blood or tissue levels:- multiple enzyme effect; Oral-rat TDLo: 2 gm/kg/20 days-intermittent: Liver: other changes; Biochemical: Enzyme inhibition, induction, or change in blood or tissue levels: phosphatases, Enzyme inhibition, induction, or change in blood or tissue levels; Intraperitoneal-rat TDLo: 791 mg/kg/18 weeks-intermittent: Nutritional and Gross Metabolic: weight loss or decreased weight gain; Intraperitoneal-rat TDLo: 7500 µg/kg: female 3 day(s) after conception: Reproductive: Fertility: other measures of fertility; Subcutaneonsrat TDLo: 12768 µg/kg: male 1 day(s) pre-mating: Reproductive: Paternal Effects: testes, epididymis, sperm duct; Intratesticular-rat TDLo:3192 µg/kg: male 1 day(s) pre-mating: Reproductive: Paternal Effects: spermatogenesis (incl. genetic material, sperm morphology, motility, and count), testes, epididymis, sperm duct; Oral-mouse TDLo: 3 gm/kg/8 weeks-continuous: Blood: changes in spleen; Immunological Including Allergic: decrease in cellular immune response, decrease in humoral immune response; Oral-mouse TDLo: 2 gm/kg/3 weekscontinuous:
Blood: changes in spleen; Immunological Including Allergic: decrease in cellular immune response, decrease in humoral
immune response; Subcutaneous-mouse LDLo: 500 µg/kg; Subcutaneous-mouse TDLo: 12768 µg/kg: male 30 day(s) pre-mating: Reproductive: Paternal Effects: testes, epididymis, sperm duct; Intravenous-mouse TDLo: 3200 µg/kg: female 8 day(s) after conception: Reproductive: Effects on Embryo or Fetus: fetotoxicity (except death, e.g., stunted fetus), Specific Developmental Abnormalities: Central Nervous System, cardiovascular (circulatory) system; Intravenous-mouse TDLo: 3200 µg/kg: female 7 day(s) after conception: Reproductive: Fertility: post-implantation mortality (e.g. dead and/or resorbed implants per total number of implants); Oral-Dog, adult LDLo: 60 mg/kg; Intravenous-guinea pig TDLo: 2 mg/kg; Subcutaneous-Guinea Pig, adult LDLo: 62 mg/kg; Oral-Pigeon LDLo: 1000 mg/kg; Oral-Domestic animals (Goat, Sheep) LDLo: 5 mg/kg; Oral-Bird-wild species LDLo: 300 mg/kg; Intravenous-frog LDLo: 25 mg/kg; Parenteral-chicken TDLo: 10 mg/kg: Tumorigenic: equivocal tumorigenic agent by RTECS criteria; Endocrine: tumors; Oral-pig TDLo: 140 mg/kg: female 1-15 week(s) after conception, lactating female 4 week(s) post-birth: Reproductive: Effects on Newborn: biochemical and metabolic; Intravenous-hamster TDLo: 2130 µg/kg: female 8 day(s) after conception: Reproductive: Fertility: postimplantation
mortality (e.g. dead and/or resorbed implants per total number of implants), Specific Developmental Abnormalities: Central Nervous System, body wall

* * * Section 11 - Toxicological Information (Continued) * * *

Carcinogenicity

A: General Product Information

Copper Sulfate Pentahydrate (7758-99-8)

Cytogenetic Analysis-Rat/ast 300 mg/kg

B: Component Carcinogenicity

Copper dusts and mists, as Cu (7440-50-8)

EPA: EPA-D (Not Classifiable as to Human Carcinogenicity - inadequate human and animal evidence of carcinogenicity or no data available)

Epidemiology

No information available.

Neurotoxicity

Has not been identified.

Mutagenicity

Human and animal mutation data are available for Copper Sulfate Pentahydrate; these data were obtained during clinical studies on specific human and animal tissues exposed to high doses of this compound.

Teratogenicity

There are no reports of teratogenicity in humans. Animal studies indicate that a deficiency or excess of copper in the body can cause significant harm to developing embryos. The net absorption of copper is limited and toxic levels are unlikely from industrial exposure.

Other Toxicological Information

Individuals with Wilson's disease are unable to metabolize copper. Thus, persons with pre-existing Wilson's disease may be more susceptible to the effects of overexposure to this product.

* * * Section 12 - Ecological Information * * *

Ecotoxicity

A: General Product Information

Harmful to aquatic life in very low concentrations. Copper Sulfate Pentahydrate is toxic to fish and marine organisms when applied to streams, rivers, ponds or lakes.

B: Ecotoxicity

Copper Sulfate Pentahydrate (7758-99-8)

LC_{50} (*Lepomis machochirus* bluegill) wt 1.5 g = 884 mg/L at 18°C, static bioassay (95% confidence limit 707-1,100 mg/L) (technical material, 100% (about 25% elemental copper); LC_{50} (*Leopmis cyanellus*, Green Sunfish) = 1.1 g, 3,510 µg/L at °C; LC_{50} (*Pimephales promelas*, Fat-head minnow) = 1.2 g, 838 µg/L at 18°C; LC_{50} (*Crassius auratus*, Goldfish) = 0.9 g, 1380 µg/L at 18°C; LC_{50} (*Crassius auratus*, Goldfish) = 0.1-2.5 mg/L; LC_{50} (*EEL*) = 0.1-2.5 mg/L; LC_{50} (*Salmo gairdneri*, Rainbow trout) = 1.6 g, 135 µg/L at 18°C; LC_{50} (*Salmo gairdneri*, Rainbow trout) 48 hours =0.14 ppm; LC_{50} (*Daphnia magna*) no time specified = 0.182 mg/L; LC_{50} (*Salmo gairdneri*, Rainbow trout) no time specified = 0.17 mg/L; LC_{50} (*Lepomis machochirus*, Blue gill) no time specified = 1.5 g, 884 µg/L at 18°C; LC_{50} (Stripped Bass) 96 hours = 1 ppm or lower; LC_{50} (Prawn) 48 hours = 0.14; LC_{50} (Shrimp) 96 hours = 17.0 ppm copper; LC_{50} (Blue Crab) 96 hours = 28 ppm copper; LC_{50} (Oyster) 96 hours = 5.8 ppm copper; LC_{50} (*Viviparus bengalensis* snail) 96 hours = 0.060 ppm copper (at 32.5°C; 0.066 ppm copper static bioassay); LC_{50} (*Viviparus bengalensis* snail) 96 hours = 0.09 ppm copper (at 27.3°C; 0.066 ppm copper static bioassay); LC_{50} (*Viviparus bengalensis* snail) 96 hours = 0.39 ppm copper (at 20.3°C; 0.066 ppm copper static bioassay)

Environmental Fate

If released to soil, copper sulfate may leach to groundwater, be partly oxidized or bind to humic materials, clay or hydrous oxides of iron and manganese. In water, it will bind to carbonates as well as humic materials, clay and hydrous oxides of iron and mauganese. Copper is accumulated by plants and animals, but it does not appear to biomagnify from plants to animals. In air, copper aerosols have a residence time of 2 to 10 days in an unpolluted atmosphere and 0.1 to greater than 4 days in polluted, urban areas.

* * * Section 13 - Disposal Considerations * * *

US EPA Waste Number & Descriptions

A: General Product Information

This product is a registered pesticide.

B: Component Waste Numbers

No EPA Waste Numbers are applicable for this product's components.

Disposal Instructions

All wastes must be handled in accordance with local, state and federal regulations or with regulations of Canada and its Provinces. This material can be converted to a less hazardous material by weak reduciug agents followed by neutralization. Do not reuse empty containers. Do not rinse unless required for recycling. If partly filled, call local solid waste agency for disposal instructions. Never pour unused product down drains or on the ground.

Pesticide Disposal

Pesticide wastes are acutely hazardous. Improper disposal of excess pesticides, spray mixtures, or rinsate is a violation of U.S. Federal and Canadian Law. If these wastes cannot be disposed of by use, according to product label instruction, contact your U.S. State, or Canadian Province Pesticide or Environmental Control Agency, or the hazardous waste representative at the nearest U.S. EPA Regional Office, or the offices of Environment Canada for guidance.

* * * Section 14 – Transportation Information Ground * * *

NOTE: The shipping classification information in this section (Section 14) is meant as a guide to the overall classification of the product. However, transportation classifications may be subject to change with changes in package size. Consult shipper requirements under 49 CFR, IATA and IMDG to assure regulatory compliance.

US DOT 49 CFR 100-185 Revised July 24, 2009 Information

UN/NA #: UN 3077

Shipping Name: Environmentally Hazardous Substance, solid, n.o.s. (cupric sulfate)

Hazard Class: 9

Packing Group: III

Required Label(s): Class 9

Special Provision: 8, 146, IB8, IP2, N20

Packaging: 172.213

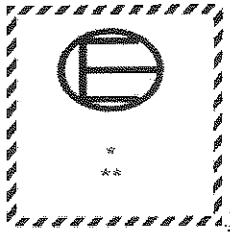
RQ Quantity: For a single package less than the RQ of 10lb (4.54 kg), the RQ designation should be not be used.

Additional Shipping Information

Limited Qnantity Shipments: Shipments, except for air, need not be marked with the Proper Shipping Name of the contents, but shall be marked with the UN Number (3077) of the contents, preceded by the letters "UN", placed within a diamond. The width of the line forming the diamond shall be at least 2 mm; the number shall be at least 6 mm high. The total weight of each outer packaging cannot exceed 30 kg (66 pounds.) .

Small Quantities for Highway and Rail: The maximum quantity of this material per inner receptacle is limited to 30 g (1 ounce) per receptacle. The inner receptacles must be securely packed in an inside packaging with cushioning material to prevent movement of the inner receptacles and packed in a strong outer box with a gross mass not to exceed 29kg (64 pounds). The completed package must meet the drop test requirements of 173.4(6) (i). The outside of the package must be marked with the statement "**This package conforms to 49 CFR 173.4 for domestic highway or rail transport only.**"

Excepted Quantities: The maximum quantity of this material per inner receptacle is limited to 30 g (1 ounce) per receptacle and the aggregate quantity of this material per completed package does not exceed 1kg (2.2 pounds). The inner receptacles must be securely packed in an inside packaging with cushioning material to prevent movement in the inner receptacles and packed in a strong outer box with a gross mass not to exceed 29kg (64 pounds). The completed package must meet a drop test. The requirements are found in 173.4(6) (i). The package must not be opened or otherwise altered until it is no longer in commerce. For highway or rail transportation no shipping paper is required. The package must be legibly marked with the following marking:



NOTE: The "*" must be replaced by the primary hazard class, or when assigned, the division of each of the hazardous materials contained in the package. The "**" must be replaced by the name of the shipper or consignee if not shown elsewhere on the package. The symbol shall be not less than 100 mm (3.9 inches) x 100 mm (3.9 inches), and must be durable and clearly visible.

De minimis Exceptions: The maximum quantity of this material per inner receptacle is limited to 1g (0.04 ounce) per receptacle and the aggregate quantity of this material per completed package does not exceed 100 g (0.22 pounds). The inner receptacles must be securely packed in an inside packaging with cushioning material to prevent movement in the inner receptacles and packed in a strong outer box with a gross mass not to exceed 29kg (64 pounds). The completed package must meet the drop test. The requirements are found in 173.4(6) (i). The package must not be opened or otherwise altered until it is no longer in commerce and may be transported by aircraft. If all of the above requirements are met, then this material is not regulated.

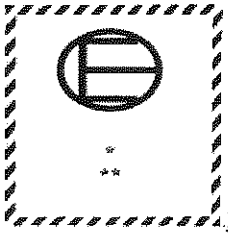
* * * Section 14 – Transportation Information Air * * *

50th Edition International Air Transport Association (IATA):

For Shipments by Air transport: This information applies to air shipments both within the U.S. and for shipments originating in the U.S., but being shipped to a different country.

UN/NA #: UN 3077
Proper Shipping Name: Environmentally Hazardous Substance, solid, n.o.s. (cupric sulfate)
Hazard Class: 9 (Miscellaneous Dangerous Goods)
Packing Group: III
Passenger & Cargo Aircraft Packing Instruction: 911
Passenger & Cargo Aircraft Maximum Net Quantity: 400 kg
Limited Quantity Packing Instruction (Passenger & Cargo Aircraft): Y911
Limited Quantity Maximum Net Quantity (Passenger & Cargo Aircraft): 30 kg G
Cargo Aircraft Only Packing Instruction: 911
Cargo Aircraft Only Maximum Net Qnantity: 400 kg
Excepted Quantities: E1
Special Provisions: A97, A158
ERG Code: 9L
Limited Quantity Shipments: Shipments for air must be marked with the Proper Shipping Name, Environmentally Hazardous Substance, solid, n.o.s. (cupric sulfate), and shall be marked with the UN Nnmber (3077) preceded by the letters "UN", placed within a diamond. The width of the line forming the diamond shall be at least 2 mm; the number shall be at least 6 mm high. The total weight of each outer packaging cannot exceed 30 kg.

Excepted Quantities: The maximum quantity of this material per inner receptacle is limited to 30 g per receptacle and the aggregate quantity of this material per completed package does not exceed 1kg. The inner receptacles must be securely packed in an intermediate packaging with cushioning material to prevent movement in the inner receptacles and packed in a strong onter box with a gross mass not to exceed 29kg. The completed package must meet a drop test. The requirements are found in 2.7.6.1. The package must not be opened or otherwise altered until it is no longer in commerce. For air transportation no shipping paper is required. The package must be legibly marked with the following marking:



NOTE: The "*" must be replaced by the primary hazard class, or when assigned, the division of each of the hazardous materials contained in the package. The "**" must be replaced by the name of the shipper or consignee if not shown elsewhere on the package. The symbol shall be not less than 100 mm x 100 mm and must be durable and clearly visible.

* * * Section 14 – Transportation Information Vessel * * *

Amendment 34-08 International Maritime Dangerous Goods (IMDG) Code
For shipments via marine vessel transport, the following classification information applies.

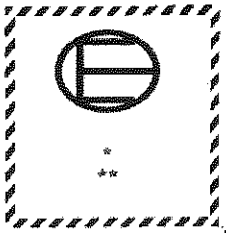
UN/NA #: UN 3077
Proper Shipping Name: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (Cupric sulfate)
Hazard Class: Class 9 (Miscellaneous Dangerous Goods)
Packing Group: III
Special Provisions: 179,274,335,909
Limited Quantities 5 kg
Excepted Quantities: E1
Packing Instructions: P002/LP02
Provisions: PP12
IBC Instructions IBC08
IBC Provisions: B2
EmS: F-A, S-S
Stowage and Segregation: Category A.

Marine Pollutant: This material is considered a marine pollutant by the IMO and shipments of the material must carry the new marking

Refer to IMO Amendment 34-08 Chapter 2.9 and 2.10.

Limited Quantity Shipments: Shipments need not be marked with the Proper Shipping Name of the contents, but shall be marked with the UN Number (3077) of the contents, preceded by the letters "UN", placed within a diamond. The width of the line forming the diamond shall be at least 2 mm; the number shall be at least 6 mm high. The total weight of each outer packaging cannot exceed 30kg.

Excepted Quantities: The maximum quantity of this material per inner receptacle is limited to 30g per receptacle and the aggregate quantity of this material per completed package does not exceed 1,000g. Maximum number of packages per Cargo Transport Unit (CTU) shall not exceed 1,000 packages. The inner receptacles must be securely packed in an intermediate packaging with cushioning material to prevent movement in the inner receptacles and packed in a strong outer box with a gross mass not to exceed 29 kg. The completed package must meet a drop test. The requirements are found in 3.5.3.1. Packages must not be opened or otherwise altered until it is no longer in commerce and a shipping paper is required. The package must be legibly marked with the following marking:



NOTE: The "*" must be replaced by the primary hazard class, or when assigned, the division of each of the hazardous materials contained in the package. The "**" must be replaced by the name of the shipper or consignee if not shown elsewhere on the package. The symbol shall be not less than 100 mm x 100 mm and must be durable and clearly visible.

* * * Section 15 - Regulatory Information * * *

US Federal Regulations

A: General Product Information
Copper Sulfate Pentahydrate (CAS # 7758-99-8) is listed as a Priority and Toxic Pollutant under the Clean Water Act.

B: Component Analysis This material contains one or more of the following chemicals required to be identified under SARA Section 302 (40 CFR 355 Appendix A), SARA Section 313 (40 CFR 372.65) and/or CERCLA (40 CFR 302.4):

Copper Compounds (7440-50-8)
SARA 313: final RQ = 5000 pounds (2270 kg) Note: No reporting of releases of this substance is required if the diameter of the pieces of the solid metal released is equal to or greater than 0.004 inches.

Cupric Sulfate (7758-98-7)
CERCLA: final RQ = 10 pounds (4.54 kg)

* * * Section 15 - Regulatory Information (Continued) * * *

C: Sara 311/312 Tier II Hazard Ratings:

Component	CAS #	Fire Hazard	Reactivity Hazard	Pressure Hazard	Immediate Health Hazard	Chronic Health Hazard
Copper Sulfate Pentahydrate	7758-99-8	No	No	No	Yes	Yes

State Regulations

A: General Product Information

California Proposition 65

Copper Sulfate Pentahydrate is not on the California Proposition 65 chemical lists.

B: Component Analysis - State

The following components appear on one or more of the following state hazardous substance lists:

Component	CAS #	CA	FL	MA	MN	NJ	PA
Copper	7440-50-8	Yes	No	Yes	No	Yes	Yes
Copper, fume, dust and mists	N/A	No	Yes	No	Yes	No	Yes
Copper Sulfate Pentahydrate	7758-99-8	No	No	No	No	Yes	Yes

Other Regulations

A: General Product Information

When used as a pesticide, the requirements of the U.S. Federal Insecticide, Fungicide and Rodenticide Act (FIFRA), or requirements under the Canadian Pest Control Act, are applicable.

B: Component Analysis - Inventory

Component	CAS #	TSCA	DSL	EINECS
Copper Sulfate Pentahydrate	7758-99-8	Excepted	No	Yes

Although this compound is not on the TSCA Inventory, it is excepted as a hydrate of a listed compound, Copper Sulfate (CAS # 7758-98-7), per 40 CFR 710.4 (d)(3) and 40 CFR 720.30 (h)(3). Under this section of TSCA, any chemical substance which is a hydrate of a listed compound is excepted.

C: Component Analysis - WHMIS IDL

The following components are identified under the Canadian Hazardous Products Act Ingredient Disclosure List:

Component	CAS #	Minimum Concentration
Copper Sulfate Pentahydrate	7758-99-8	1 percent

ANSI Labeling (Z129.1):

WARNING! MAY BE HARMFUL OR FATAL IF SWALLOWED. CAUSES SKIN AND EYE IRRITATION. HARMFUL IF INHALED. Keep from contact with clothing. Do not taste or swallow. Do not get on skin or in eyes. Avoid breathing dusts or particulates. Keep container closed. Use only with adequate ventilation. Wash thoroughly after handling. Wear gloves, goggles, faceshields, suitable body protection, and NIOSH-approved respiratory protection, as appropriate. **FIRST-AID:** In Case of Contamination of Skin or Clothing: Take off contaminated clothing. Rinse skin immediately with plenty of water for 15-20 minutes. In Case of Contamination of Eyes: Hold eye open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue to rinse eye. If Inhaled: Move person to fresh air. If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably by mouth to mouth, if possible. If Ingested: Call poison control center or doctor immediately for treatment advice. Have person sip a glass of water if able to swallow. Do not induce vomiting unless told to do so by the poison control center or doctor. Do not give anything by mouth to an unconscious person. Call a poison control center or doctor for treatment advice. Have the product container or label with you when calling a poison control center or doctor, or going for treatment. In the event of a medical emergency, you may also contact The National Pesticide Information Center at 1-800-858-7378. **IN CASE OF FIRE:** Use water fog, dry chemical, CO_2, or "alcohol" foam. **IN CASE OF SPILL:** Absorb spill with inert material. Place residue in suitable container. Consult Material Safety Data Sheet for additional information.

Labeling Information for Pesticide Use of Product:

DANGER! HAZARD TO HUMANS AND DOMESTIC ANIMALS.

DANGER: CORROSIVE: Causes eye damage and irritation to the skin and mucous membrane. Harmful or fatal if swallowed. Do not get in eyes, on skin or on clothing. Do not breathe dust or spray mist. May cause skin sensitization reactions to certain individuals.

PERSONAL PROTECTIVE EQUIPMENT: Applicators and other handlers must wear long-sleeved shirt and long pants, chemical-resistant gloves, made of any water-proof material, shoes, plus socks and protective eyewear. Discard clothing and other absorbent materials that have been drenched or heavily contaminated with this solutions of this product. Do not reuse such contaminated items. Follow manufacturer's instructions for cleaning and maintaining PPE. If no such instructions for reusable items exist, wash using detergent and hot water. Keep and wash PPE separately for other laundry.

USER SAFETY RECOMMENDATIONS: Persons using this product should wash hands before eating, drinking, chewing gum, using tobacco or using the toilet. Remove clothing immediately if contaminated by the pesticide. Wash contaminated clothing thoroughly and put on clean clothing. Remove PPE immediately after use with this product. Wash outside of gloves and other equipment before removing. After removal of PPE, wash thoroughly and change into clean clothing.

ENVIRONMENTAL HAZARDS: This product is toxic to fish. Direct application of Copper Sulfate to water may cause a significant reduction in populations of aquatic invertebrates, plants and fish. Do not treat more than one-half of lake or pond at one time in order to avoid depletion of oxygen from decaying vegetation. Allow 2 weeks between treatments for oxygen levels to recover. Trout and other species of fish may be killed at application rates recommended on this label, especially in soft or acid waters. However, fish toxicity generally decreases when the hardness of the water increases. Do not contaminate water by cleaning of equipment of disposal of wastes. Consult local State Fish and Game Agency before applying this product to public waters. Permits may be required before treating such waters.

STORAGE AND DISPOSAL: PROHIBITIONS: Do not contaminate water, food or feed by storage or disposal. Open burning and dumping is prohibited. Do not re-use empty containers. Keep pesticide in original container. Do not put concentrate or dilutions of concentrate in food or drink containers. Pesticide wastes are acutely hazardous. Improper disposal of excess pesticide, spray mixture or rinsate is a violation of Federal law. If these wastes cannot be disposed of by use, according to label instructions, contact your State Pesticide or Environmental Control Agency, or the Hazardous Waste Representative at the nearest EPA Regional Office for guidance. Completely empty bag of product into application equipment. Dispose of empty bag in a sanitary landfill or by incineration, or if allowed by State and local authorities, by burning. If burned, avoid smoke.

DIRECTIONS FOR USE: It is a violation of Federal Law to use this product inconsistent with its labeling. Do not apply this product in a way that will contaminate workers or other persons, either directly or through drift. Only protected handlers may be in the area during application. For requirements specific to your State, consult the agency responsible for your pesticide regulations.

AGRICULTURAL USE REQUIREMENTS: Use this product only in accordance with its labeling and with the Worker Protection Standard, CFR Part 170. This standard contains requirements for the protection of agricultural workers on farms, forests, nurseries and greenhouses, and handlers of agricultural pesticides. The Standard contains requirements for the training, decontamination, notification, and emergency assistance. It also contains specific instructions and exceptions pertaining to the statements on this label about personal protective equipment (PPE), and restricted-entry interval. These requirements only apply to uses of this product that are covered under the Worker Protection Standard. Do not apply this product in a way that will contaminate workers or other persons, either directly or through drift. Only protected handlers may be in the area during application. Do not allow worker entry into treated areas during the restricted interval (REI) of 48 hours. PPE required for early entry to treated areas that is permitted under the Worker Protection Standard and that involves contact with anything that has been treated, such as plants, soil or water, is" Coveralls, waterproof gloves, shoes, plus socks and protective eyewear.

Labeling Information for Pesticide Use of Product (continued):

GENERAL USE INSTRUCTIONS: Water hardness, temperature of the water, the type and amount of vegetation to be controlled and the amount of water flow, are to be considered in using Copper Sulfate to control algae. Begin treatment soon after plant growth has started. If treatment is delayed until a large amount of algae is present, larger quantities of Copper Sulfate will required. Algal growth is difficult to control with Copper Sulfate when water temperatures are low or when water is hard. Larger quantities of Copper Sulfate will be required to kill and control algae in water which is flowing than in a body of stagnant water. If possible, curtail the flow of water before treatment and hold dormant until approximately three days after treatment or until the algae have begun to die. When preparing a Copper Sulfate solution in water, the mixing container should be made of plastic or glass, or a painted, enameled, or copper-lined metal container. It is usually best to treat algae on a sunny day when the heavy mats of filamentous algae are most likely to be floating on the surface, allowing the solution to be sprayed directly on the algae. If there is some doubt about the concentration to apply, it is generally best to start with a lower concentration and to increase this concentration until the algae are killed.

ENDANGERED SPECIES RESTRICTION: It is a violation of Federal Law to use any pesticide in a manner that results in the death of an endangered species or adverse modification to their habitat. The use of this product may pose a hazard to certain Federally Designated species known to occur in specific areas. Contact the EPA for information on these areas. Obtain a copy of the EPA Bulletin specific to your area. This bulletin identifies areas within specific State counties where the use of this pesticide is prohibited, unless specified otherwise. The EPA Bulletin is available from either your County Agricultural Extension Agent, the Endangered Species Specialist in your State Wildlife Agency Headquarters, or the appropriate Regional Office of the U.S. Fish and Wildlife Service. THIS BULLETIN MUST BE REVIEWED PRIOR TO PESTICIDE USE.

EPA REG. NO. 56576- EPA EST. NO. 52117-MX-001

* * * Section 16 - Other Information * * *

Other Information

Chem One Ltd. ("Chem One") shall not be responsible for the use of any information, product, method, or apparatus herein presented ("Information"), and you must make your own determination as to its suitability and completeness for your own use, for the protection of the environment, and for health and safety purposes. You assume the entire risk of relying on this Information. In no event shall Chem One be responsible for damages of any nature whatsoever resulting from the use of tbis product or products, or reliance upon this Information. By providing this Information, Chem One neither can nor intends to control the method or manner by which you use, handle, store, or transport Chem One products. If any materials are mentioned that are not Chem One products, appropriate industrial hygiene and other safety precautions recommended by their manufacturers should be observed. Chem One makes no representations or warranties, either express or implied of merchantability, fitness for a particular purpose or of any other nature regarding this information, and nothing herein waives any of Chem One's conditions of sale. This information could include technical inaccuracies or typographical errors. Chem One may make improvements and/or changes in the product (s) and/or the program (s) described in this information at any time. If you have any questions, please contact us at Tel. 713-896-9966 or E-mail us at Safety@chemone.com.

Key/Legend

EPA = Environmental Protection Agency; TSCA = Toxic Substance Control Act; ACGIH = American Conference of Governmental Industrial Hygienists; IARC = International Agency for Research on Cancer; NIOSH = National Institute for Occupational Safety and Health; NTP = National Toxicology Program; OSHA = Occupational Safety and Health Administration

Contact: Sue Palmer-Koleman, PhD **Contact Phone:** (713) 896-9966

Revision log 07/24/00 4:24 PM SEP Changed company name, Sect 1 and 16, from Corporation to Ltd.
07/27/00 2:49 PM SEP Added "Fine 200, FCC IV, Very High Purity" to synonyms, Section 1
08/23/00 3:15 PM SEP Added "Copper Sulfate Crystals" to synonyms, Section 1
05/31/01 9:31 AM HDF Checked exposure limits; made changes to Sect 9; overall review, add SARA 311/312 Haz Ratings.
06/01/01 7:28 AM HDF Added text to label information from EPA Approved Label
07/24/01 4:31 AM CLJ Add Shipments by Air information to Section 14, Changed contact to Sue, non-800 Chemtrec Num.
09/18/01 11:34 AM SEP Added Domestic Transportation Exception, Sect 14
10/05/01 3:30 PM SEP Deleted Alternate Shipping Name, Sect 14
02/15/02 11:01 AM: HDF Revision of SARA Chronic Hazard Rating to "Yes".
2/21/02 4:21 PM HDF Added more information on Marine Pollutant Markings and Limited Quantity Shipments
9/16/03: 3:45 PM HDF Addition of chronic health hazard information. Addition of inhalation hazard information, Section 3. Section 4. expansion of information on Information for Physicians. Up-graded Section 10 Reactivity Information. Up-dated DFG MAK exposure limits. Up-Dated entire Section 14 Transportation Information to include IATA, IMO and current Canadian transport information.
06/22/05 2:24PM SEP Update IATA Section 14
01/06/2006 10:12 am SEP Corrected Section 14 DOT domestic transport exception to read 49 CFR 172.322 (d) (3).
09/08/06 2:52PM SEP Updated DOT and IMO Section 14 SEP
09/25/06 08:43 HDF Review of new toxicological data and addition of data to Section 11.
10/17/06 12:15 pm SEP Updated Section 11.
10/16/07 9:48am SEP Updated Section 14- IATA
10/10/08 3:48 PM DLY Changed Chem One Physical Address, Section 1
09/18/09 MMK Updated Section 14 limited &excepted quantities and exceptions, updated REI and treatment interval per EPA label RED
04 /07/ 11 SEP Add "F 25" Section 1
This is the end of MSDS # C1-121A

Conforms to ANSI Z400.5-2004 Standard (United States).

Material Safety Data Sheet

Nautique* Aquatic Herbicide

1 . Product and company identification

Product name : Nautique* Aquatic Herbicide

EPA Registration Number : 67690-10

Material uses : Aquatic plant herbicide.

Supplier/Manufacturer : **SePRO Corporation**
11550 North Meridian Street
Suite 600
Carmel, IN 46032 U.S.A.
Tel: 317-580-8282
Toll free: 1-800-419-7779
Fax: 317-428-4577
Monday - Friday, 8am to 5pm E.S.T.
www.sepro.com

Responsible name : Atrion Regulatory Services, Inc.

In case of emergency : **INFOTRAC - 24-hour service 1-800-535-5053**

2 . Hazards identification

Physical state : Liquid.

Odor : Ammoniacal. [Slight]

OSHA/HCS status : This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).

Emergency overview : **DANGER!**

CAUSES RESPIRATORY TRACT, EYE AND SKIN BURNS. MAY CAUSE SEVERE ALLERGIC RESPIRATORY AND SKIN REACTION. HARMFUL IF ABSORBED THROUGH SKIN. MAY BE HARMFUL IF SWALLOWED. CONTAINS MATERIAL THAT CAN CAUSE TARGET ORGAN DAMAGE.

Harmful if absorbed through the skin. Corrosive to the eyes, skin and respiratory system. Causes burns. May be harmful if swallowed. May cause sensitization by inhalation and skin contact. Avoid exposure - obtain special instructions before use. Do not breathe vapor or mist. Do not ingest. Do not get in eyes or on skin or clothing. Contains material that can cause target organ damage. Use only with adequate ventilation. Keep container tightly closed and sealed until ready for use. Wash thoroughly after handling.

Routes of entry : Dermal contact. Eye contact. Inhalation. Ingestion.

Potential acute health effects

Inhalation : Corrosive to the respiratory system. May cause sensitization by inhalation. Exposure to decomposition products may cause a health hazard. Serious effects may be delayed following exposure.

Ingestion : Harmful if swallowed. May cause burns to mouth, throat and stomach.

Skin : Corrosive to the skin. Causes burns. Toxic in contact with skin. May cause sensitization by skin contact.

Eyes : Corrosive to eyes. Causes burns.

Potential chronic health effects

Chronic effects : Contains material that can cause target organ damage.

Carcinogenicity : No known significant effects or critical hazards.

Mutagenicity : No known significant effects or critical hazards.

Teratogenicity : No known significant effects or critical hazards.

Developmental effects : No known significant effects or critical hazards.

Fertility effects : No known significant effects or critical hazards.

Target organs : Contains material which causes damage to the following organs: kidneys, liver, upper respiratory tract, skin, eye, lens or cornea.

Over-exposure signs/symptoms

Inhalation	:	Adverse symptoms may include the following: respiratory tract irritation coughing wheezing and breathing difficulties asthma
Ingestion	:	Adverse symptoms may include the following: stomach pains
Skin	:	Adverse symptoms may include the following: pain or irritation redness blistering may occur
Eyes	:	Adverse symptoms may include the following: pain watering redness
Medical conditions aggravated by over-exposure	:	Pre-existing respiratory and skin disorders and disorders involving any other target organs mentioned in this MSDS as being at risk may be aggravated by over-exposure to this product.

See toxicological information (section 11)

3 . Composition/information on ingredients

United States

Name	CAS number	%
1,2-Diaminoethane	107-15-3	10 - 30
Triethanolamine	102-71-6	10 - 30
Copper (II) Carbonate Basic	12069-69-1	10 - 30

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified as hazardous to health or the environment and hence require reporting in this section.

4 . First aid measures

Eye contact	:	Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 20 minutes. Get medical attention immediately.
Skin contact	:	In case of contact, immediately flush skin with plenty of water for at least 20 minutes. Get medical attention immediately.
Inhalation	:	If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.
Ingestion	:	Do not induce vomiting. Never give anything by mouth to an unconscious person. Get medical attention immediately.
Protection of first-aiders	:	No action shall be taken involving any personal risk or without suitable training. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Wash contaminated clothing thoroughly with water before removing it, or wear gloves.
Notes to physician	:	In case of inhalation of decomposition products in a fire, symptoms may be delayed. The exposed person may need to be kept under medical surveillance for 48 hours.

5 . Fire-fighting measures

Flammability of the product	:	Flammable.
Extinguishing media		
Suitable	:	Use an extinguishing agent suitable for the surrounding fire.
Not suitable	:	None known.
Hazardous thermal decomposition products	:	Decomposes above 390°F (200°C). May form oxides of carbon and nitrogen.
Special protective equipment for fire-fighters	:	Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

6 . Accidental release measures

Personal precautions : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilled material. Avoid breathing vapor or mist. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment (see section 8).

Environmental precautions : Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods for cleaning up

Small spill : Stop leak if without risk. Move containers from spill area. Dilute with water and mop up if water-soluble or absorb with an inert dry material and place in an appropriate waste disposal container. Dispose of via a licensed waste disposal contractor.

Large spill : Stop leak if without risk. Move containers from spill area. Approach release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Wash spillages into an effluent treatment plant or proceed as follows. Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations (see section 13). Dispose of via a licensed waste disposal contractor. Contaminated absorbent material may pose the same hazard as the spilled product. Note: see section 1 for emergency contact information and section 13 for waste disposal.

7 . Handling and storage

Handling : Put on appropriate personal protective equipment (see section 8). Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Persons with a history of skin sensitization problems or asthma, allergies or chronic or recurrent respiratory disease should not be employed in any process in which this product is used. Do not get in eyes or on skin or clothing. Do not breathe vapor or mist. Do not ingest. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Empty containers retain product residue and can be hazardous. Do not reuse container.

Storage : Store in accordance with local regulations. Store in original container protected from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see section 10) and food and drink. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabeled containers. Use appropriate containment to avoid environmental contamination.

8 . Exposure controls/personal protection

	United States
Product name	**Exposure limits**
1,2-Diaminoethane	**ACGIH TLV (United States, 1/2006). Skin** TWA: 25 mg/m³ 8 hour(s). **NIOSH REL (United States, 12/2001).** TWA: 25 mg/m³ 10 hour(s). **OSHA PEL (United States, 11/2006).** TWA: 25 mg/m³ 8 hour(s).
Triethanolamine	**ACGIH TLV (United States, 1/2006).** TWA: 5 mg/m³ 8 hour(s).

Consult local authorities for acceptable exposure limits.

Recommended monitoring procedures : If this product contains ingredients with exposure limits, personal, workplace atmosphere or biological monitoring may be required to determine the effectiveness of the ventilation or other control measures and/or the necessity to use respiratory protective equipment. **Applicators should refer to the product label for personal protective clothing and equipment.**

Engineering measures : Use only with adequate ventilation. If user operations generate dust, fumes, gas, vapor or mist, use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits.

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Personal protection

Eyes : Face shield.

Skin : Synthetic apron. Boots.

Respiratory : Vapor respirator.

Hands : Nitrile gloves.

Personal protective equipment (Pictograms) :

HMIS Code/Personal protective equipment : D

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

9 . Physical and chemical properties

Physical state : Liquid.

Color : Purple. [Dark]

Odor : Ammoniacal. [Slight]

pH : 9.69 [Conc. (% w/w): 1%]

Relative density : 1.2

10 . Stability and reactivity

Stability : The product is stable.

Hazardous polymerization : Under normal conditions of storage and use, hazardous polymerization will not occur.

Conditions to avoid : No specific data.

Materials to avoid : Reactive or incompatible with the following materials: Strong acids and nitrites. Should not be used in water where the pH is less than 6.0 due to the possible breakdown of the copper chelate, which could form copper ions, which would precipitate. Should not be applied to water when temperature of the water is below 60°F (15°C).

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Highly flammable in the presence of the following materials or conditions: open flames, sparks and static discharge.
Flammable in the presence of the following materials or conditions: heat.

11 . Toxicological information

Acute toxicity

Product/ingredient name	Species	Dose	Result	Exposure
Nautique* Aquatic Herbicide	Rabbit - Male, Female	700 mg/kg	LD50 Dermal	-
	Rat - Male, Female	0.68 g/kg	LD50 Oral	-
	Rat - Male, Female	2100 g/m³	LC50 Inhalation Vapor	4 hours

Inhalation : Corrosive to the respiratory system. May cause sensitization by inhalation. Exposure to decomposition products may cause a health hazard. Serious effects may be delayed following exposure.

Ingestion : Harmful if swallowed. May cause burns to mouth, throat and stomach.

Skin : Corrosive to the skin. Causes burns. Toxic in contact with skin. May cause sensitization by skin contact.

Eyes : Corrosive to eyes. Causes burns.

Carcinogenicity Classification

Product/ingredient name	ACGIH	IARC	EPA	NIOSH	NTP	OSHA
1,2-Diaminoethane	A4	-	-	-	-	-
Triethanolamine	-	3	-	-	-	-

12 . Ecological information

Environmental effects : No known significant effects or critical hazards.

Aquatic ecotoxicity

Product/ingredient name	Test	Species	Exposure	Result
1,2-Diaminoethane	Population	Algae	48 hours	Acute EC50 >100 mg/L
	Mortality	Fish	96 hours	Acute LC50 275 mg/L
	Mortality	Fish	96 hours	Acute LC50 220 mg/L
	Mortality	Fish	96 hours	Acute LC50 115.7 mg/L
	Mortality	Fish	96 hours	Acute LC50 1544.7 mg/L

Remark: It is reasonable to assume that Copper compounds contain Arsenic, Cadmium, Chromium, and Lead in concentrations ranging from a few parts per billlion to several hundred parts per million.

13 . Disposal considerations

Waste disposal : The generation of waste should be avoided or minimized wherever possible. Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe way. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Avoid dispersal spilled material and runoff and contact with soil, waterways, drains and sewers.

Disposal should be in accordance with applicable regional, national and local laws and regulations.

Refer to Section 7: HANDLING AND STORAGE and Section 8: EXPOSURE CONTROLS/PERSONAL PROTECTION for additional handling information and protection of employees.

14 . Transport information

AERG : 151

Regulatory information	UN number	Proper shipping name	Classes	PG*	Label	Additional information
DOT Classification	UN3010	COPPER BASED PESTICIDES, LIQUID, TOXIC	6.1	III		-
IMDG Class	UN3010	COPPER BASED PESTICIDES, LIQUID, TOXIC	6.1	III		-
IATA-DGR Class	UN3010	COPPER BASED PESTICIDES, LIQUID, TOXIC	6.1	III		-

PG* : Packing group

15 . Regulatory information

United States

HCS Classification : Toxic material
Corrosive material
Sensitizing material
Target organ effects

U.S. Federal regulations : **United States inventory (TSCA 8b):** All components listed.
TSCA precursor chemical list: Triethanolamine

SARA 302/304/311/312 extremely hazardous substances : 1,2-Diaminoethane
SARA 302/304 emergency planning and notification : 1,2-Diaminoethane
SARA 302/304/311/312 hazardous chemicals : Copper (II) Carbonate Basic; 1,2-Diaminoethane; Triethanolamine
SARA 311/312 MSDS distribution - chemical inventory - hazard identification : Copper (II) Carbonate Basic: Delayed (chronic) health hazard; 1,2-Diaminoethane: Fire hazard, Immediate (acute) health hazard, Delayed (chronic) health hazard; Triethanolamine: Immediate (acute) health hazard, Delayed (chronic) health hazard

Clean Water Act (CWA) 307: Copper (II) Carbonate Basic

Clean Water Act (CWA) 311: 1,2-Diaminoethane

Clean Air Act (CAA) 112 accidental release prevention : 1,2-Diaminoethane

Clean Air Act (CAA) 112 regulated flammable substances : No products were found.

Clean Air Act (CAA) 112 regulated toxic substances : 1,2-Diaminoethane

SARA 313

	Product name	CAS number	Concentration
Form R - Reporting requirements :	Copper (II) Carbonate Basic	12069-69-1	10 - 30
Supplier notification :	Copper (II) Carbonate Basic	12069-69-1	10 - 30

SARA 313 notifications must not be detached from the MSDS and any copying and redistribution of the MSDS shall include copying and redistribution of the notice attached to copies of the MSDS subsequently redistributed.

State regulations : **Connecticut Carcinogen Reporting** : None of the components are listed.
Connecticut Hazardous Material Survey : None of the components are listed.
Florida substances : None of the components are listed.
Illinois Chemical Safety Act: None of the components are listed.
Illinois Toxic Substances Disclosure to Employee Act : None of the components are listed.
Louisiana Reporting: None of the components are listed.
Louisiana Spill: None of the components are listed.
Massachusetts Spill: None of the components are listed.
Massachusetts Substances : The following components are listed: 1,2-Diaminoethane
Michigan Critical Material: None of the components are listed.
Minnesota Hazardous Substances : None of the components are listed.
New Jersey Hazardous Substances : The following components are listed: 1,2-Diaminoethane;Copper (II) Carbonate Basic
New Jersey Spill: None of the components are listed.
New Jersey Toxic Catastrophe Prevention Act : None of the components are listed.
New York Acutely Hazardous Substances : The following components are listed: 1,2-Diaminoethane
New York Toxic Chemical Release Reporting : None of the components are listed.
Pennsylvania RTK Hazardous Substances : The following components are listed: 1,2-Diaminoethane;Copper (II) Carbonate Basic
Rhode Island Hazardous Substances : None of the components are listed.

California Prop. 65 No products were found.

United States inventory (TSCA 8b) : **United States inventory (TSCA 8b):** Not determined.

International regulations

International lists : This product, (and its ingredients) is (are) listed on national inventories, or is (are) exempted from being listed, in Australia (AICS), in Europe (EINECS/ELINCS), in Korea (TCCL), in Japan (METI), in the Philippines (RA6969).

16 . Other information

Label requirements : **CAUSES RESPIRATORY TRACT, EYE AND SKIN BURNS. MAY CAUSE SEVERE ALLERGIC RESPIRATORY AND SKIN REACTION. HARMFUL IF ABSORBED THROUGH SKIN. MAY BE HARMFUL IF SWALLOWED. CONTAINS MATERIAL THAT CAN CAUSE TARGET ORGAN DAMAGE.**

Hazardous Material Information System (U.S.A.) :

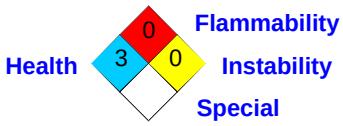
Health	*	3
Fire hazard		0
Physical Hazard		0
Personal protection		D

HAZARD RATINGS

4- Extreme
3- Serious
2- Moderate
1- Slight
0- Minimal
See section 8 for more detailed information on personal protection.

The customer is responsible for determining the PPE code for this material.

National Fire Protection Association (U.S.A.) :



References : ANSI Z400.1, MSDS Standard, 2004. - Manufacturer's Material Safety Data Sheet. - 29CFR Part1910.1200 OSHA MSDS Requirements. - 49CFR Table List of Hazardous Materials, UN#, Proper Shipping Names, PG.

Date of issue : 01/15/2009
Date of previous issue : 12/15/2008
Version : 2

Notice to reader

To the best of our knowledge, the information contained herein is accurate. However, neither the above named supplier nor any of its subsidiaries assumes any liability whatsoever for the accuracy or completeness of the information contained herein. Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist. The data in this MSDS relates only to the specific material designated herein. Possible adverse effects (see Section 2, 11 and 12) may occur if this material is not handled in the recommended manner.

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Conforms to ANSI Z400.5-2004 Standard (United States).

Material Safety Data Sheet

Komeen

1 . Product and company identification

Product name : Komeen

EPA Registration Number : 67690-25

Material uses : Aquatic herbicide.

Supplier/Manufacturer : **SePRO Corporation**
11550 North Meridian Street
Suite 600
Carmel, IN 46032 U.S.A.
Tel: 317-580-8282
Toll free: 1-800-419-7779
Fax: 317-428-4577
Monday - Friday, 8am to 5pm E.S.T.
www.sepro.com

Responsible name : Atrion Regulatory Services, Inc.

In case of emergency : **INFOTRAC - 24-hour service 1-800-535-5053**

2 . Hazards identification

Physical state : Liquid.

Odor : None

OSHA/HCS status : This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).

Emergency overview : **DANGER!**

CAUSES RESPIRATORY TRACT, EYE AND SKIN BURNS. MAY CAUSE SEVERE ALLERGIC RESPIRATORY AND SKIN REACTION. HARMFUL IF SWALLOWED. CONTAINS MATERIAL THAT CAN CAUSE TARGET ORGAN DAMAGE. CANCER HAZARD - CONTAINS MATERIAL WHICH CAN CAUSE CANCER.

Harmful if swallowed. Corrosive to the eyes, skin and respiratory system. Causes burns. May cause sensitization by inhalation and skin contact. Avoid exposure - obtain special instructions before use. Do not breathe vapor or mist. Do not ingest. Do not get in eyes or on skin or clothing. Contains material that can cause target organ damage. Contains material which can cause cancer. Risk of cancer depends on duration and level of exposure. Use only with adequate ventilation. Keep container tightly closed and sealed until ready for use. Wash thoroughly after handling.

Routes of entry : Dermal contact. Eye contact. Inhalation. Ingestion.

Potential acute health effects

Inhalation : Corrosive to the respiratory system. May cause sensitization by inhalation. Exposure to decomposition products may cause a health hazard. Serious effects may be delayed following exposure.

Ingestion : Toxic if swallowed. May cause burns to mouth, throat and stomach.

Skin : Corrosive to the skin. Causes burns. May cause sensitization by skin contact.

Eyes : Corrosive to eyes. Causes burns.

Potential chronic health effects

Chronic effects : Contains material that can cause target organ damage. Once sensitized, a severe allergic reaction may occur when subsequently exposed to very low levels.

Carcinogenicity : Contains material which can cause cancer. Risk of cancer depends on duration and level of exposure.

Mutagenicity : No known significant effects or critical hazards.

Teratogenicity : No known significant effects or critical hazards.

Developmental effects : No known significant effects or critical hazards.

Fertility effects : No known significant effects or critical hazards.

Target organs : Contains material which causes damage to the following organs: kidneys, liver, upper respiratory tract, skin, eye, lens or cornea.

Over-exposure signs/symptoms

Inhalation	:	Adverse symptoms may include the following: respiratory tract irritation coughing wheezing and breathing difficulties asthma
Ingestion	:	Adverse symptoms may include the following: stomach pains
Skin	:	Adverse symptoms may include the following: pain or irritation redness blistering may occur
Eyes	:	Adverse symptoms may include the following: pain watering redness
Medical conditions aggravated by over-exposure	:	Pre-existing respiratory and skin disorders and disorders involving any other target organs mentioned in this MSDS as being at risk may be aggravated by over-exposure to this product.

See toxicological information (section 11)

3 . Composition/information on ingredients

United States

Name	CAS number	%
Active ingredient:		
Copper sulphate pentahydrate	7758-98-7	30 - 60
Inert ingredient:		
Proprietary Amine	Proprietary	10 - 30

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified as hazardous to health or the environment and hence require reporting in this section.

4 . First aid measures

Eye contact	:	Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 20 minutes. Get medical attention immediately.
Skin contact	:	In case of contact, immediately flush skin with plenty of water for at least 20 minutes. Get medical attention immediately.
Inhalation	:	If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.
Ingestion	:	Do not induce vomiting. Never give anything by mouth to an unconscious person. Get medical attention immediately.
Protection of first-aiders	:	No action shall be taken involving any personal risk or without suitable training. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Wash contaminated clothing thoroughly with water before removing it, or wear gloves.
Notes to physician	:	In case of inhalation of decomposition products in a fire, symptoms may be delayed. The exposed person may need to be kept under medical surveillance for 48 hours.

5 . Fire-fighting measures

Flammability of the product	:	May be combustible at high temperature.
Extinguishing media		
Suitable	:	Use an extinguishing agent suitable for the surrounding fire.
Not suitable	:	None known.
Special exposure hazards	:	Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training. Fire water contaminated with this material must be contained and prevented from being discharged to any waterway, sewer or drain.

Hazardous thermal decomposition products	:	Decomposition products may include the following materials: carbon dioxide carbon monoxide nitrogen oxides sulfur oxides metal oxide/oxides Decomposes above 200°C.
Special protective equipment for fire-fighters	:	Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

6 . Accidental release measures

Personal precautions	:	No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilled material. Do not breathe vapor or mist. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment (see section 8).
Environmental precautions	:	May be harmful to the environment if released in large quantities.
Methods for cleaning up		
Small spill	:	Stop leak if without risk. Move containers from spill area. Dilute with water and mop up if water-soluble or absorb with an inert dry material and place in an appropriate waste disposal container. Dispose of via a licensed waste disposal contractor.
Large spill	:	Stop leak if without risk. Move containers from spill area. Approach release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Wash spillages into an effluent treatment plant or proceed as follows. Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations (see section 13). Dispose of via a licensed waste disposal contractor. Contaminated absorbent material may pose the same hazard as the spilled product. Note: see section 1 for emergency contact information and section 13 for waste disposal.

7 . Handling and storage

Handling	:	Put on appropriate personal protective equipment (see section 8). Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Persons with a history of skin sensitization problems or asthma, allergies or chronic or recurrent respiratory disease should not be employed in any process in which this product is used. Do not get in eyes or on skin or clothing. Do not breathe vapor or mist. Do not ingest. Avoid release to the environment. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Empty containers retain product residue and can be hazardous. Do not reuse container.
Storage	:	Store in accordance with local regulations. Store in original container protected from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see section 10) and food and drink. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabeled containers. Use appropriate containment to avoid environmental contamination.

8 . Exposure controls/personal protection

	United States
Product name	**Exposure limits**
Copper sulphate pentahydrate	**ACGIH TLV (United States).** TWA: 1 mg/m³ 8 hour(s). Form: Copper dust. **OSHA PEL (United States).** TWA: 1 mg/m³ 8 hour(s). Form: Copper dust.
Proprietary Amine	**ACGIH TLV (United States, 1/2008). Absorbed through skin.** TWA: 25 mg/m³ 8 hour(s). TWA: 10 ppm 8 hour(s). **NIOSH REL (United States, 12/2001).** TWA: 25 mg/m³ 10 hour(s). TWA: 10 ppm 10 hour(s).

OSHA PEL (United States, 11/2006).
TWA: 25 mg/m³ 8 hour(s).
TWA: 10 ppm 8 hour(s).

Consult local authorities for acceptable exposure limits.

Recommended monitoring procedures : If this product contains ingredients with exposure limits, personal, workplace atmosphere or biological monitoring may be required to determine the effectiveness of the ventilation or other control measures and/or the necessity to use respiratory protective equipment.
Applicators should refer to the product label for personal protective clothing and equipment.

Engineering measures : Use only with adequate ventilation. If user operations generate dust, fumes, gas, vapor or mist, use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits.

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Personal protection

Eyes : Splash goggles.

Skin : Lab coat.

Respiratory : Vapor respirator.

Hands : Rubber gloves.

Personal protective equipment (Pictograms) :

HMIS Code/Personal protective equipment : G

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

9 . Physical and chemical properties

Physical state : Liquid.

Color : Purple. [Dark]

Odor : None

pH : 9.62

Relative density : 1.22 g/cm³ (20°C).

Vapor pressure : No appreciable vapor pressure. Open containers can lose small amounts of water by volatilization.

Solubility : Soluble in water and alcohols.

10 . Stability and reactivity

Stability : The product is stable.

Hazardous polymerization : Under normal conditions of storage and use, hazardous polymerization will not occur.

Conditions to avoid : Avoid exposure - obtain special instructions before use.

Materials to avoid : Reactive or incompatible with the following materials: oxidizing materials and acids. (Specific materials to avoid) Do not use where water is below 6. Copper chelate may dissociate and release copper ions which could subsequently be precipitated as insoluble copper salts. Should not be applied when water temperature is below 60°F.

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Highly flammable in the presence of the following materials or conditions: open flames, sparks and static discharge.
Flammable in the presence of the following materials or conditions: heat.

11 . Toxicological information

Acute toxicity

Product/ingredient name	Species	Dose	Result	Exposure
Copper sulphate pentahydrate	Rat	20 mg/kg	LD50 Intraperitoneal	-
	Rat	48900 ug/kg	LD50 Intravenous	-
	Rat - Female	300 mg/kg	LD50 Oral	-
	Rat	960 mg/kg	LD50 Oral	-
Proprietary Amine	Rabbit	730 uL/kg	LD50 Dermal	-
	Rat	1200 mg/kg	LD50 Oral	-

Inhalation : Corrosive to the respiratory system. May cause sensitization by inhalation. Exposure to decomposition products may cause a health hazard. Serious effects may be delayed following exposure.

Ingestion : Toxic if swallowed. May cause burns to mouth, throat and stomach.

Skin : Corrosive to the skin. Causes burns. May cause sensitization by skin contact.

Eyes : Corrosive to eyes. Causes burns.

Carcinogenicity

Classification

Product/ingredient name	ACGIH	IARC	EPA	NIOSH	NTP	OSHA
Proprietary Amine	A4	-	-	-	-	-

12 . Ecological information

Environmental effects : May be harmful to the environment if released in large quantities.

Aquatic ecotoxicity

Product/ingredient name	Test	Species	Exposure	Result
Proprietary Amine	-	Fish	96 hours	Acute LC50 115700 to 131600 ug/L
	-	Daphnia	48 hours	Acute LC50 26500 to 34400 ug/L

13 . Disposal considerations

Waste disposal : The generation of waste should be avoided or minimized wherever possible. Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe way. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Avoid dispersal spilled material and runoff and contact with soil, waterways, drains and sewers.

Disposal should be in accordance with applicable regional, national and local laws and regulations.

Refer to Section 7: HANDLING AND STORAGE and Section 8: EXPOSURE CONTROLS/PERSONAL PROTECTION for additional handling information and protection of employees.

14 . Transport information

AERG : 151

Regulatory information	UN number	Proper shipping name	Classes	PG*	Label	Additional information
DOT Classification	UN3010	COPPER BASED PESTICIDES, LIQUID, TOXIC	6.1	III		

IMDG Class	UN3010	COPPER BASED PESTICIDES, LIQUID, TOXIC	6.1	III		
IATA-DGR Class	UN3010	COPPER BASED PESTICIDES, LIQUID, TOXIC	6.1	III		-

PG* : Packing group

15 . Regulatory information

United States

HCS Classification : Toxic material
Corrosive material
Sensitizing material
Carcinogen
Target organ effects

U.S. Federal regulations : **United States inventory (TSCA 8b):** All components are listed or exempted.

SARA 302/304/311/312 extremely hazardous substances : Proprietary Amine
SARA 302/304 emergency planning and notification : Proprietary Amine
SARA 302/304/311/312 hazardous chemicals : Copper sulphate pentahydrate; Proprietary Amine
SARA 311/312 MSDS distribution - chemical inventory - hazard identification : Copper sulphate pentahydrate: Immediate (acute) health hazard, Delayed (chronic) health hazard; Proprietary Amine: Fire hazard, Immediate (acute) health hazard, Delayed (chronic) health hazard

Clean Water Act (CWA) 307: Copper sulphate pentahydrate

Clean Water Act (CWA) 311: Copper sulphate pentahydrate; Proprietary Amine; Proprietary Acid

Clean Air Act (CAA) 112 accidental release prevention : Proprietary Amine

Clean Air Act (CAA) 112 regulated flammable substances : No products were found.

Clean Air Act (CAA) 112 regulated toxic substances : Proprietary Amine

SARA 313

	Product name	CAS number	Concentration
Form R - Reporting requirements :	Copper sulphate pentahydrate	7758-98-7	30 - 60
Supplier notification :	Copper sulphate pentahydrate	7758-98-7	30 - 60

SARA 313 notifications must not be detached from the MSDS and any copying and redistribution of the MSDS shall include copying and redistribution of the notice attached to copies of the MSDS subsequently redistributed.

State regulations : **Connecticut Carcinogen Reporting:** None of the components are listed.
Connecticut Hazardous Material Survey: None of the components are listed.
Florida substances: None of the components are listed.
Illinois Chemical Safety Act: None of the components are listed.
Illinois Toxic Substances Disclosure to Employee Act: None of the components are listed.
Louisiana Reporting: None of the components are listed.
Louisiana Spill: None of the components are listed.
Massachusetts Spill: None of the components are listed.
Massachusetts Substances: The following components are listed: Copper sulphate pentahydrate; Proprietary Amine
Michigan Critical Material: None of the components are listed.
Minnesota Hazardous Substances: None of the components are listed.
New Jersey Hazardous Substances: The following components are listed: Copper sulphate pentahydrate; Proprietary Amine; Proprietary Acid
New Jersey Spill: None of the components are listed.
New Jersey Toxic Catastrophe Prevention Act: None of the components are listed.
New York Acutely Hazardous Substances: The following components are listed: Copper sulphate pentahydrate; Proprietary Amine; Proprietary Acid
New York Toxic Chemical Release Reporting: None of the components are listed.
Pennsylvania RTK Hazardous Substances: The following components are listed: Copper sulphate pentahydrate; Proprietary Amine; Proprietary Acid
Rhode Island Hazardous Substances: None of the components are listed.

California Prop. 65 : **WARNING:** This product contains a chemical known to the State of California to cause cancer.

Ingredient name	Cancer	Reproductive	No significant risk level	Maximum acceptable dosage level
Sulfuric acid	Yes.	No.	No.	No.

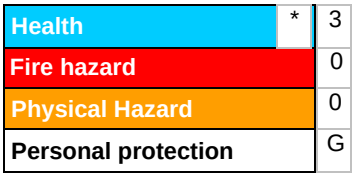
International regulations

International lists : This product, (and its ingredients) is (are) listed on national inventories, or is (are) exempted from being listed, in Australia (AICS), in Europe (EINECS/ELINCS), in Korea (TCCL), in Japan (METI), in the Philippines (RA6969).

16 . Other information

Label requirements : **CAUSES RESPIRATORY TRACT, EYE AND SKIN BURNS. MAY CAUSE SEVERE ALLERGIC RESPIRATORY AND SKIN REACTION. HARMFUL IF SWALLOWED. CONTAINS MATERIAL THAT CAN CAUSE TARGET ORGAN DAMAGE. CANCER HAZARD - CONTAINS MATERIAL WHICH CAN CAUSE CANCER.**

Hazardous Material Information System (U.S.A.) :



HAZARD RATINGS

4- Extreme
3- Serious
2- Moderate
1- Slight
0- Minimal
See section 8 for more detailed information on personal protection.

The customer is responsible for determining the PPE code for this material.

National Fire Protection Association (U.S.A.) :

References : ANSI Z400.1, MSDS Standard, 2004. - Manufacturer's Material Safety Data Sheet. - 29CFR Part1910.1200 OSHA MSDS Requirements. - 49CFR Table List of Hazardous Materials, UN#, Proper Shipping Names, PG.

Date of issue : 03/15/2009

Version : 1

Notice to reader

To the best of our knowledge, the information contained herein is accurate. However, neither the above named supplier nor any of its subsidiaries assumes any liability whatsoever for the accuracy or completeness of the information contained herein. Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist. The data in this MSDS relates only to the specific material designated herein. Possible adverse effects (see Section 2, 11 and 12) may occur if this material is not handled in the recommended manner.

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Date of issue : 03/15/2009

Conforms to HazCom 2012/United States

SAFETY DATA SHEET

Captain® XTR Algaecide

Section 1. Identification

GHS product identifier : Captain® XTR

Other means of identification : Not available.

EPA Registration No. : 67690-9

Relevant identified uses of the substance or mixture and uses advised against

Aquatic Algaecide.

Supplier's details : SePRO Corporation
11550 North Meridian Street
Suite 600
Carmel, IN 46032 U.S.A.
Tel: 317-580-8282
Toll free: 1-800-419-7779
Fax: 317-580-8290
Monday - Friday, 8am to 5pm E.S.T.
www.sepro.com

Emergency telephone number (with hours of operation) : **INFOTRAC - 24-hour service 1-800-535-5053**

Section 2. Hazards identification

OSHA/HCS status : This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).

Classification of the substance or mixture : ACUTE TOXICITY: ORAL - Category 4
SKIN CORROSION/IRRITATION - Category 2
SERIOUS EYE DAMAGE/ EYE IRRITATION - Category 2A
SKIN SENSITIZATION - Category 1B

GHS label elements

Hazard pictograms : Exclamation mark

Signal word : Warning

Hazard statements : Harmful if swallowed.
Causes serious eye irritation.
Causes skin irritation.
May cause an allergic skin reaction.

Precautionary statements

Prevention : Wear protective gloves. Wear eye or face protection. Avoid breathing vapor. Do not eat, drink or smoke when using this product. Wash hands thoroughly after handling. Contaminated work clothing should not be allowed out of the workplace.

Section 2. Hazards identification

Response : IF SWALLOWED: Call a POISON CENTER or physician if you feel unwell. Rinse mouth. IF ON SKIN: Wash with plenty of soap and water. Take off contaminated clothing. Wash contaminated clothing before reuse. If skin irritation or rash occurs: Get medical attention. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical attention.

Storage : Not applicable.

Disposal : Dispose of contents and container in accordance with all local, regional, national and international regulations.

Hazards not otherwise classified : None known.

Section 3. Composition/information on ingredients

Substance/mixture : Mixture

Other means of identification : Not available.

CAS number/other identifiers

CAS number : Not applicable.

Ingredient name	%	CAS number
Active ingredient		
Copper Triethanolamine Complex	10 - 30	82027-59-6
Copper Monoethanolamine Complex	10 - 30	14215-52-2
Inert ingredient		
Proprietary ingredient 1	10 - 30	-
Proprietary ingredient 2	10 - 30	-
Proprietary ingredient 3	5 - 15	-

Any concentration shown as a range is to protect confidentiality or is due to batch variation.

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified as hazardous to health or the environment and hence require reporting in this section.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Continue to rinse for at least 20 minutes. Get medical attention.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Get medical attention if adverse health effects persist or are severe. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband. In case of inhalation of decomposition products in a fire, symptoms may be delayed. The exposed person may need to be kept under medical surveillance for 48 hours.

Skin contact : Wash with plenty of soap and water. Remove contaminated clothing and shoes. Wash contaminated clothing thoroughly with water before removing it, or wear gloves. Continue to rinse for at least 20 minutes. Get medical attention. In the event of any complaints or symptoms, avoid further exposure. Wash clothing before reuse. Clean shoes thoroughly before reuse.

Section 4. First aid measures

Ingestion : Wash out mouth with water. Remove dentures if any. Remove victim to fresh air and keep at rest in a position comfortable for breathing. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Stop if the exposed person feels sick as vomiting may be dangerous. Do not induce vomiting unless directed to do so by medical personnel. If vomiting occurs, the head should be kept low so that vomit does not enter the lungs. Get medical attention. If necessary, call a poison center or physician. Never give anything by mouth to an unconscious person. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : Causes serious eye irritation.

Inhalation : Exposure to decomposition products may cause a health hazard. Serious effects may be delayed following exposure.

Skin contact : Causes skin irritation. May cause an allergic skin reaction.

Ingestion : Harmful if swallowed. Irritating to mouth, throat and stomach.

Over-exposure signs/symptoms

Eye contact : Adverse symptoms may include the following:
pain or irritation
watering
redness

Inhalation : No known significant effects or critical hazards.

Skin contact : Adverse symptoms may include the following:
irritation
redness

Ingestion : No known significant effects or critical hazards.

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : In case of inhalation of decomposition products in a fire, symptoms may be delayed. The exposed person may need to be kept under medical surveillance for 48 hours.

Specific treatments : No specific treatment.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Wash contaminated clothing thoroughly with water before removing it, or wear gloves.

See toxicological information (Section 11)

Section 5. Fire-fighting measures

Extinguishing media

Suitable extinguishing media : Use an extinguishing agent suitable for the surrounding fire.

Unsuitable extinguishing media : None known.

Specific hazards arising from the chemical : No specific fire or explosion hazard.

Section 5. Fire-fighting measures

Hazardous thermal decomposition products : Decomposition products may include the following materials:
carbon dioxide
carbon monoxide
nitrogen oxides
metal oxide/oxides

Special protective actions for fire-fighters : No special protection is required.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilled material. Avoid breathing vapor or mist. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.

For emergency responders : If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions : Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and materials for containment and cleaning up

Spill : Stop leak if without risk. Move containers from spill area. Approach release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Wash spillages into an effluent treatment plant or proceed as follows. Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations (see Section 13). Dispose of via a licensed waste disposal contractor. Contaminated absorbent material may pose the same hazard as the spilled product. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8). Persons with a history of skin sensitization problems should not be employed in any process in which this product is used. Do not get in eyes or on skin or clothing. Do not ingest. Avoid breathing vapor or mist. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Empty containers retain product residue and can be hazardous. Do not reuse container.

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Section 7. Handling and storage

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in original container protected from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10) and food and drink. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabeled containers. Use appropriate containment to avoid environmental contamination.

Section 8. Exposure controls/personal protection

Control parameters

Occupational exposure limits

Ingredient name	Exposure limits
Proprietary ingredient 1 Proprietary ingredient 2	**ACGIH TLV (United States, 3/2012).** TWA: 5 mg/m³ 8 hours. **ACGIH TLV (United States, 2/2010).** STEL: 15 mg/m³ 15 minutes. STEL: 6 ppm 15 minutes. TWA: 7.5 mg/m³ 8 hours. TWA: 3 ppm 8 hours. **NIOSH REL (United States, 6/2009).** STEL: 15 mg/m³ 15 minutes. STEL: 6 ppm 15 minutes. TWA: 8 mg/m³ 10 hours. TWA: 3 ppm 10 hours. **OSHA PEL (United States, 6/2010).** TWA: 6 mg/m³ 8 hours. TWA: 3 ppm 8 hours.

Appropriate engineering controls : No special ventilation requirements. Good general ventilation should be sufficient to control worker exposure to airborne contaminants. If this product contains ingredients with exposure limits, use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure below any recommended or statutory limits.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Contaminated work clothing should not be allowed out of the workplace. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists, gases or dusts. If contact is possible, the following protection should be worn, unless the assessment indicates a higher degree of protection: chemical splash goggles.

Section 8. Exposure controls/personal protection

Skin protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers. In the case of mixtures, consisting of several substances, the protection time of the gloves cannot be accurately estimated.

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory protection : Use a properly fitted, air-purifying or supplied air respirator complying with an approved standard if a risk assessment indicates this is necessary. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

Section 9. Physical and chemical properties

Appearance

Physical state : Liquid.

Color : Blue. [Dark]

Odor : Ammoniacal. [Slight]

Odor threshold : Not available.

pH : 10 to 10.5

Melting point : Not available.

Boiling point : 100°C (212°F)

Flash point : Open cup: >93.3°C (>199.9°F)

Burning time : Not applicable.

Burning rate : Not applicable.

Evaporation rate : <1 (Butyl acetate = 1)

Flammability (solid, gas) : Not available.

Lower and upper explosive (flammable) limits : Not available.

Vapor pressure : 2.3 kPa (17 mm Hg) [room temperature]

Vapor density : 3.5 [Air = 1]

Relative density : 1.2

Solubility : Miscible in water.

Solubility in water : Not available.

Partition coefficient: n-octanol/water : Not available.

Auto-ignition temperature : Not available.

Decomposition temperature : 198.89°C (390°F)

SADT : Not available.

Viscosity : Not available.

Section 10. Stability and reactivity

Reactivity : No specific test data related to reactivity available for this product or its ingredients.

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid : No specific data.

Incompatible materials : Reactive or incompatible with the following materials: oxidizing materials, acids and alkalis. Strong acids and nitrites.

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Product/ingredient name	Result	Species	Dose	Exposure
Captain* XTR	LD50 Dermal LD50 Oral	Rabbit Rat	>2000 mg/kg 590 mg/kg	- -

Irritation/Corrosion

Product/ingredient name	Result	Species	Score	Exposure	Observation
Captain* XTR	Eyes - Severe irritant Skin - Severe irritant	Rabbit Rabbit	- -	0.1 ml 0.5 ml	- -

Sensitization

Skin : There is no data available.

Respiratory : There is no data available.

Mutagenicity

There is no data available.

Carcinogenicity

Classification

Product/ingredient name	OSHA	IARC	NTP
Proprietary ingredient 1	-	3	-

Reproductive toxicity

There is no data available.

Teratogenicity

There is no data available.

Specific target organ toxicity (single exposure)

There is no data available.

Specific target organ toxicity (repeated exposure)

There is no data available.

Aspiration hazard

There is no data available.

Section 11. Toxicological information

Information on the likely routes of exposure : Routes of entry anticipated: Oral, Dermal, Inhalation, Eye.

Potential acute health effects

Eye contact : Causes serious eye irritation.

Inhalation : Exposure to decomposition products may cause a health hazard. Serious effects may be delayed following exposure.

Skin contact : Causes skin irritation. May cause an allergic skin reaction.

Ingestion : Harmful if swallowed. Irritating to mouth, throat and stomach.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : Adverse symptoms may include the following:
pain or irritation
watering
redness

Inhalation : No known significant effects or critical hazards.

Skin contact : Adverse symptoms may include the following:
irritation
redness

Ingestion : No known significant effects or critical hazards.

Delayed and immediate effects and also chronic effects from short and long term exposure

Short term exposure

Potential immediate effects : No known significant effects or critical hazards.

Potential delayed effects : No known significant effects or critical hazards.

Long term exposure

Potential immediate effects : No known significant effects or critical hazards.

Potential delayed effects : No known significant effects or critical hazards.

Potential chronic health effects

General : Once sensitized, a severe allergic reaction may occur when subsequently exposed to very low levels.

Carcinogenicity : No known significant effects or critical hazards.

Mutagenicity : No known significant effects or critical hazards.

Teratogenicity : No known significant effects or critical hazards.

Developmental effects : No known significant effects or critical hazards.

Fertility effects : No known significant effects or critical hazards.

Numerical measures of toxicity

Acute toxicity estimates

Route	ATE value
Inhalation (vapors)	33.68 mg/L

Section 12. Ecological information

Toxicity

Product/ingredient name	Result	Species	Exposure
Proprietary ingredient 1	Acute EC50 609.98 mg/L Fresh water	Crustaceans - *Ceriodaphnia dubia* - Neonate	48 hours
	Acute LC50 11800000 µg/l Fresh water	Fish - *Pimephales promelas*	96 hours
	Chronic NOEC 16000 µg/l Fresh water	Daphnia - *Daphnia magna*	21 days
Proprietary ingredient 2	Acute EC50 80000 µg/l Fresh water	Algae - *Isochrysis galbana*	96 hours
	Acute LC50 >100000 µg/l Marine water	Crustaceans - *Crangon crangon* - Adult	48 hours
	Acute LC50 170000 µg/l Fresh water	Fish - *Carassius auratus*	96 hours
Proprietary ingredient 3	Acute EC50 4.53 mg/L Fresh water	Crustaceans - *Ceriodaphnia dubia* - Neonate	48 hours

Persistence and degradability

There is no data available.

Bioaccumulative potential

Product/ingredient name	$LogP_{ow}$	BCF	Potential
Proprietary ingredient 1	-2.3	3.89	low
Proprietary ingredient 2	-1.31	-	low

Mobility in soil

Soil/water partition coefficient (K_{OC}) : Not available.

Other adverse effects : No known significant effects or critical hazards.

Section 13. Disposal considerations

Disposal methods : The generation of waste should be avoided or minimized wherever possible. Disposal of this product, solutions and any by-products should comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste should not be disposed of untreated to the sewer unless fully compliant with the requirements of all authorities with jurisdiction. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Care should be taken when handling empty containers that have not been cleaned or rinsed out. Empty containers or liners may retain some product residues. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

Section 14. Transport information

	DOT Classification	IMDG	IATA
UN number	UN1760	UN1760	UN1760
UN proper shipping name	CORROSIVE LIQUID, N.O.S.	CORROSIVE LIQUID, N.O.S.. Marine pollutant	CORROSIVE LIQUID, N.O.S.

Section 14. Transport information

Transport hazard class(es)	8 	8 	8 
Packing group	III	III	III
Environmental hazards	Yes.	Yes.	No.
Additional information	- **FOR PACKAGES SIZES GREATER THAN ONE GALLON**	-**FOR PACKAGES SIZES GREATER THAN ONE GALLON**	-**FOR PACKAGES SIZES GREATER THAN ONE GALLON**

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code : Not available.

Section 15. Regulatory information

U.S. Federal regulations : **TSCA 8(a) CDR Exempt/Partial exemption**: Not determined

Commerce control list precursor: Proprietary ingredient 1

United States inventory (TSCA 8b): Not determined.

Clean Water Act (CWA) 307: Copper, Bis[2-(Amino-.Kappa.N)Ethanolato-.Kappa.O]-; Copper triethanolamine complex

Clean Air Act Section 112 (b) Hazardous Air Pollutants (HAPs) : Not listed

Clean Air Act Section 602 Class I Substances : Not listed

Clean Air Act Section 602 Class II Substances : Not listed

DEA List I Chemicals (Precursor Chemicals) : Not listed

DEA List II Chemicals (Essential Chemicals) : Not listed

SARA 302/304

Composition/information on ingredients

No products were found.

SARA 304 RQ : Not applicable.

SARA 311/312

Classification : Immediate (acute) health hazard

Section 15. Regulatory information

Composition/information on ingredients

Name	%	Fire hazard	Sudden release of pressure	Reactive	Immediate (acute) health hazard	Delayed (chronic) health hazard
Proprietary ingredient 1	10 - 30	No.	No.	No.	Yes.	No.
Proprietary ingredient 2	10 - 30	No.	No.	No.	Yes.	No.
Proprietary ingredient 3	5 - 10	No.	No.	No.	Yes.	No.

SARA 313

	Product name	CAS number	%
Form R - Reporting requirements	Copper Triethanolamine Complex Copper Monoethanolamine Complex	82027-59-6 14215-52-2	10 - 30 10 - 30
Supplier notification	Copper Triethanolamine Complex Copper Monoethanolamine Complex	82027-59-6 14215-52-2	10 - 30 10 - 30

SARA 313 notifications must not be detached from the SDS and any copying and redistribution of the SDS shall include copying and redistribution of the notice attached to copies of the SDS subsequently redistributed.

State regulations

Massachusetts : The following components are listed: Proprietary ingredient 1; Proprietary ingredient 2

New York : None of the components are listed.

New Jersey : The following components are listed: Copper, Bis[2-(Amino-.Kappa.N)Ethanolato-.Kappa.O]-; Copper triethanolamine complex; Proprietary ingredient 1; Proprietary ingredient 2

Pennsylvania : The following components are listed: Copper, Bis[2-(Amino-.Kappa.N)Ethanolato-.Kappa.O]-; Copper triethanolamine complex; Proprietary ingredient 1; Proprietary ingredient 2

California Prop. 65

No products were found.

International regulations

International lists : **Australia inventory (AICS)**: Not determined.
China inventory (IECSC): Not determined.
Japan inventory: Not determined.
Korea inventory: Not determined.
Malaysia Inventory (EHS Register): Not determined.
New Zealand Inventory of Chemicals (NZIoC): Not determined.
Philippines inventory (PICCS): Not determined.
Taiwan inventory (CSNN): Not determined.

Chemical Weapons Convention List Schedule I Chemicals : Not listed

Chemical Weapons Convention List Schedule II Chemicals : Not listed

Chemical Weapons Convention List Schedule III Chemicals : Listed

Section 16. Other information

Hazardous Material Information System (U.S.A.)

Health : 3 * **Flammability :** 1 **Physical hazards :** 0

Caution: HMIS® ratings are based on a 0-4 rating scale, with 0 representing minimal hazards or risks, and 4 representing significant hazards or risks Although HMIS® ratings are not required on SDSs under 29 CFR 1910.1200, the preparer may choose to provide them. HMIS® ratings are to be used with a fully implemented HMIS® program. HMIS® is a registered mark of the National Paint & Coatings Association (NPCA). HMIS® materials may be purchased exclusively from J. J. Keller (800) 327-6868.

The customer is responsible for determining the PPE code for this material.

National Fire Protection Association (U.S.A.)

Health : 3 **Flammability :** 1 **Instability :** 0

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Copyright ©2001, National Fire Protection Association, Quincy, MA 02269. This warning system is intended to be interpreted and applied only by properly trained individuals to identify fire, health and reactivity hazards of chemicals. The user is referred to certain limited number of chemicals with recommended classifications in NFPA 49 and NFPA 325, which would be used as a guideline only. Whether the chemicals are classified by NFPA or not, anyone using the 704 systems to classify chemicals does so at their own risk.

History

Date of issue mm/dd/yyyy : 02/15/2013

Version : 1

Revised Section(s) : Not applicable.

Prepared by : KMK Regulatory Services Inc.

Key to abbreviations : ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL 73/78 = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
UN = United Nations

Notice to reader

To the best of our knowledge, the information contained herein is accurate. However, neither the above-named supplier, nor any of its subsidiaries, assumes any liability whatsoever for the accuracy or completeness of the information contained herein.
Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.

APPENDIX I

MATERIAL SAFETY DATA SHEET

EARTH SCIENCE LABORATORIES, INC.
106 North 37th Street, Suite B
Rogers, AR 72756
www.earthsciencelabs.com

Emergency Phone Number: 1-800-535-5053 (Infotrac)
Information Phone Number: 1-479-619-2713

Material Name: *EarthTec®*

Issue Date: 12/93
Revision Date: 7/03

Section 1 – PRODUCT IDENTIFICATION

Product Name: EarthTec®

EPA No: 64962-1

Section 2 – HAZARDOUS INGREDIENTS

Components	CAS#	OSHA PEL	ACGIH TLV	%
Copper sulfate pentahydrate	7758-99-8	1mg/m^3	1mg/m^3	18.25-21.75%

Section 3 – HEALTH HAZARDS IDENTIFICATION

Primary Routes of Entry: *Inhalation, Absorption, and Ingestion.*
Eyes: *Corrosive.* Exposure may cause severe burns, destruction of eye tissue and possible permanent injury or blindness.
Skin: *Corrosive.* Contact may cause reddening, itching, inflammation, burns, blistering and possibly tissue damage.
Ingestion: *Corrosive.* May cause painful irritation and burning of the mouth and throat, painful swallowing, labored breathing, burns or perforation of the gastrointestinal tract leading to ulceration and secondary infection.
Inhalation: *Irritating.* Overexposure may cause burns and tissue damage.

Section 4 – FIRST AID MEASURES

Eyes: Flush immediately with large amounts of water for at least 20 minutes. Eyelids should be held away from the eyeball to ensure thorough rinsing. Get immediate medical attention.
Skin: Immediately flush skin with plenty of water for at least 20 minutes while removing contaminated clothing and shoes. Get immediate medical attention.
Ingestion: If victim is conscious and alert, give 1-3 glasses of water to dilute stomach contents. Rinse mouth out with water. Do not induce vomiting unless directed by medical personnel. Get immediate medical attention.
Inhalation: Remove to fresh air. If not breathing, institute cardiopulmonary resuscitation (CPR). If breathing is difficult, ensure clear airway and give oxygen. Keep affected person warm and at rest. Get immediate medical attention.

Section 5 – FIRE AND EXPLOSION HAZARDS

Flash Point: N/E **UFL:** N/E **LFL:** N/E

General Fire Hazards: Water applied directly could result in spattering of acid solution.
Hazardous Combustion Products: May react with high carbon metals to produce hydrogen gas, which can form an explosive mixture.
Fire Fighting Equipment/Instructions: Firefighters must wear MSHA/NIOSH approved positive pressure breathing apparatus (SCBA) with full face mask and full protective equipment.

NFPA Ratings:	**Fire:** 0	**Health:** 2	**Reactivity:** 1	**Other:** X
HMIS III Ratings:	**Fire:** 0	**Health:** 2	**Reactivity:** 1	**Personal Protection:** X

Section 6 – ACCIDENTAL RELEASE MEASURES

Containment Procedures: Flush with water into retaining area or container. Caution should be exercised regarding personal safety and exposure to released product.
Clean-Up Procedures: Neutralize solution with bicarbonate of soda.
Evacuation Procedures: Keep unnecessary people away; isolate hazard area and deny entry. Stay upwind.
Special Instructions: Notify local authorities and the National Response Center, if required.

Section 7 – HANDLING AND STORAGE

Procedures for Handling: Avoid contact with strong oxidizers. Do not use with materials or equipment sensitive to corrosive solutions.
Recommended Storage Methods: Avoid storage in excessive heat; expansion of container may occur creating spillage. Do not store in galvanized or nylon equipment.

Section 8 – PERSONAL PROTECTION

Respiratory Protection: Ventilation and other forms of engineering controls are the preferred means for controlling exposures. A NIOSH/ MSHA approved air-purifying respirator with an appropriate acid gas cartridge or canister may be appropriate under certain circumstances where airborne concentrations are expected to exceed exposure limits.
Protective Gloves: Use appropriate chemical gloves that are in usable order.
Other Protective Clothing or Equipment: Eye and face protection is necessary, long sleeved shirts, long pants, socks and shoes.
Work/Hygienic Practices: Use good personal hygiene. Body shower for prolonged skin contact.

Section 9 – PHYSICAL & CHEMICAL PROPERTIES

Appearance: Clear blue liquid
Physical State: Liquid
pH: 0.5
Vapor Pressure: 0.1mm 68° F
Boiling Point: 220° F
Melting Point: N/A

Odor: Minimal odor
Vapor Density (Air=1): 1.0
Evaporation Rate: N/A
Solubility in Water: Complete
Specific Gravity (H_20=1): 1.2

Section 10 – REACTIVITY INFORMATION

Chemical Stability: Stable.
Conditions to Avoid: Avoid mixing with strong bases and strong reducing agents.
Incompatibility: Incompatible with strong bases and strong reducing agents.
Hazardous Decomposition Products: Sulfur dioxide and sulfur trioxide may be produced with decomposition.
Hazardous Polymerization: Will not occur.

Section 11 - TOXICOLOGICAL INFORMATION

Acute Toxicity / Chronic Toxicity: Continued overexposure to this solution may cause systemic toxicity.
Carcinogenicity: N/A
Signs and Symptoms of Exposure: Overexposure may cause the following specific symptoms, depending on the concentration and duration of exposure: vomiting, shallow respiration and lung function changes.

Section 12 – DISPOSAL CONSIDERATIONS

Disposal Instructions: Neutralize with bicarbonate of soda or fertilizer grade lime and dispose of in accordance with all federal, state and local regulations.

Section 13 – TRANSPORTATION INFORMATION

DOT Information

Proper Shipping Name: Corrosive liquid, acidic, inorganic, n.o.s., (contains cupric sulfate)
Hazard Class: 8
UN/NA #: UN3264
Packing Group: III

- *Packages that contain more than 5.1 US gallons are **RQ** (reportable quantity)*
- *Packages that contain less than 4.0 liters could be **ORM-D***
- *The proper shipping information is the responsibility of the shipper and this information is only guidelines.*

APPENDIX J

The Department of Water Resources

Annual Monitoring Report
Water Quality Order No. 2004-0009-DWQ

Statewide General National Pollutant Discharge Elimination System
Permit for the Discharge of Aquatic Pesticides for Aquatic Weed Control in
the Waters of the United States

February 21, 2014

Department of Water Resources
Division of Operations and Maintenance
Environmental Assessment Branch
1416 Ninth Street, Room 620
Sacramento, California 95814

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EXECUTIVE SUMMARY

The Department of Water Resources (DWR) operates and manages the State Water Project (SWP), the largest state-built, multipurpose water project in the United States. The SWP is comprised of a complex system of dams, reservoirs, powerplants, pumping plants, canals, and aqueducts to deliver water. The SWP provides drinking water to approximately 25 million Californians and SWP water is used to irrigate about 750,000 acres of farmland, mainly in the south San Joaquin Valley. Also, the SWP was designed and built to control floods, generate power, and provide recreational facilities as well as enhance habitats for fish and wildlife.

Aquatic plants and algae pose a number of serious water quality and supply problems in the SWP and negatively impact water conveyance for municipal, irrigation, and industrial purposes. Cyanobacteria (bluegreen algae) produce compounds such as 2-methylisoborneol (MIB) and geosmin that cause unpleasant taste and odors in drinking water. In addition, certain species of cyanobacteria produce toxins that are potentially harmful to fish, wildlife, and human health. To minimize the impacts caused by submerged aquatic plants and algae, DWR applies aquatic herbicides on an as-needed basis in the SWP. In 2013, seven sites were treated: South Bay Aqueduct, Coastal Branch Aqueduct, Pyramid Lake, Castaic Lake, Silverwood Lake, Lake Perris, and East Branch of the California Aqueduct. These treatment sites are found within the jurisdictions of the San Francisco Bay, Central Valley, Los Angeles, Santa Ana, and Lahontan Regional Water Quality Control Boards. No aquatic pesticide applications were done at Clifton Court Forebay in 2013. DWR hired a contractor to apply sodium carbonate peroxyhydrate (PAK®27) to Silverwood Lake to control cyanobacteria. PAK®27 does not contain copper as an active ingredient. DWR also hired a contractor to treat Pyramid Lake with Littora (diquat) to control aquatic weeds.

A Mitigated Negative Declaration was prepared by DWR in 2004 to comply with the California Environmental Quality Act (CEQA) and fulfill regulatory requirements established by the State Water Resources Control Board (SWRCB). DWR, a public entity, was granted a Section 5.3 Exception by the SWRCB (Water Quality Order 2004-0009-DWQ) and is not required to meet the copper limitation in receiving waters during the granted exception period as described in DWR's Aquatic Pesticide Application Plan (APAP).

SOUTH BAY AQUEDUCT

Copper sulfate was applied to the South Bay Aqueduct to control filter clogging diatoms (*Melosira varians*, *Diatoma* spp. and *Synedra spp.)* and filamentous algae (*Cladophora* spp.) and to reduce taste and odor producing cyanobacteria. Water quality was improved as measured by reduction in algal biomass and taste and odor compounds after applications of copper sulfate in compliance with the permit. The reduction in diatom abundance minimized filter clogging and interruption in delivery of water at treatment plants operated by Santa Clara Valley Water Agency, Zone 7 Water Agency, and Alameda County Water District.

COASTAL BRANCH AQUEDUCT

The accumulation of aquatic plants and filamentous algae (*Cladophora* spp.) on the trash racks of the Devil's Den, Badger Hill, and Las Perillas Pumping Plants was reduced by the copper sulfate and Nautique® treatments conducted in 2013. Pumping plant shutdowns were minimized and pumping was maintained during spring and summer except during periods when

aquatic weed growth and upstream contribution from fragmented weeds exceeded the capacity to mechanically remove the plant biomass from the trash racks. There were no violations to the permit and the APAP was effective in reducing and preventing discharge of pollutants associated with the aquatic herbicide applications.

PYRAMID LAKE

Pyramid Lake experienced a high volume of aquatic weed growth, which posed various problems in managing the lake, including risk of entanglement of swimmers. In September 2013, DWR hired a contractor to treat the lake with Littora (diquat) to control the aquatic weeds.

CASTAIC LAKE

Copper sulfate was effective in controlling production of the taste and odor compound geosmin in Castaic Lake. The two treatments in 2013 were in compliance with the permit.

EAST BRANCH OF THE CALIFORNIA AQUEDUCT

As a result of the copper sulfate treatments, water quality was improved by reducing the concentrations of attached cyanobacteria that produce the taste and odor compounds MIB and geosmin. Regular monitoring for MIB and geosmin along with improved treatment methods based on the outcomes of the 2011 and 2012 copper sulfate treatments enabled DWR to effectively control cyanobacteria in 2013 while minimizing environmental impacts.

SILVERWOOD LAKE

In the past, treatment of the East Branch Aqueduct was sufficient in controlling cyanobacterial production of taste and odor compounds, and Silverwood Lake was never treated. However, algal production of geosmin in Silverwood Lake itself began in 2013, necessitating the treatment of the lake. Since DWR does not have a SIP exception to treat Silverwood Lake with copper, sodium carbonate peroxyhydrate (PAK®27) was used to treat the lake instead. This treatment was ineffective at controlling the targeted geosmin-producing cyanobacteria due to high abundance of a species not susceptible to sodium carbonate peroxyhydrate.

LAKE PERRIS

Copper sulfate was effective in controlling production of the taste and odor compound MIB in Lake Perris. The single treatment in 2013 was in compliance with the permit.

INTRODUCTION AND LOCATION

The Department of Water Resources (DWR) applies aquatic herbicides when necessary, to State Water Project (SWP) aqueducts, forebays, and reservoirs (Table 1). SWP water storage and conveyance facilities are located within the jurisdiction of the following five Regional Water Quality Control Boards: San Francisco Bay, Central Valley, Los Angeles, Lahontan, and Santa Ana.

A Mitigated Negative Declaration was prepared by DWR to comply with the California Environmental Quality Act (CEQA) and the regulatory requirements established by the State Water Resources Control Board (SWRCB). DWR, a public entity, was granted a Section 5.3 Exception by the SWRCB (Water Quality Order 2004-0009-DWQ) covering the following water bodies: South Bay Aqueduct, Clifton Court Forebay, Coastal Branch Aqueduct, East Branch Aqueduct, Castaic Lake, and Lake Perris.

DWR currently applies copper sulfate pentahydrate, Captain™ (a liquid copper algaecide), diquat, and PAK®27 (sodium carbonate peroxyhydrate) on an as-needed basis to control submerged aquatic weeds and algal blooms so that such blooms do not degrade drinking water quality through elevated tastes and odors, production of algal toxins, clogging of filters, and reduction in water flow.

PROJECT BACKGROUND

DWR operates and manages the SWP, the largest state-built, multipurpose water project in the United States. The SWP depends on a complex system of dams, reservoirs, power plants, pumping plants, canals, and aqueducts to deliver water. The SWP provides drinking water to approximately 25 million Californians and SWP water is used to irrigate about 750,000 acres of farmland, mainly in the south San Joaquin Valley. The SWP was designed and built to control floods, generate power, and provide recreational facilities as well as enhance habitats for fish and wildlife.

The mission of DWR is to manage the water resources of California in cooperation with other agencies, to benefit the State's people, and to protect, restore, and enhance the natural and human environments. To carry out this mission, DWR routinely monitors and tests water samples from its reservoirs, canals, aqueducts, and other water supply facilities to assure compliance with state and federal requirements for safe drinking water quality.

Water quality monitoring provides detailed information on concentrations and distribution of chemical, physical, and biological properties at over 40 stations throughout the SWP. Objectives of this monitoring are to:

- Assess the influence of hydrological conditions and project operations on water quality.
- Document long-term changes in SWP water quality.
- Provide water quality data to assess water treatment plant operational needs.
- Identify, monitor, and respond to water quality emergencies and determine impacts to the SWP.
- Provide data needed to determine if State Water Contracts Article 19 and California Department of Public Health Drinking Water Standards are met.
- Assess issues of concern through special studies.

DWR applies aquatic herbicides for two main purposes: (1) to control cyanobacteria (bluegreen algae) producing taste and odor compounds and (2) to control submerged aquatic vegetation and attached algae negatively impacting conveyance of water supplies for municipal, irrigation, and industrial purposes.

DWR routinely monitors taste and odor compounds produced by algae. Chemical substances in water often associated with earthy, musty smelling or tasting water, which are produced in natural and manmade lakes by certain types of algae. The taste and odor compounds geosmin and MIB are natural byproducts of algal chlorophyll production. However, not all algae produce the compounds or produce them in the same amounts, so the presence of algae alone is not a reliable indicator of taste and odor problems.

DWR's evaluation of a taste and odor event is based upon microscopic examination of samples, and most importantly, chemical analysis for the presence of geosmin and MIB. When sampling results indicate that concentrations of geosmin or MIB increase to 10 nanograms per liter (ng/l) (1 ng/l is one nanogram per liter of water, or one part per trillion), DWR's water quality staff respond by searching for the location of the source. To do this, water quality samples are collected and analyzed, and field staff ascertains possible algal sources. If an algal source is identified, DWR staff develops an application plan to control the specific algae associated with elevated geosmin and/or MIB concentrations.

1. SOUTH BAY AQUEDUCT

Nuisance algal problems began in the South Bay Aqueduct (SBA) soon after completion of the aqueduct in 1966. DWR applies copper sulfate in the SBA for two main purposes: (1) to control cyanobacteria producing taste and odor compounds and (2) to control attached diatoms such as *Melosira varians* and *Synedra ulna* that negatively impact conveyance of water supplies for municipal, irrigation, and industrial purposes.

a. Summary of Monitoring Data

Identification of Water Quality Improvements or Degradation

Copper sulfate was applied to the SBA on 12 occasions in 2013 to control filter clogging diatoms (*Melosira varians, Diatoma* spp., and *Synedra* spp.*)* and to reduce the abundance of taste and odor producing cyanobacteria (Table 2). Copper sulfate was applied at three locations. The application and treatment areas are shown in Figure 1.

Algal biomass is used to evaluate the effectiveness of the copper sulfate treatments along the SBA. Samples were collected about weekly at Del Valle Check 7 (milepost [MP] 16.38) and analyzed for algal species composition and biomass with an inverted microscope.

Overall, water quality was improved as measured by the reduction in algal biomass. The water treatment plants operated by the three SBA water contractors reported longer filter run times with no adverse effects following copper sulfate treatments.

Recommended Improvements to APAP

DWR's detailed biological monitoring of real-time algal fluorescence and weekly microscopic algal enumeration provide the management tools to minimize copper sulfate use, control the problem-causing diatoms and cyanobacteria, and maintain high water quality. The 2004 APAP followed in reporting year 2013 has been superseded by an APAP (DWR, 2013) prepared pursuant to the new general permit, Order No. 2013-0002-DWQ.

Comparison of Monitoring Data to Water Quality Standards

DWR is a public entity granted a Section 5.3 Exception and not required to meet the copper limitation in receiving waters during the exception period from March 1 to November 30 as described in the DWR's APAP (DWR, 2004). Water quality data are presented in Table 3.

b. Identification and Effectiveness of BMPs

Existing BMPs

Application: Copper sulfate was applied under the supervision of a certified pesticide applicator. Delta Field Division has one licensed Pest Control Advisor (PCA) and seven Certified Qualified Applicators (QACs).

Notification: DWR's South Bay Water Contractors, who also provide treated municipal water to customers, are notified prior to a treatment. The contractors are Zone 7 Water Agency, Alameda County Water District, and Santa Clara Valley Water Agency.

Treatment: Prior to treatment, water contractors were notified by email. The notification includes information on the start and end times of the treatment and calculated arrival time of the copper plume at specific canal locations. The copper was applied during daylight hours of maximum photosynthetic activity to optimize copper uptake by the algal community.

Water Quality Monitoring: SBA water quality is typically monitored continuously by automated instrumentation at two stations: Del Valle Check 7 and Vallecitos. The sensors at these stations measure water temperature, turbidity, pH, and specific conductance. Additionally, algal biomass (flow-through fluorometry) is measured at Del Valle Check 7. SBA water quality is also monitored by analyzing routine grab samples at SBA stations throughout the year.

Access: There are limited recreational activities on the SBA and most sections are closed to public access with locked gates. Fishing is not permitted in the South Bay Aqueduct.

Post-Treatment: Algae and taste and odor compounds were monitored weekly throughout the year.

c. **Modifications of BMPs to Address Violations of General Permit**

There were no violations to the general permit due to the SBA copper sulfate applications.

d. **Map of Application and Treatment Areas**

A map of the application and treatment areas are shown in Figure 1.

e. **Types and Amount of Aquatic Pesticides Applied in 2013**

Copper sulfate pentahydrate crystals were applied at three locations in the SBA during 12 applications from March 5 to November 6 (Table 2). In each treatment, DWR applied 550 to 1,300 pounds of copper sulfate for an annual total of 10,850 pounds. Application rates are based on aqueduct flow (cfs) at the start of the treatment.

f. Surface Area and Volume Treated with Aquatic Pesticides in 2013

Flow during the applications ranged from 123.9 to 298.2 cfs (Table 2). Application rates and travel times are calculated using the FlowTimes Program, a spreadsheet model developed by DWR (see the 2004 DWR APAP for details).

g. Operation of Gates

Turnouts were closed for a minimum of two hours prior to the start of the copper sulfate treatment and remained closed for a minimum of two hours after the copper sulfate plume passed the following three turnouts:

Arroyo Mocho Check – located at MP 14.6 on the South Bay Aqueduct.

Arroyo Valle 1 (AV1) – located at MP 0.9DV on the Del Valle Branch Pipeline.

Arroyo Valle 2 (AV2) – located at MP 1.53DV on the Del Valle Branch Pipeline.

AV1 and AV2 are operated manually while the Arroyo Mocho gate is controlled remotely at the Delta Field Division Headquarters in Byron. The gates at AV1 and AV2 are inspected during operation to ensure the gate is closed and no water is discharged into Arroyo Mocho Creek. The Arroyo Mocho gate is equipped with a flow meter that is remotely monitored in the control room to verify proper operation of the gate.

h. Monitoring Data

Monitoring data are presented in Table 3.

i. Recommendations to Improve Monitoring Program, BMPs and APAP

Both the BMPs and APAP were effective in minimizing copper sulfate use while not impacting either water quality or the volume of water delivered to the South Bay water districts.

Twelve copper sulfate treatments to control filter clogging algae were required from March 5 to November 6, 2013. Historically, highest algal biomass and most severe filter clogging problems at water treatment plants occurred during the spring and fall when water demands are greatest. Two of the twelve SBA treatments were conducted in the month of March when diatoms are most abundant.

The monitoring program BMPs and APAP recently approved by the SWRCB (December 11, 2013) will be followed in 2014.

j. Proposed Changes to APAP Monitoring Plan for 2014

In 2013, an APAP was prepared to comply with the new general NPDES permit 2013-0002-DWQ. This new APAP Monitoring Plan will be followed when treating the South Bay Aqueduct with aquatic herbicides in 2014.

2. COASTAL BRANCH AQUEDUCT

Copper compounds are applied to control aquatic weeds that clog trash racks at Devil's Den, Badger Hill, and Las Perillas Pumping Plants in the Coastal Branch Aqueduct. The accumulation of large quantities of aquatic weeds on the trash racks often results in a complete shutdown of pumping until the weeds can be manually removed. The targeted plants are filamentous algae (*Cladophora* spp.), submerged aquatic weeds (*Zannichellia palustris*), and taste and odor producing cyanobacteria.

a. Summary of Monitoring Data

Identification of Water Quality Improvements or Degradation

Filter clogging algae and submersed aquatic weeds: The accumulation of aquatic weeds and filamentous algae on the trash racks of pumping plants was greatly reduced by the four copper treatments in 2013. Pumping plant shutdowns were problematic prior to the treatments, however, shutdowns were minimized and pumping was maintained after the copper treatments.

Recommended Improvements to APAP

In 2014, DWR will follow the APAP prepared pursuant to the new general permit, Order No. 2013-0002-DWQ.

Comparison of Monitoring Data to Water Quality Standards

No physical or chemical monitoring data were required at the Coastal Branch Aqueduct as described in the DWR APAP monitoring plan. Therefore, only visual observations were done at the Coastal Branch. The monthly monitoring was conducted at the South Bay Aqueduct to comply with the permit (see Table 3 for South Bay Aqueduct monitoring data).

b. **Identification and Effectiveness of BMPs**

Application: The copper sulfate and Nautique® applications were directed under the supervision of a PCA and use of these aquatic herbicides was consistent with label instructions.

Notification: Water users that might have been impacted by the copper applications were notified prior to a treatment. The notified water users were Brenda Mesa Water District and the Central Coast Water Authority.

Treatment: Copper sulfate and Nautique® were applied during the daylight hours of maximum photosynthetic activity to optimize copper uptake by the aquatic plant community.

Access: There are no recreational activities in the Coastal Aqueduct. Most sections are protected with locked gates and are inaccessible to the public.

c. Modifications of BMPs to Address Violations of General Permit

There were no violations of the general permit.

d. Maps of Application and Treatment Areas

A map of the application and treatment areas is shown in Figure 2.

e. **Types and Amount of Aquatic Pesticides Applied in 2013**

Copper sulfate pentahydrate was applied on March 20 (450 lb.), April 10 (4,900 lb.), and May 17 (4,900 lb.) to control submerged weeds and filter clogging algae. DWR applied 375 gallons of Nautique® on May 22 (Table 2).

f. Surface Area and Volume Treated with Aquatic Pesticides in 2013

On March 20, copper sulfate was applied at three locations: mileposts 0.02, 4.93 (Badger Hill Headworks), and 10.45 (bridge). On April 10 and May 17, DWR applied copper sulfate at mileposts 0.02 (CBA mouth), 2.2 (bridge), 4.93 (Badger Hill Headworks), 7.23 (Check 3), 9.36 (Check 4), 10.45 (bridge), and 12.2(Check 5). On May 22, DWR applied Nautique® at the CBA mouth (milepost 0.02).

Flows during the four applications are shown in Table 2.

g. Operation of Gates

All gates remained open prior to and during the copper applications.

h. Monitoring Data

No physical or chemical samples were collected as described in the DWR APAP.

i. Recommendations to Improve Monitoring Program, BMPs and APAP

The monitoring program BMPs and APAP recently approved by the SWRCB (December 11, 2013) will be followed in 2014.

j. Proposed Changes to APAP Monitoring Plan for 2014

For 2014, the monitoring plan in the APAP recently approved by the SWRCB (December 11, 2013) will supersede the 2004 APAP monitoring plan.

3. PYRAMID LAKE

Pyramid Lake is subject to infestations of aquatic weeds including Eurasian watermilfoil (*Myriophyllum spicatum*) and sago pondweed (*Stuckenia pectinata*). Eurasian watermilfoil can grow up to one foot per week and reach the lake surface from depths of up to 25 feet. It forms dense mats that clog the lake surface. This species, if uncontrolled, shades out native aquatic plants in the lake. The native species then die back and may be replaced by non-native species. Eurasian watermilfoil beds can become so dense in Pyramid Lake that they create a hazard for swimmers who become entangled in the plants.

a. Summary of Monitoring Data

Identification of Water Quality Improvements or Degradation

Littora (diquat) was effective in controlling aquatic weeds in Pyramid Lake.

Recommended Improvements to APAP

In 2014, DWR will follow the APAP prepared pursuant to the new general permit, Order No. 2013-0002-DWQ. DWR also plans to apply for a SIP 5.3 Exception for copper at Pyramid Lake.

Comparison of Monitoring Data to Water Quality Standards

The permit does not identify a receiving water limitation for diquat. Therefore, DWR was not required to monitor for this aquatic herbicide.

b. Identification and Effectiveness of BMPs

Application: Southern Field Division (SFD) currently has two licensed Pest Control Advisors (PCAs) and six to eight certified Qualified Applicators (QACs). Diquat was applied by boat according to label instructions by a contractor.

Notification: Metropolitan Water District (MWD), Department of Fish and Wildlife, Department of State Parks and Recreation and the Department of Pesticide Regulation were notified prior to the treatment. A permit was filed with the County Agricultural Commissioner.

Treatment: Prior to treatment, MWD was notified and the reservoir was shut down to recreational users during the day of application.

Minimize Treated Area: The smallest practicable area was treated to minimize potential impacts to non-target aquatic life.

c. Modifications of BMPs to Address Violations of General Permit

There were no violations of the general permit.

d. Maps of Application and Treatment Areas

Application and treatment areas are shown in Figure 3.

e. Types and Amount of Aquatic Pesticides Applied in 2013

Littora was applied on September 17 by boat by a contractor, AquaTechnex. The amount and area treated are shown in (Table 2). Thirty gallons of Littora were applied at a rate of 1.5 gallons per surface acre during the spot treatment. (See Appendix 1 for the application report prepared by AquaTechnex.)

f. Surface Area and Volume Treated with Aquatic Pesticides in 2013

Twenty surface acres of the lake were treated (Table 2).

g. Operation of Gates

No gate or valve changes were made during or after the treatment.

h. Monitoring Data

No monitoring data were required for the use of diquat.

i. Recommendations to Improve Monitoring Program, BMPs and APAP

The monitoring program BMPs and APAP recently approved by the SWRCB (December 11, 2013) will be followed in 2014.

j. Proposed Changes to APAP Monitoring Plan for 2014

For 2014, the monitoring plan in the APAP recently approved by the SWRCB (December 11, 2013) will supersede the 2004 APAP monitoring plan.

4. CASTAIC LAKE

a. Summary of Monitoring Data

Identification of Water Quality Improvements or Degradation

Copper sulfate was effective in controlling cyanobacteria that produce taste and odor compounds in Castaic Lake.

The taste and odor compound, geosmin was reduced following the copper sulfate applications on June 11, and July 31, 2013.

Fish

June 11, and July 31, 2013 Treatments: No distressed or dead fish were observed during the treatment or post-treatment visual inspections.

Recommended Improvements to APAP

In 2014, DWR will follow the APAP prepared pursuant to the new general permit, Order No. 2013-0002-DWQ.

Comparison of Monitoring Data to Water Quality Standards

DWR is a public entity granted a Section 5.3 Exception and not required to meet the copper limitation in receiving waters during the exception period from March 1 to November 30 as described in the DWR's APAP (DWR, 2004). Water quality data are presented in Table 4 for background, event, and post-event monitoring.

b. Identification and Effectiveness of BMPs

Application: Southern Field Division (SFD) currently has two licensed Pest Control Advisors (PCAs) and six to eight certified Qualified Applicators (QACs). Copper sulfate is applied according to label instructions by a licensed helicopter applicator.

Notification: Metropolitan Water District (MWD), Department of Fish and Wildlife, Department of State Parks and Recreation and the Department of Pesticide Regulation were notified prior to the treatment. A permit was filed with the County Agricultural Commissioner.

Treatment: Prior to treatment, MWD was notified and the reservoir was shut down to recreational users during the day of application.

Prior to scheduling the helicopter, DWR staff received a weather forecast and monitored wind direction and speed. To minimize pesticide drift, aerial applications are cancelled in the event continuous wind velocity exceeds 10 mph.

Minimize Treated Area: The smallest practicable area was treated to minimize potential impacts to non-target aquatic life.

c. Modifications of BMPs to Address Violations of General Permit

There were no violations of the general permit.

d. Maps of Application and Treatment Areas

Application and treatment areas are shown in Figure 4.

e. Types and Amount of Aquatic Pesticides Applied in 2013

Copper sulfate pentahydrate was applied on June 11 and again on July 31 by helicopter using a motor operated spreader. The amount and area treated are shown in (Table 2). For both treatments, copper sulfate was applied at a rate of 0.8 pounds per acre-foot.

f. Surface Area and Volume Treated with Aquatic Pesticides in 2013

A volume of 25,000 acre-feet was treated each time (Table 2).

g. Operation of Gates

No gate or valve changes were made during or after the treatment.

h. Monitoring Data

Monitoring data are presented in Table 4.

i. Recommendations to Improve Monitoring Program, BMPs and APAP

In 2013, an APAP was prepared to comply with the new general NPDES permit 2013-0002-DWQ. This new APAP Monitoring Plan will be followed when treating the Castaic Lake with algaecides in 2014.

j. Proposed Changes to APAP Monitoring Plan for 2014

For 2014, the monitoring plan in the APAP recently approved by the SWRCB (December 11, 2013) will supersede the 2004 APAP monitoring plan.

5. EAST BRANCH OF THE CALIFORNIA AQUEDUCT

Off-flavor compounds, geosmin and MIB, produced by bluegreen algae in the East Branch of the California Aqueduct have been controlled with copper sulfate since 1991. The most troublesome portion for taste and odor problems is located between mileposts 326 and 403. Copper sulfate has also been applied in the past to the first and second Devil Canyon Afterbays to control the attached cyanobacterial genera, *Phormidium* and *Oscillatoria.* Taste and odor production was problematic in the summer of 2013 and thus required multiple applications of copper compounds (copper sulfate and Captain™). Application of copper was limited to the aqueduct pools where taste and odor algae are present as determined using SPME analysis. In 2013, Pools 64, and 65 were treated with copper sulfate. Pool 59 was treated with Captain™ (liquid copper algaecide).

a. Summary of Monitoring Data

Identification of water quality improvements or degradation

Drinking water quality was improved as a result of the copper sulfate treatments by reducing the concentrations of attached cyanobacteria that produce the taste and odor compounds geosmin and MIB.

Recommended improvements to APAP

DWR plans to add the application of PAK®27 as a treatment option for the East Branch of the California Aqueduct to the revised APAP being prepared pursuant to the revised Aquatic Pesticides for Aquatic Weed Control general permit.

Comparison of monitoring data to water quality standards

DWR is a public entity granted a Section 5.3 Exception and not required to meet the copper limitation in receiving waters during the exception period from March 1 to November 30 as described in the DWR's APAP (DWR, 2004). Due to an urgent need to control cyanobacteria in January 2013, DWR submitted to Lahontan Regional Water Quality Control Board an amended Notice of Intent extending the exception period along with the section of the 2004 APAP pertaining to the EBA. Water quality data are present in Table 4 for pre-event, event, and post-event monitoring.

Fish

No distressed or dead fish were observed during the treatment or post-treatment visual inspections.

b. Identification and Effectiveness of BMPs

Application: Southern Field Division (SFD) currently has two licensed Pest Control Advisors (PCAs) and six to eight certified Qualified Applicators (QACs). Off-flavor compounds, MIB and geosmin, produced by bluegreen algae in the East Branch of the California Aqueduct have been controlled with copper sulfate or Captain™ on an as-needed basis since 1991.

Notification: Downstream water users were notified prior to copper sulfate or Captain™ treatments.

Treatment: Prior to treatment, the affected water contractors were notified. Copper sulfate is applied during the daylight hours of maximum photosynthetic activity to optimize copper uptake by the submersed plant community. There are limited recreational activities in the California Aqueduct and most sections are accessible only through locked gates.

Minimize Treatment Area: Only those specific sections or "pools" of the aqueduct where the attached bluegreen algae occur were treated with copper sulfate or Captain™ to minimize cost and chemical use.

c. Modifications of BMPs to Address Violations of General Permit

There are no modifications of the BMPs proposed for 2014.

d. Maps of Application and Treatment Areas

Maps of application and treatment areas in the East Branch Aqueduct are presented in Figures 5-7. The maps show the Aqueduct milepost markers with each map spanning about 13–15 miles of canal.

e. Types and Amount of Aquatic Pesticides Applied in 2013

On January 17, DWR applied Captain™ to Pool 59 of the Aqueduct. The amount applied was 212 gallons in a flow of 560 cfs for 2 hours. Pools 53 and 54 were treated with Captain™ on February 14 and 15. For each of these treatments, 304 gallons was applied in a flow of 750 cfs.

Copper sulfate was applied once to Pools 64 and 65 of the East Branch of the California Aqueduct (Table 2) on February 21. Using a skid mounted blower, the copper sulfate was placed on the liner starting at a depth of 6 inches and down to a depth of 3 feet. A total of 1,000 pounds of copper sulfate were applied (Figures 5-7).

f. Surface Area and Volume Treated with Aquatic Pesticides in 2013

This information is presented in Table 2.

g. Operation of Gates

All control gates remained open during and after the treatment.

h. Monitoring Data

Monitoring data are shown in Table 4.

i. Recommendations to Improve Monitoring Program, BMPs and APAP

In 2013, an APAP was prepared to comply with the new general NPDES permit 2013-0002-DWQ. This new APAP Monitoring Plan will be followed when treating the East Branch Aqueduct with algaecides in 2014.

j. Proposed Changes to APAP Monitoring Program for 2014

For 2014, the monitoring plan in the APAP approved by the SWRCB (December 11, 2013) will supersede the 2004 APAP monitoring plan.

6. SILVERWOOD LAKE

When taste and odor compound concentrations are high in the East Branch Aqueduct and algae are not controlled with aquatic herbicides, unacceptably high concentrations of taste and odor compounds often result in Silverwood Lake. Algal production of geosmin in Silverwood Lake itself began in 2013, necessitating the treatment of the lake. In the summer of 2013, Silverwood Lake experienced a bloom of the species *Anabaena lemmermannii* that caused severe taste and odor problems.

a. Summary of Monitoring Data

Identification of Water Quality Improvements or Degradation

PAK®27 (sodium carbonate peroxyhydrate) was applied to Silverwood Lake by a contractor, Clean Lakes Inc., in an attempt to control *Anabaena lemmermannii*. The

treatment had little effect on the algae due to high abundance of a species not susceptible to sodium carbonate peroxyhydrate. (See Appendix 2 for the application report prepared by Clean Lakes Inc.)

Recommended Improvements to APAP

In 2014, DWR will follow the APAP prepared pursuant to the new general permit, Order No. 2013-0002-DWQ. DWR also plans to apply for a SIP 5.3 Exception for copper at Silverwood Lake.

Comparison of Monitoring Data to Water Quality Standards

The permit does not identify a receiving water limitation for sodium carbonate peroxyhydrate. Therefore, DWR was not required to monitor for this aquatic herbicide.

b. Identification and Effectiveness of BMPs

Application: Southern Field Division (SFD) currently has two licensed Pest Control Advisors (PCAs) and six to eight certified Qualified Applicators (QACs). PAK®27 was applied by boat according to label instructions by a contractor.

Notification: Metropolitan Water District (MWD), Department of Fish and Wildlife, Department of State Parks and Recreation and the Department of Pesticide Regulation were notified prior to the treatment. A permit was filed with the County Agricultural Commissioner.

Treatment: Prior to treatment, MWD was notified and the reservoir was shut down to recreational users during the day of application.

Minimize Treated Area: The smallest practicable area was treated to minimize potential impacts to non-target aquatic life.

c. Modifications of BMPs to Address Violations of General Permit

There were no violations of the general permit.

d. Maps of Application and Treatment Areas

Application and treatment areas are shown in Figure 8.

e. Types and Amount of Aquatic Pesticides Applied in 2013

PAK®27 was applied on June 25 by contractor boat. The amount applied was 58,201 pounds at a rate of 60 pounds per surface acre.

f. Surface Area and Volume Treated with Aquatic Pesticides in 2013

PAK®27 was applied to 970 surface acres (Table 2).

g. Operation of Gates

No gate or valve changes were made during or after the treatment.

h. Monitoring Data

No monitoring data were required for the use of PAK®27.

i. Recommendations to Improve Monitoring Program, BMPs and APAP

The monitoring program BMPs and APAP recently approved by the SWRCB (December 11, 2013) will be followed in 2014.

j. Proposed Changes to APAP Monitoring Plan for 2014

For 2014, the monitoring plan in the APAP recently approved by the SWRCB (December 11, 2013) will supersede the 2004 APAP monitoring plan.

7. LAKE PERRIS

Taste and odor problems were first reported in Lake Perris in the late 1970s. Copper sulfate was applied at low rates during the early treatments from 1978 to 1984. Major off-flavor events in Lake Perris are common due to the shallow depth of the lake and high concentrations of bioavailable nitrogen and phosphorus. In 1987, the first helicopter application was made to control nuisance algae. The cyanobacteria, *Synechococcus*, *Pseudanabaena*, and *Anabaena* were isolated as the primary contributors to off-flavor incidents in Lake Perris.

Copper sulfate was applied once in Lake Perris during 2013 to control attached benthic cyanobacteria. The treatment targeted the littoral zone to control geosmin producers in the shallow area of the reservoir southwest of Alessandro Island. Figure 9 shows a map of application and treatment areas.

a. Summary of Monitoring Data

Identification of Water Quality Improvements or Degradation

Copper sulfate was effective in controlling cyanobacteria that produce the taste and odor compounds in Lake Perris.

The taste and odor compound, geosmin was reduced following the copper sulfate application on August 27, 2013.

Fish

August 27, 2013 Treatment: No distressed or dead fish were observed during the treatment or post-treatment visual inspections.

Recommended Improvements to APAP

In 2014, DWR will follow the APAP prepared pursuant to the new general permit, Order No. 2013-0002-DWQ.

Comparison of Monitoring Data to Water Quality Standards

DWR is a public entity granted a Section 5.3 Exception and not required to meet the copper limitation in receiving waters during the exception period from March 1 to November 30 as described in the DWR's APAP (DWR, 2004). Water quality data are presented in Table 4 for background, event, and post-event monitoring.

b. Identification and Effectiveness of BMPs

Application: Southern Field Division (SFD) currently has two licensed Pest Control Advisors (PCAs) and six to eight certified Qualified Applicators (QACs). Copper sulfate is applied according to label instructions by a licensed helicopter applicator.

Notification: Metropolitan Water District (MWD), Department of Fish and Wildlife, Department of State Parks and Recreation and the Department of Pesticide Regulation were notified prior to the treatment. A permit was filed with the County Agricultural Commissioner.

Treatment: Prior to treatment, MWD was notified and the reservoir was shut down to recreational users during the day of application.

Prior to scheduling the helicopter, DWR staff received a weather forecast and monitored wind direction and speed. To minimize pesticide drift, aerial applications are cancelled in the event continuous wind velocity exceeds 10 mph.

Minimize Treated Area: The smallest practicable area was treated to minimize potential impacts to non-target aquatic life.

c. Modifications of BMPs to Address Violations of General Permit

There were no violations of the general permit.

d. Maps of Application and Treatment Areas

Application and treatment areas are shown in Figure 9.

e. Types and Amount of Aquatic Pesticides Applied in 2013

Copper sulfate pentahydrate was applied on August 27 by helicopter using a motor operated spreader. The amount and area treated are shown in (Table 2). The copper sulfate was applied at a rate of 0.67 pounds per acre-foot during the treatment.

f. Surface Area and Volume Treated with Aquatic Pesticides in 2013

A volume of 12,000 acre-feet was treated (Table 2).

g. Operation of Gates

No gate or valve changes were made during or after the treatment.

h. Monitoring Data

Monitoring data are presented in Table 4.

i. Recommendations to Improve Monitoring Program, BMPs and APAP

In 2013, an APAP was prepared to comply with the new general NPDES permit 2013-0002-DWQ. This new APAP Monitoring Plan will be followed when treating the Lake Perris with algaecides in 2014.

j. Proposed Changes to APAP Monitoring Plan for 2014

For 2014, the monitoring plan in the APAP approved by the SWRCB (December 11, 2013) will supersede the 2004 APAP monitoring plan.

REFERENCES

Department of Water Resources. 2004. Aquatic Pesticides Application Plan. Submitted to Regional Water Quality Control Boards 2, 4, 5, 6, and 8. July 29, 2004. 42 pp.

Department of Water Resources. 2013. Aquatic Pesticides Application Plan. Submitted to State Water Resources Control Board. October 21, 2013. 91 pp.

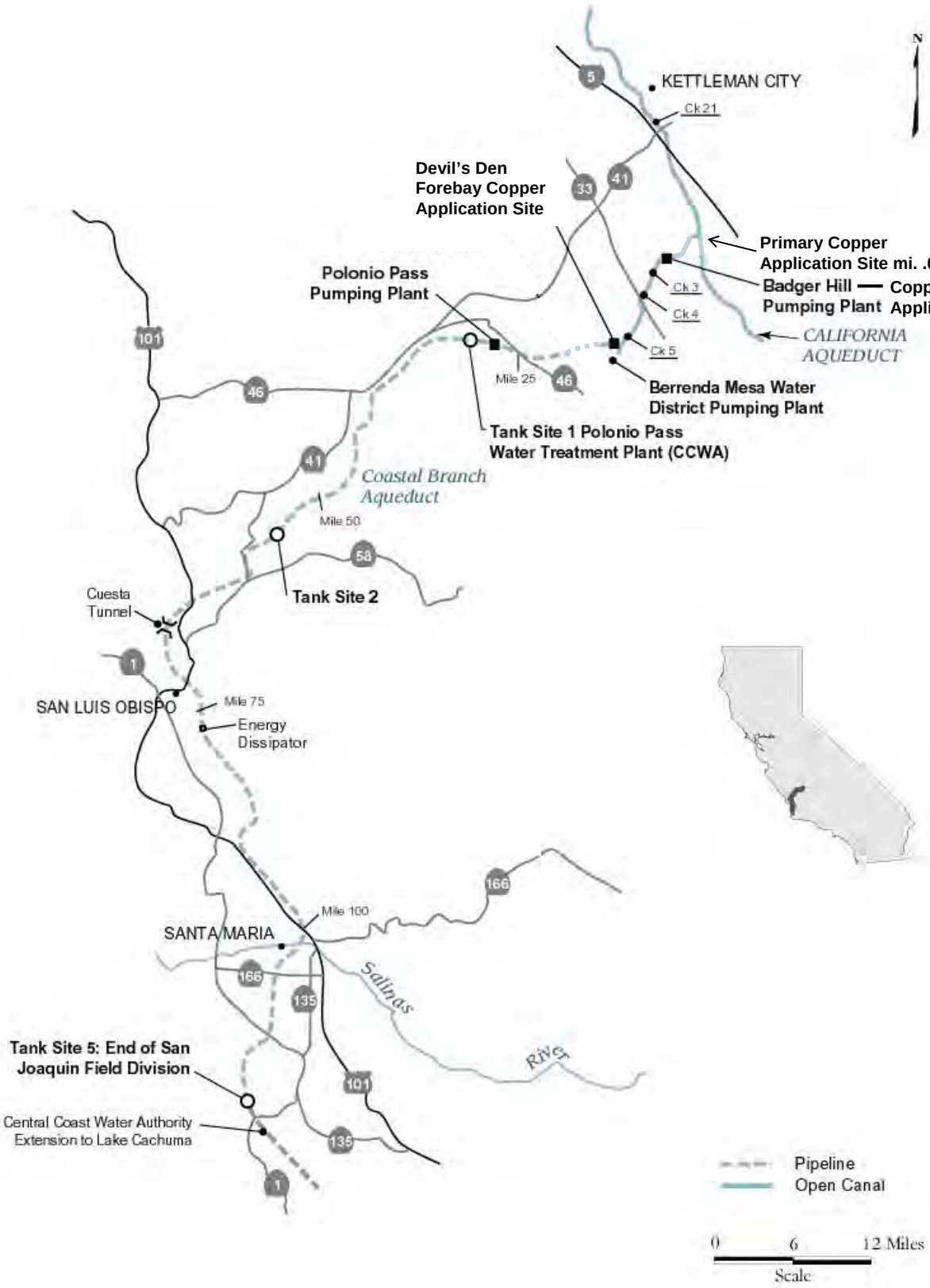
O'Conner-Marer, P J. and K. K. Garvey. 2001. Aquatic Pest Control. University of California, Statewide Integrated Pest Management Project, Publication 3337. 168 pp.

FIGURES

1 - 9

Figure 1. Map of South Bay Aqueduct Showing Location of Application and Treatment Areas

Figure 2. Map of Coastal Branch Aqueduct Showing Location of Treatment and Application Areas



N

0.5

Miles

Map Citations:
Main: ESRI Street Map
Inset: ESRI Street Map

Figure 3 - Pyramid Lake Overview Map

Los Angeles County, CA
118°46'19.483"W
34°39'14.054"N

Legend

★ Sampling Sites
Station Name
(Station Number)

Figure 4. Map of Castaic Lake showing location of Copper Sulfate Application and Treatment Areas to Control Taste and Odor Producing Algae

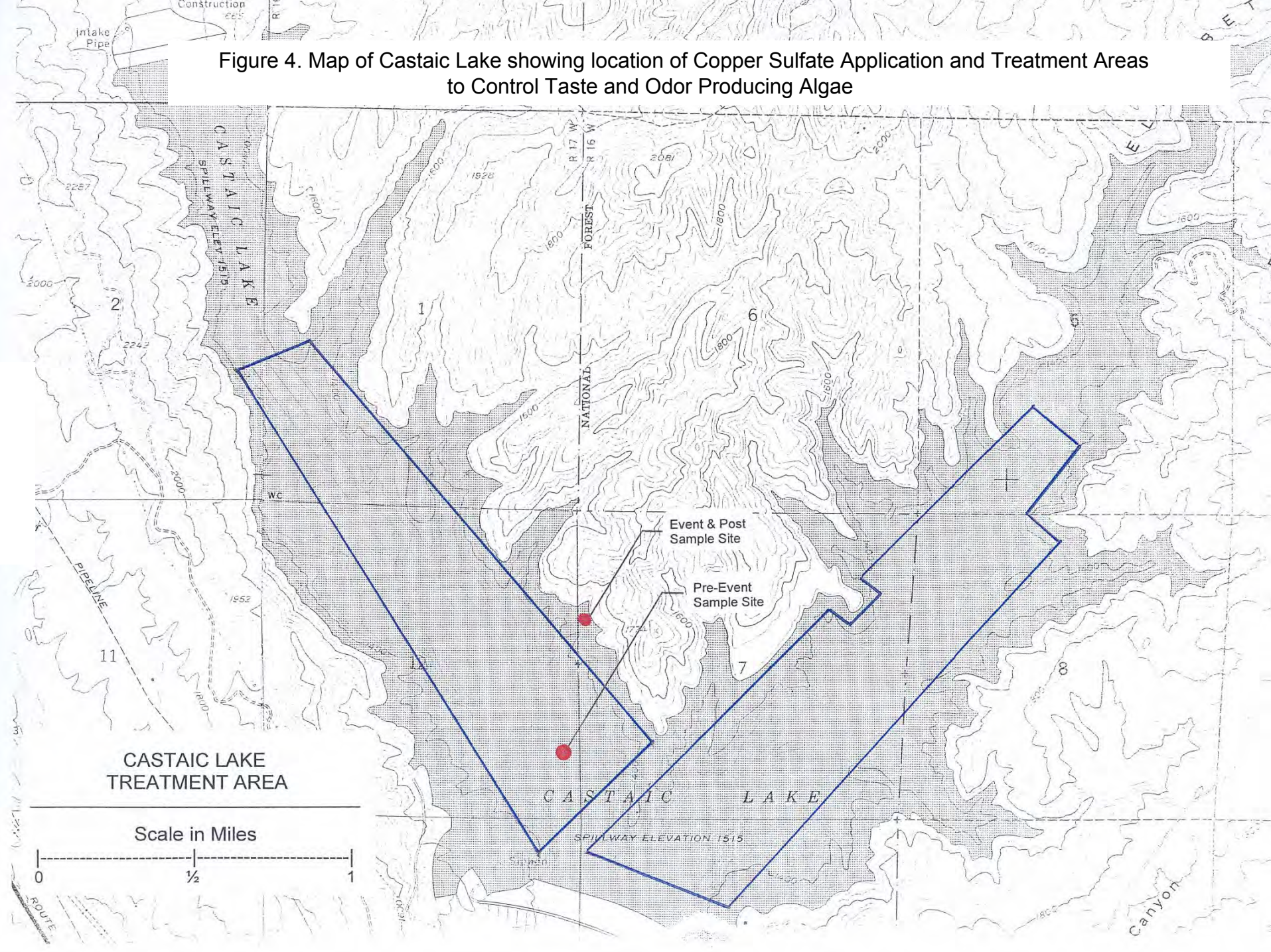


Figure 5. Map of East Branch California Aqueduct showing location of application sites (Pools 53 and 54)

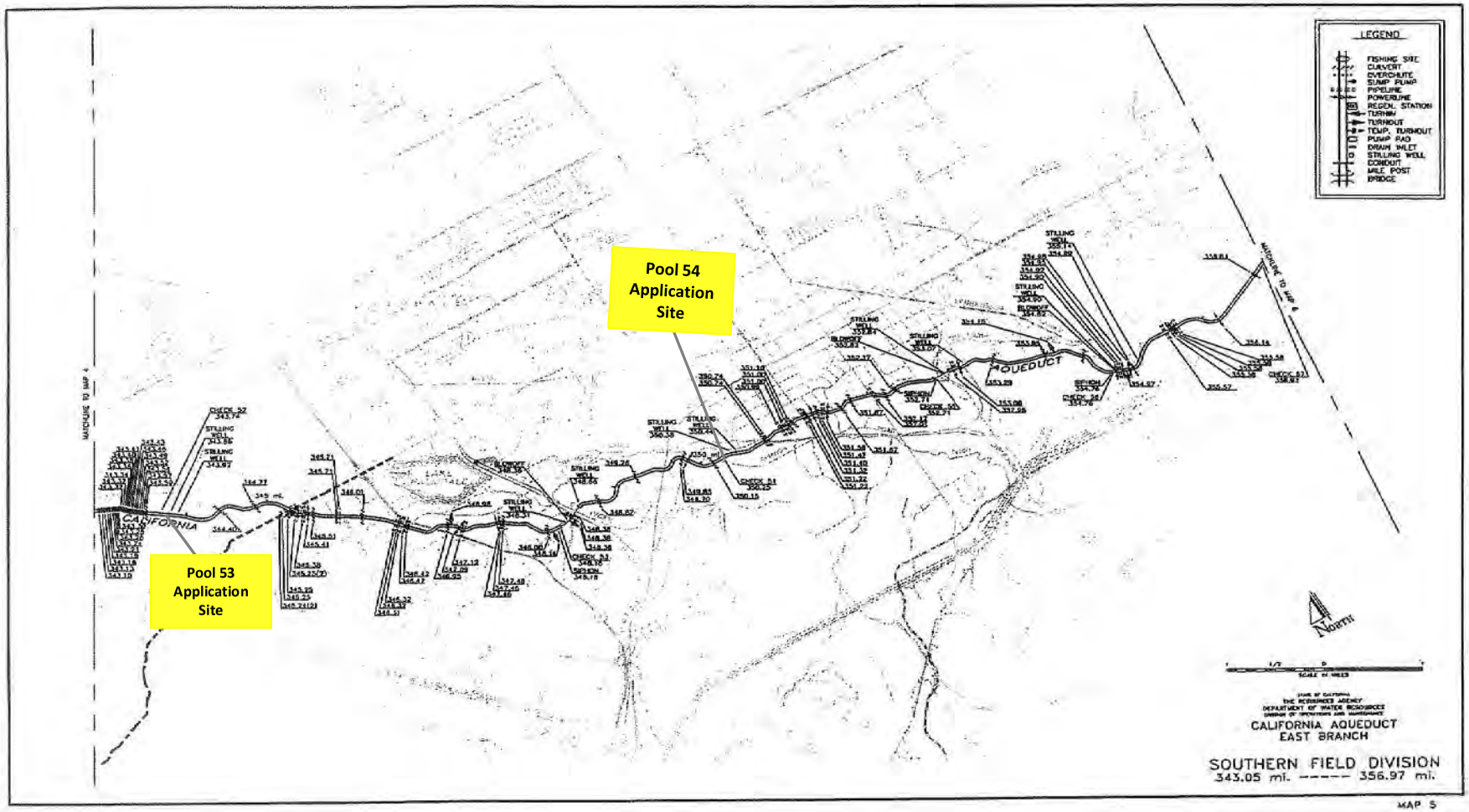


Figure 6. Map of East Branch California Aqueduct showing location of application site (Pool 59)

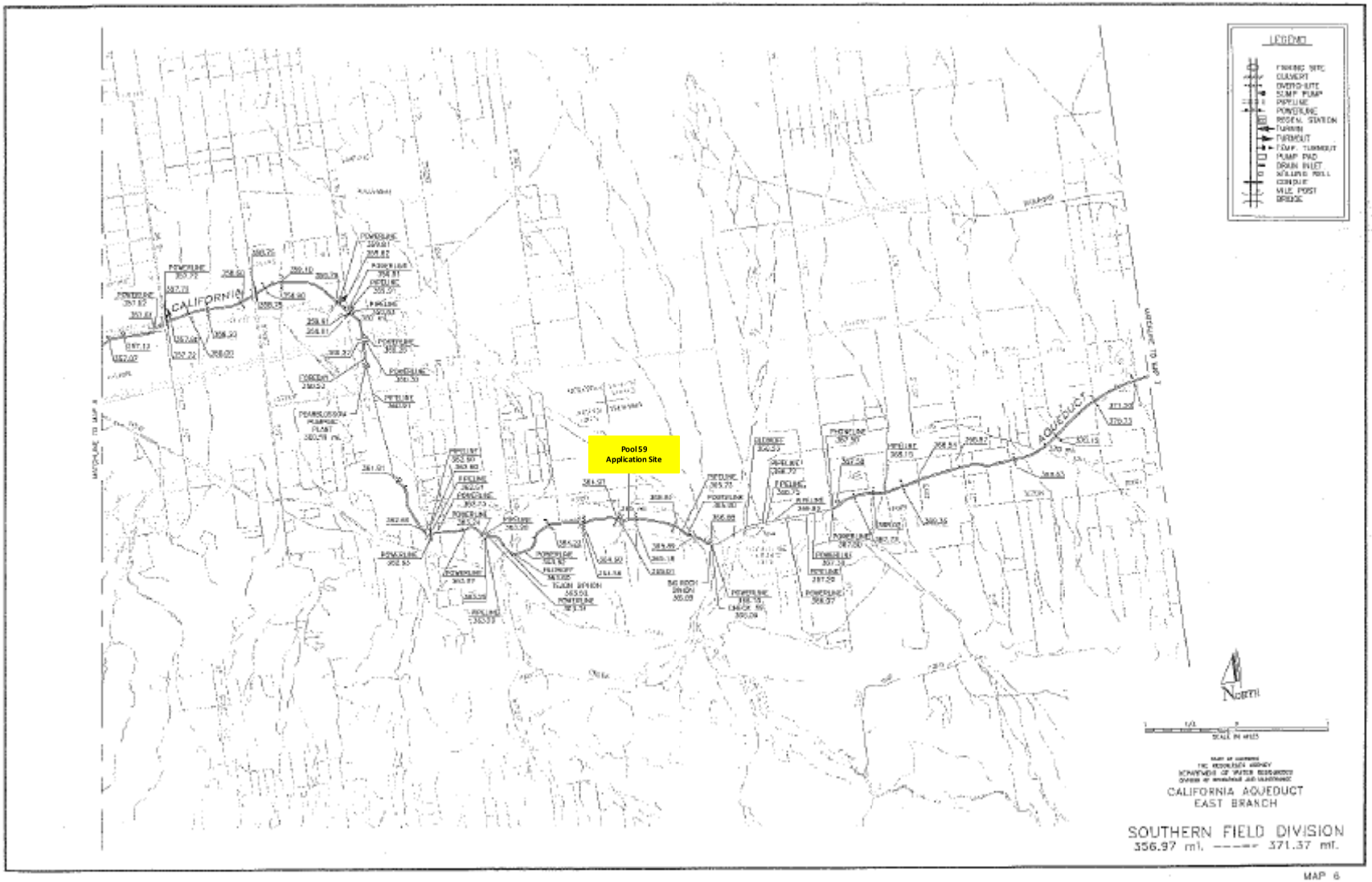
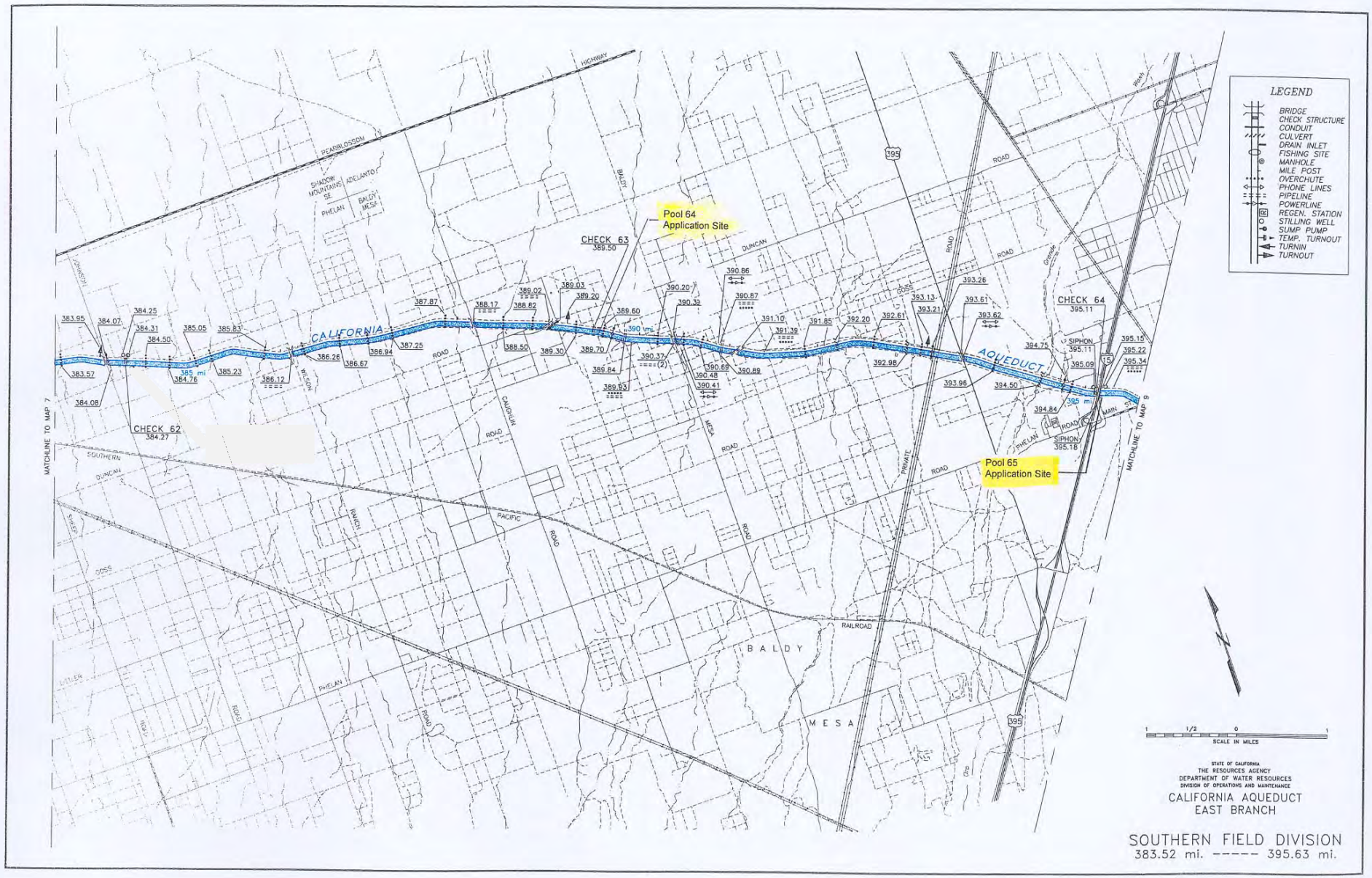


Figure 7. East Branch California Aqueduct from Miles 383.52 to 395.63 showing location of Application Sites (Pools 64 and 65)



N

0.5

Miles

Map Citations:
Main: ESRI Street Map
Inset: ESRI Street Map

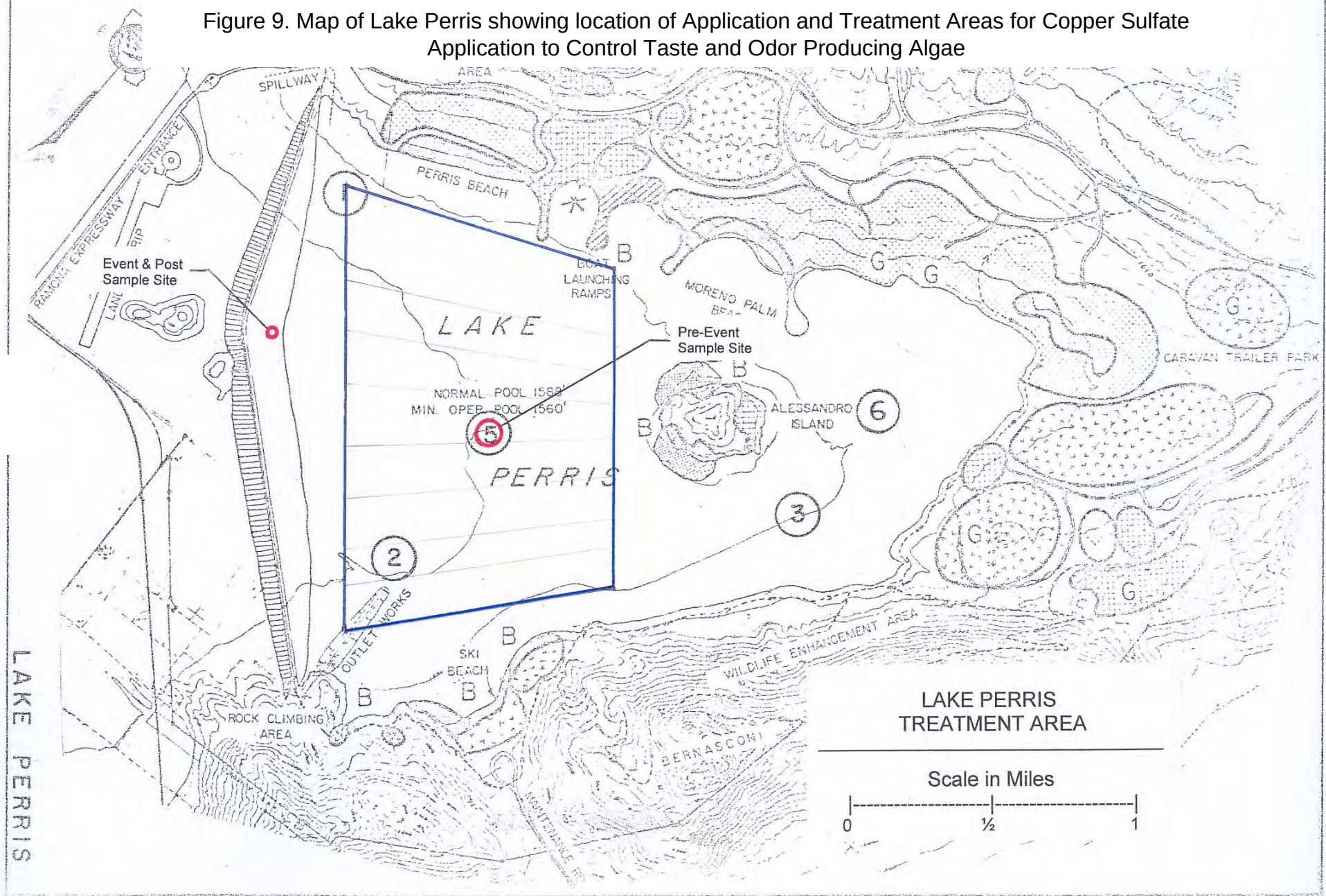
Figure 8 - Silverwood Lake Overview Map

San Bernardino County, CA
117°19'29.851"W
34°17'30.214"N

Legend

★ Sampling Sites
Station Name
(Station Number)

Figure 9. Map of Lake Perris showing location of Application and Treatment Areas for Copper Sulfate Application to Control Taste and Odor Producing Algae



TABLES

1 - 4

Table 1. Aquatic weed and algal bloom control program in the State Water Project and Regional Water Quality Control Board jurisdiction.

Locations Treated	Region (RWQCB)	County	Problem Biota	Associated Problems	Aquatic Pesticide
Treated in 2013					
South Bay Aqueduct	2	Alameda and Contra Costra	Diatoms; Cyanobacteria	Filter clogging Taste and odor, toxins	Copper sulfate
Coastal Branch Aqueduct	5	Kings and San Luis Obispo	Aquatic weeds, Cyanobacteria	Taste and odor, filter clogging, and toxins	Copper sulfate
Pyramid Lake	4	Los Angeles	Aquatic weeds	Swimming hazard	Littora (diquat)
Castaic Lake	4	Los Angeles	Cyanobacteria	Taste and odor	Copper sulfate
East Branch Aqueduct	6	Los Angeles, San Bernardino, Riverside	Cyanobacteria	Taste and odor	Copper sulfate
Silverwood Lake	6	San Bernardino	Cyanobacteria	Taste and odor	PAK®27 (sodium carbonate peroxyhydrate)
Lake Perris	8	Riverside	Cyanobacteria	Taste and odor	Copper sulfate
Treated in previous years, but not in 2013					
Clifton Court Forebay	5	Contra Costa	Aquatic weeds	*Reduce water flows, Impacts fish salvage at Skinner Fish Facility	--
			Cyanobacteria	Taste and odor, filter clogging, and toxins	--

* Creates operational problems by clogging trash racks and filters

RWQCB - Regional Water Quality Control Boards

Region 2	San Francisco Bay
Region 4	Los Angeles
Region 5	Central Valley
Region 6	Lahontan
Region 8	Santa Ana

TABLE 2. Types and amounts of aquatic pesticides applied to DWR reservoirs and aqueducts in 2013.

cfs = cubic feet/sec; AF = acre-feet

Location	Date of Treatment	Manufacturer and name of Product applied	EPA/CA Registration Number from Label	Total Product Used (lbs/gal)	Number of Applications	Acres/Units Treated
South Bay Aqueduct	3/5/13	Chem-One LTD Copper Sulfate Crystals	56576-1 52117-MEX-001	550 lb.	3 sites	123.9 cfs
	3/21/13	Chem- One LTD Copper Sulfate Crystals	56576-1 52117-MEX-001	600 lb.	3 sites	138.0 cfs
	4/9/13	Chem- One LTD Copper Sulfate Crystals	56576-1 52117-MEX-001	800 lb.	3 sites	189.2 cfs
	4/30/13	Chem- One LTD Copper Sulfate Crystals	56576-1 52117-MEX-001	1,100 lb.	3 sites	243.9 cfs
	5/14/13	Chem-One LTD Copper Sulfate Crystals	56576-1 52117-MEX-001	600 lb.	3 sites	146.7 cfs
	6/21/13	Chem- One LTD Copper Sulfate Crystals	56576-1 52117-MEX-001	1,100 lb.	3 sites	252.5 cfs
	7/9/13	Chem- One LTD Copper Sulfate Crystals	56576-1 52117-MEX-001	1,250 lb.	3 sites	280.4 cfs
	8/6/13	Chem-One LTD Copper Sulfate Crystals	56576-1 52117-MEX-001	1,150 lb.	3 sites	263.5 cfs
	8/22/13	Chem-One LTD Copper Sulfate Crystals	56576-1 52117-MEX-001	1,300 lb.	3 sites	298.2 cfs
	9/24/13	Chem-One LTD Copper Sulfate Crystals	56576-1 52117-MEX-002	550 lb.	2 sites	188.0 cfs
	10/16/13	Chem-One LTD Copper Sulfate Crystals	56576-1 52117-MEX-003	950 lb.	3 sites	216.0 cfs
	11/6/13	Chem-One LTD Copper Sulfate Crystals	56576-1 52117-MEX-002	900 lb.	3 sites	201.9 cfs
			Total	**10,850 lb.**		
Coastal Branch Aqueduct	3/20/13	Chem-One LTD. Copper Sulfate Pentahydrate	56576-1	450 lb.	3 sites	150 cfs
	4/10/13	Chem-One LTD. Copper Sulfate Pentahydrate	56576-1	4,900 lb.	7 sites	200-300 cfs
	5/17/13	Chem-One LTD. Copper Sulfate Pentahydrate	56576-1	4,900 lb.	7 sites	300 cfs
			Total	**lb.**		
	5/22/13	Nautique®	67690-10	375 gal.	1 site	300-411 cfs
			Total	**375 gal.**		
Pyramid Lake	9/17/13	Littora (diquat)	67690-53	30 gal.	1 site	20 surface acres
			Total	**30 gal.**		**20 surface acres**
Castaic Lake	6/11/13	Chem-One LTD Copper Sulfate Crystals	56576-1 52117-MX-001	16,000 lb.	1 site	25,000 AF
	7/31/13	Chem-One LTD Copper Sulfate Crystals	56576-1 52117-MX-001	16,000 lb.	1 site	25,000 AF
			Total	**32,000** lb.		**50,000 AF**

TABLE 2. (continued)

Location	Date of Treatment	Manufacturer and name of Product applied	EPA/CA Registration Number from Label	Total Product Used (lbs/gal)	Number of Applications	Acres/Units Treated
East Branch California Aqueduct	2/21/13	Chem-One LTD Copper Sulfate Crystals	56576-1 52117-MX-001	1000 lb.	2 sites	467 AF
			Total	**1,000 lb.**		**467 AF**
	1/16/13	Captain™	67690-9	212 gal.	1 site	560 cfs
	2/14/13		67690-9	304 gal.	2 sites	750 cfs
	2/15/13		67690-9	304 gal.	2 sites	750 cfs
			Total	**820 gal.**		
Silverwood Lake	8/27/13	PAK®27	68660-9-67690	58,201 lb.	1 site	970 surface acres
			Total	**58,201 lb.**		**970 surface acres**
Lake Perris	8/27/13	Chem-One LTD Copper Sulfate Crystals	56576-1 52117-MX-001	8,000 lb.	1 site	12,000 AF
			Total	**8,000 lb.**		**12,000 AF**

Table 3. South Bay Aqueduct water quality monitoring data, 2013.

Agency	Station Code	Water body	Sample Location	Sample Type	SampleDate	Depth (feet)	Analyte	Conc.	Rpt. Limit	Units
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Pre-Event	3/4/2013 11:25	1	Dissolved calcium	25	1	mg/L
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Pre-Event	3/4/2013 11:25	1	Dissolved copper	0.002	0.001	mg/L
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Pre-Event	3/4/2013 11:25	1	Dissolved hardness	121	1	mg/L as Ca CO_3
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Pre-Event	3/4/2013 11:25	1	Dissolved magnesium	14	1	mg/L
DWR	KB001350	South Bay Aqueduct	Milepost 13.5	Event	3/5/2013 13:10	1	Dissolved calcium	25	1	mg/L
DWR	KB001350	South Bay Aqueduct	Milepost 13.5	Event	3/5/2013 13:10	1	Dissolved copper	0.032	0.001	mg/L
DWR	KB001350	South Bay Aqueduct	Milepost 13.5	Event	3/5/2013 13:10	1	Dissolved hardness	119	1	mg/L as Ca CO_3
DWR	KB001350	South Bay Aqueduct	Milepost 13.5	Event	3/5/2013 13:10	1	Dissolved magnesium	14	1	mg/L
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Post-Event	3/11/2013 11:40	1	Dissolved calcium	25	1	mg/L
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Post-Event	3/11/2013 11:40	1	Dissolved copper	0.002	0.001	mg/L
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Post-Event	3/11/2013 11:40	1	Dissolved hardness	120	1	mg/L as Ca CO_3
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Post-Event	3/11/2013 11:40	1	Dissolved magnesium	14	1	mg/L
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Pre-Event	3/19/2013 14:45	1	Dissolved calcium	25	1	mg/L
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Pre-Event	3/19/2013 14:45	1	Dissolved copper	0.002	0.001	mg/L
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Pre-Event	3/19/2013 14:45	1	Dissolved hardness	125	1	mg/L as Ca CO_3
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Pre-Event	3/19/2013 14:45	1	Dissolved magnesium	15	1	mg/L
DWR	KB001350	South Bay Aqueduct	Milepost 13.5	Event	3/21/2013 12:30	1	Dissolved calcium	25	1	mg/L
DWR	KB001350	South Bay Aqueduct	Milepost 13.5	Event	3/21/2013 12:30	1	Dissolved copper	0.041	0.001	mg/L
DWR	KB001350	South Bay Aqueduct	Milepost 13.5	Event	3/21/2013 12:30	1	Dissolved hardness	122	1	mg/L as Ca CO_3
DWR	KB001350	South Bay Aqueduct	Milepost 13.5	Event	3/21/2013 12:30	1	Dissolved magnesium	15	1	mg/L
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Post-Event	3/25/2013 11:45	1	Dissolved calcium	24	1	mg/L
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Post-Event	3/25/2013 11:45	1	Dissolved copper	0.003	0.001	mg/L
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Post-Event	3/25/2013 11:45	1	Dissolved hardness	118	1	mg/L as Ca CO_3
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Post-Event	3/25/2013 11:45	1	Dissolved magnesium	14	1	mg/L
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Pre-Event	4/8/2013 12:15	1	Dissolved calcium	31	1	mg/L
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Pre-Event	4/8/2013 12:15	1	Dissolved copper	0.002	0.001	mg/L
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Pre-Event	4/8/2013 12:15	1	Dissolved hardness	157	1	mg/L as Ca CO_3
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Pre-Event	4/8/2013 12:15	1	Dissolved magnesium	19	1	mg/L
DWR	KB001350	South Bay Aqueduct	Milepost 13.5	Event	4/9/2013 11:45	1	Dissolved calcium	33	1	mg/L
DWR	KB001350	South Bay Aqueduct	Milepost 13.5	Event	4/9/2013 11:45	1	Dissolved copper	0.563	0.001	mg/L
DWR	KB001350	South Bay Aqueduct	Milepost 13.5	Event	4/9/2013 11:45	1	Dissolved hardness	169	1	mg/L as Ca CO_3
DWR	KB001350	South Bay Aqueduct	Milepost 13.5	Event	4/9/2013 11:45	1	Dissolved magnesium	21	1	mg/L
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Post-Event	4/15/2013 12:40	1	Dissolved calcium	37	1	mg/L
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Post-Event	4/15/2013 12:40	1	Dissolved copper	0.002	0.001	mg/L
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Post-Event	4/15/2013 12:40	1	Dissolved hardness	187	1	mg/L as Ca CO_3
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Post-Event	4/15/2013 12:40	1	Dissolved magnesium	23	1	mg/L

Table 3. (continued)

Agency	Station Code	Water body	Sample Location	Sample Type	SampleDate	Depth (feet)	Analyte	Conc.	Rpt. Limit	Units
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Pre-Event	4/29/2013 10:45	1	Dissolved calcium	24	1	mg/L
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Pre-Event	4/29/2013 10:45	1	Dissolved copper	0.002	0.001	mg/L
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Pre-Event	4/29/2013 10:45	1	Dissolved hardness	117	1	mg/L as Ca CO_3
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Pre-Event	4/29/2013 10:45	1	Dissolved magnesium	14	1	mg/L
DWR	KB001350	South Bay Aqueduct	Milepost 13.5	Event	4/30/2013 11:30	1	Dissolved calcium	22	1	mg/L
DWR	KB001350	South Bay Aqueduct	Milepost 13.5	Event	4/30/2013 11:30	1	Dissolved copper	0.502	0.001	mg/L
DWR	KB001350	South Bay Aqueduct	Milepost 13.5	Event	4/30/2013 11:30	1	Dissolved hardness	110	1	mg/L as Ca CO_3
DWR	KB001350	South Bay Aqueduct	Milepost 13.5	Event	4/30/2013 11:30	1	Dissolved magnesium	13	1	mg/L
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Post-Event	5/6/2013 10:40	1	Dissolved calcium	17	1	mg/L
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Post-Event	5/6/2013 10:40	1	Dissolved copper	0.002	0.001	mg/L
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Post-Event	5/6/2013 10:40	1	Dissolved hardness	87	1	mg/L as Ca CO_3
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Post-Event	5/6/2013 10:40	1	Dissolved magnesium	11	1	mg/L
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Pre-Event	5/13/2013 12:45	1	Dissolved calcium	16	1	mg/L
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Pre-Event	5/13/2013 12:45	1	Dissolved copper	0.002	0.001	mg/L
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Pre-Event	5/13/2013 12:45	1	Dissolved hardness	76	1	mg/L as Ca CO_3
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Pre-Event	5/13/2013 12:45	1	Dissolved magnesium	9	1	mg/L
DWR	KB001350	South Bay Aqueduct	Milepost 13.5	Event	5/14/2013 12:35	1	Dissolved calcium	16	1	mg/L
DWR	KB001350	South Bay Aqueduct	Milepost 13.5	Event	5/14/2013 12:35	1	Dissolved copper	0.024	0.001	mg/L
DWR	KB001350	South Bay Aqueduct	Milepost 13.5	Event	5/14/2013 12:35	1	Dissolved hardness	77	1	mg/L as Ca CO_3
DWR	KB001350	South Bay Aqueduct	Milepost 13.5	Event	5/14/2013 12:35	1	Dissolved magnesium	9	1	mg/L
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Post-Event	5/20/2013 12:50	1	Dissolved calcium	18	1	mg/L
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Post-Event	5/20/2013 12:50	1	Dissolved copper	0.002	0.001	mg/L
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Post-Event	5/20/2013 12:50	1	Dissolved hardness	84	1	mg/L as Ca CO_3
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Post-Event	5/20/2013 12:50	1	Dissolved magnesium	10	1	mg/L
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Pre-Event	6/20/2013 15:05	1	Dissolved calcium	19	1	mg/L
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Pre-Event	6/20/2013 15:05	1	Dissolved copper	0.002	0.001	mg/L
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Pre-Event	6/20/2013 15:05	1	Dissolved hardness	93	1	mg/L as Ca CO_3
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Pre-Event	6/20/2013 15:05	1	Dissolved magnesium	11	1	mg/L
DWR	KB001350	South Bay Aqueduct	Milepost 13.5	Event	6/21/2013 11:20	1	Dissolved calcium	18	1	mg/L
DWR	KB001350	South Bay Aqueduct	Milepost 13.5	Event	6/21/2013 11:20	1	Dissolved copper	0.3	0.001	mg/L
DWR	KB001350	South Bay Aqueduct	Milepost 13.5	Event	6/21/2013 11:20	1	Dissolved hardness	93	1	mg/L as Ca CO_3
DWR	KB001350	South Bay Aqueduct	Milepost 13.5	Event	6/21/2013 11:20	1	Dissolved magnesium	12	1	mg/L
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Post-Event	6/24/2013 13:15	1	Dissolved calcium	18	1	mg/L
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Post-Event	6/24/2013 13:15	1	Dissolved copper	0.003	0.001	mg/L
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Post-Event	6/24/2013 13:15	1	Dissolved hardness	91	1	mg/L as Ca CO_3
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Post-Event	6/24/2013 13:15	1	Dissolved magnesium	11	1	mg/L

Table 3. (continued)

Agency	Station Code	Water body	Sample Location	Sample Type	SampleDate	Depth (feet)	Analyte	Conc.	Rpt. Limit	Units
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Pre-Event	7/8/2013 10:20	1	Dissolved calcium	14	1	mg/L
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Pre-Event	7/8/2013 10:20	1	Dissolved copper	0.001	0.001	mg/L
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Pre-Event	7/8/2013 10:20	1	Dissolved hardness	71	1	mg/L as Ca CO_3
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Pre-Event	7/8/2013 10:20	1	Dissolved magnesium	9	1	mg/L
DWR	KB001350	South Bay Aqueduct	Milepost 13.5	Event	7/9/2013 11:05	1	Dissolved calcium	14	1	mg/L
DWR	KB001350	South Bay Aqueduct	Milepost 13.5	Event	7/9/2013 11:05	1	Dissolved copper	0.401	0.001	mg/L
DWR	KB001350	South Bay Aqueduct	Milepost 13.5	Event	7/9/2013 11:05	1	Dissolved hardness	70	1	mg/L as Ca CO_3
DWR	KB001350	South Bay Aqueduct	Milepost 13.5	Event	7/9/2013 11:05	1	Dissolved magnesium	9	1	mg/L
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Post-Event	7/15/2013 12:30	1	Dissolved calcium	14	1	mg/L
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Post-Event	7/15/2013 12:30	1	Dissolved copper	0.002	0.001	mg/L
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Post-Event	7/15/2013 12:30	1	Dissolved hardness	72	1	mg/L as Ca CO_3
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Post-Event	7/15/2013 12:30	1	Dissolved magnesium	9	1	mg/L
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Pre-Event	8/5/2013 11:35	1	Dissolved calcium	14	1	mg/L
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Pre-Event	8/5/2013 11:35	1	Dissolved copper	0.001	0.001	mg/L
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Pre-Event	8/5/2013 11:35	1	Dissolved hardness	90	1	mg/L as Ca CO_3
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Pre-Event	8/5/2013 11:35	1	Dissolved magnesium	14	1	mg/L
DWR	KB001350	South Bay Aqueduct	Milepost 13.5	Event	8/6/2013 11:15	1	Dissolved calcium	14	1	mg/L
DWR	KB001350	South Bay Aqueduct	Milepost 13.5	Event	8/6/2013 11:15	1	Dissolved copper	0.394	0.001	mg/L
DWR	KB001350	South Bay Aqueduct	Milepost 13.5	Event	8/6/2013 11:15	1	Dissolved hardness	90	1	mg/L as Ca CO_3
DWR	KB001350	South Bay Aqueduct	Milepost 13.5	Event	8/6/2013 11:15	1	Dissolved magnesium	13	1	mg/L
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Post-Event	8/12/2013 12:45	1	Dissolved calcium	14	1	mg/L
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Post-Event	8/12/2013 12:45	1	Dissolved copper	0.002	0.001	mg/L
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Post-Event	8/12/2013 12:45	1	Dissolved hardness	91	1	mg/L as Ca CO_3
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Post-Event	8/12/2013 12:45	1	Dissolved magnesium	14	1	mg/L
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Pre-Event	8/20/2013 13:10	1	Dissolved calcium	14	1	mg/L
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Pre-Event	8/20/2013 13:10	1	Dissolved copper	0.002	0.001	mg/L
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Pre-Event	8/20/2013 13:10	1	Dissolved hardness	87	1	mg/L as Ca CO_3
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Pre-Event	8/20/2013 13:10	1	Dissolved magnesium	13	1	mg/L
DWR	KB001350	South Bay Aqueduct	Milepost 13.5	Event	8/22/2013 11:00	1	Dissolved calcium	14	1	mg/L
DWR	KB001350	South Bay Aqueduct	Milepost 13.5	Event	8/22/2013 11:00	1	Dissolved copper	0.417	0.001	mg/L
DWR	KB001350	South Bay Aqueduct	Milepost 13.5	Event	8/22/2013 11:00	1	Dissolved hardness	89	1	mg/L as Ca CO_3
DWR	KB001350	South Bay Aqueduct	Milepost 13.5	Event	8/22/2013 11:00	1	Dissolved magnesium	13	1	mg/L
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Post-Event	8/26/2013 11:55	1	Dissolved calcium	15	1	mg/L
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Post-Event	8/26/2013 11:55	1	Dissolved copper	0.003	0.001	mg/L
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Post-Event	8/26/2013 11:55	1	Dissolved hardness	92	1	mg/L as Ca CO_3
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Post-Event	8/26/2013 11:55	1	Dissolved magnesium	14	1	mg/L

Table 3. (continued)

Agency	Station Code	Water body	Sample Location	Sample Type	SampleDate	Depth (feet)	Analyte	Conc.	Rpt. Limit	Units
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Pre-Event	9/23/2013 12:05	1	Dissolved calcium	16	1	mg/L
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Pre-Event	9/23/2013 12:05	1	Dissolved copper	0.001	0.001	mg/L
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Pre-Event	9/23/2013 12:05	1	Dissolved hardness	103	1	mg/L as Ca CO_3
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Pre-Event	9/23/2013 12:05	1	Dissolved magnesium	16	1	mg/L
DWR	KB001350	South Bay Aqueduct	Milepost 13.5	Event	9/24/2013 11:30	1	Dissolved calcium	16	1	mg/L
DWR	KB001350	South Bay Aqueduct	Milepost 13.5	Event	9/24/2013 11:30	1	Dissolved copper	0.086	0.001	mg/L
DWR	KB001350	South Bay Aqueduct	Milepost 13.5	Event	9/24/2013 11:30	1	Dissolved hardness	104	1	mg/L as Ca CO_3
DWR	KB001350	South Bay Aqueduct	Milepost 13.5	Event	9/24/2013 11:30	1	Dissolved magnesium	16	1	mg/L
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Post-Event	9/30/2013 10:45	1	Dissolved calcium	16	1	mg/L
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Post-Event	9/30/2013 10:45	1	Dissolved copper	0.002	0.001	mg/L
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Post-Event	9/30/2013 10:45	1	Dissolved hardness	99	1	mg/L as Ca CO_3
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Post-Event	9/30/2013 10:45	1	Dissolved magnesium	15	1	mg/L
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Pre-Event	10/14/2013 11:55	1	Dissolved calcium	15	1	mg/L
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Pre-Event	10/14/2013 11:55	1	Dissolved copper	0.001	0.001	mg/L
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Pre-Event	10/14/2013 11:55	1	Dissolved hardness	95	1	mg/L as Ca CO_3
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Pre-Event	10/14/2013 11:55	1	Dissolved magnesium	14	1	mg/L
DWR	KB001350	South Bay Aqueduct	Milepost 13.5	Event	10/16/2013 11:30	1	Dissolved calcium	15	1	mg/L
DWR	KB001350	South Bay Aqueduct	Milepost 13.5	Event	10/16/2013 11:30	1	Dissolved copper	0.198	0.001	mg/L
DWR	KB001350	South Bay Aqueduct	Milepost 13.5	Event	10/16/2013 11:30	1	Dissolved hardness	96	1	mg/L as Ca CO_3
DWR	KB001350	South Bay Aqueduct	Milepost 13.5	Event	10/16/2013 11:30	1	Dissolved magnesium	14	1	mg/L
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Post-Event	10/21/2013 11:25	1	Dissolved calcium	15	1	mg/L
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Post-Event	10/21/2013 11:25	1	Dissolved copper	0.002	0.001	mg/L
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Post-Event	10/21/2013 11:25	1	Dissolved hardness	94	1	mg/L as Ca CO_3
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Post-Event	10/21/2013 11:25	1	Dissolved magnesium	14	1	mg/L
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Pre-Event	11/4/2013 11:50	1	Dissolved calcium	17.2	1	mg/L
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Pre-Event	11/4/2013 11:50	1	Dissolved copper	0.002	0.001	mg/L
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Pre-Event	11/4/2013 11:50	1	Dissolved hardness	96	1	mg/L as Ca CO_3
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Pre-Event	11/4/2013 11:50	1	Dissolved magnesium	13	1	mg/L
DWR	KB001350	South Bay Aqueduct	Milepost 13.5	Event	11/6/2013 11:20	1	Dissolved calcium	17.3	1	mg/L
DWR	KB001350	South Bay Aqueduct	Milepost 13.5	Event	11/6/2013 11:20	1	Dissolved copper	0.423	0.001	mg/L
DWR	KB001350	South Bay Aqueduct	Milepost 13.5	Event	11/6/2013 11:20	1	Dissolved hardness	98	1	mg/L as Ca CO_3
DWR	KB001350	South Bay Aqueduct	Milepost 13.5	Event	11/6/2013 11:20	1	Dissolved magnesium	13.4	1	mg/L
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Post-Event	11/12/2013 10:35	1	Dissolved calcium	18.5	1	mg/L
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Post-Event	11/12/2013 10:35	1	Dissolved copper	0.002	0.001	mg/L
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Post-Event	11/12/2013 10:35	1	Dissolved hardness	106	1	mg/L as Ca CO_3
DWR	KB001638	South Bay Aqueduct	Del Valle Check 7	Post-Event	11/12/2013 10:35	1	Dissolved magnesium	14.4	1	mg/L

Table 4. Castaic Lake, Lake Perris, and East Branch of the California Aqueduct water quality monitoring data, 2013.

Agency	Station Code	Water body	Sample Location	Sample Type	SampleDate	Depth (feet)	Analyte	Conc.	Rpt. Limit	Units
DWR	KA034374	East Branch Aqueduct	Check 52, Mile 343.74	Pre-Event	1/17/2013 0:00	1	Dissolved copper	0.002	0.001	mg/L
DWR	KA034374	East Branch Aqueduct	Check 52, Mile 343.74	Pre-Event	1/17/2013 0:00	1	Dissolved hardness	108	1	mg/L as $CaCO_3$
DWR	KA034374	East Branch Aqueduct	Check 52, Mile 343.74	Event	1/17/2013 7:30	1	Dissolved copper	NS	0.001	mg/L
DWR	KA034374	East Branch Aqueduct	Check 52, Mile 343.74	Event	1/17/2013 7:30	1	Dissolved hardness	NS	1	mg/L as $CaCO_3$
DWR	KA034374	East Branch Aqueduct	Check 52, Mile 343.74	Post-Event	1/17/2013 8:30	1	Dissolved copper	0.002	0.001	mg/L
DWR	KA034374	East Branch Aqueduct	Check 52, Mile 343.74	Post-Event	1/17/2013 8:30	1	Dissolved hardness	106	1	mg/L as $CaCO_3$
DWR	KA035270	East Branch Aqueduct	Check 55, Mile 352.70	Pre-Event	2/14/2013 7:00	1	Dissolved copper	0.002	0.001	mg/L
DWR	KA035270	East Branch Aqueduct	Check 55, Mile 352.70	Pre-Event	2/14/2013 7:00	1	Dissolved hardness	126	1	mg/L as $CaCO_3$
DWR	KA035270	East Branch Aqueduct	Check 55, Mile 352.70	Event	2/14/2013 10:00	1	Dissolved copper	0.43	0.001	mg/L
DWR	KA035270	East Branch Aqueduct	Check 55, Mile 352.70	Event	2/14/2013 10:00	1	Dissolved hardness	123	1	mg/L as $CaCO_3$
DWR	KA035270	East Branch Aqueduct	Check 55, Mile 352.70	Post-Event	2/14/2013 14:00	1	Dissolved copper	0.182	0.001	mg/L
DWR	KA035270	East Branch Aqueduct	Check 55, Mile 352.70	Post-Event	2/14/2013 14:00	1	Dissolved hardness	130	1	mg/L as $CaCO_3$
DWR	KA040032	East Branch Aqueduct	Check 65, Mile 400.32	Pre-Event	2/14/2013 7:05	1	Dissolved copper	0.003	0.001	mg/L
DWR	KA040032	East Branch Aqueduct	Check 65, Mile 400.32	Pre-Event	2/14/2013 7:05	1	Dissolved hardness	122	1	mg/L as $CaCO_3$
DWR	KA040032	East Branch Aqueduct	Check 65, Mile 400.32	Event	2/14/2013 11:05	1	Dissolved copper	0.012	0.001	mg/L
DWR	KA040032	East Branch Aqueduct	Check 65, Mile 400.32	Event	2/14/2013 11:05	1	Dissolved hardness	122	1	mg/L as $CaCO_3$
DWR	KA040032	East Branch Aqueduct	Check 65, Mile 400.32	Post-Event	2/14/2013 14:00	1	Dissolved copper	0.012	0.001	mg/L
DWR	KA040032	East Branch Aqueduct	Check 65, Mile 400.32	Post-Event	2/14/2013 14:00	1	Dissolved hardness	122	1	mg/L as $CaCO_3$
DWR	KA035270	East Branch Aqueduct	Check 55, Mile 352.70	Pre-Event	2/21/2013 6:30	1	Dissolved copper	0.002	0.001	mg/L
DWR	KA035270	East Branch Aqueduct	Check 55, Mile 352.70	Pre-Event	2/21/2013 6:30	1	Dissolved hardness	124	1	mg/L as $CaCO_3$
DWR	KA035270	East Branch Aqueduct	Check 55, Mile 352.70	Event	2/21/2013 10:30	1	Dissolved copper	0.442	0.001	mg/L
DWR	KA035270	East Branch Aqueduct	Check 55, Mile 352.70	Event	2/21/2013 10:30	1	Dissolved hardness	122	1	mg/L as $CaCO_3$
DWR	KA035270	East Branch Aqueduct	Check 55, Mile 352.70	Post-Event	2/21/2013 13:30	1	Dissolved copper	0.006	0.001	mg/L
DWR	KA035270	East Branch Aqueduct	Check 55, Mile 352.70	Post-Event	2/21/2013 13:30	1	Dissolved hardness	126	1	mg/L as $CaCO_3$
DWR	KA040032	East Branch Aqueduct	Check 65, Mile 400.32	Pre-Event	2/21/2013 6:45	1	Dissolved copper	0.002	0.001	mg/L
DWR	KA040032	East Branch Aqueduct	Check 65, Mile 400.32	Pre-Event	2/21/2013 6:45	1	Dissolved hardness	120	1	mg/L as $CaCO_3$
DWR	KA040032	East Branch Aqueduct	Check 65, Mile 400.32	Event	2/21/2013 10:45	1	Dissolved copper	0.016	0.001	mg/L
DWR	KA040032	East Branch Aqueduct	Check 65, Mile 400.32	Event	2/21/2013 10:45	1	Dissolved hardness	123	1	mg/L as $CaCO_3$
DWR	KA040032	East Branch Aqueduct	Check 65, Mile 400.32	Post-Event	2/21/2013 13:55	1	Dissolved copper	0.011	0.001	mg/L
DWR	KA040032	East Branch Aqueduct	Check 65, Mile 400.32	Post-Event	2/21/2013 13:55	1	Dissolved hardness	121	1	mg/L as $CaCO_3$

Table 4. (continued)

Agency	Station Code	Water body	Sample Location	Sample Type	SampleDate	Depth (feet)	Analyte	Conc.	Rpt. Limit	Units
DWR	CA002000	Castaic Lake	Castaic Lake Outlet Tower	Pre-Event	6/10/2013 8:00	1	Dissolved copper	0.002	0.001	mg/L
DWR	CA002000	Castaic Lake	Castaic Lake Outlet Tower	Pre-Event	6/10/2013 8:00	1	Dissolved hardness	117	1	mg/L as $CaCO_3$
DWR	CA006900	Castaic Lake	Castaic Lake Stn. Adj. to Copper Treatment	Event	6/11/2013 11:00	1	Dissolved copper	0.107	0.001	mg/L
DWR	CA006900	Castaic Lake	Castaic Lake Stn. Adj. to Copper Treatment	Event	6/11/2013 11:00	1	Dissolved hardness	115	1	mg/L as $CaCO_3$
DWR	CA006900	Castaic Lake	Castaic Lake Stn. Adj. to Copper Treatment	Post-Event	6/17/2013 8:00	1	Dissolved copper	0.019	0.001	mg/L
DWR	CA006900	Castaic Lake	Castaic Lake Stn. Adj. to Copper Treatment	Post-Event	6/17/2013 8:00	1	Dissolved hardness	115	1	mg/L as $CaCO_3$
DWR	CA002000	Castaic Lake	Castaic Lake Outlet Tower	Pre-Event	7/29/2013 9:00	1	Dissolved copper	0.004	0.001	mg/L
DWR	CA002000	Castaic Lake	Castaic Lake Outlet Tower	Pre-Event	7/29/2013 9:00	1	Dissolved hardness	115	1	mg/L as $CaCO_3$
DWR	CA006900	Castaic Lake	Castaic Lake Stn. Adj. to Copper Treatment	Event	7/31/2013 11:00	1	Dissolved copper	0.154	0.001	mg/L
DWR	CA006900	Castaic Lake	Castaic Lake Stn. Adj. to Copper Treatment	Event	7/31/2013 11:00	1	Dissolved hardness	118	1	mg/L as $CaCO_3$
DWR	CA006900	Castaic Lake	Castaic Lake Stn. Adj. to Copper Treatment	Post-Event	8/5/2013 8:15	1	Dissolved copper	0.022	0.001	mg/L
DWR	CA006900	Castaic Lake	Castaic Lake Stn. Adj. to Copper Treatment	Post-Event	8/5/2013 8:15	1	Dissolved hardness	119	1	mg/L as $CaCO_3$
DWR	PE005000	Lake Perris	Lake Perris W of Alessandro Island	Pre-Event	8/27/2013 7:40	1	Dissolved copper	0.002	0.001	mg/L
DWR	PE005000	Lake Perris	Lake Perris W of Alessandro Island	Pre-Event	8/27/2013 7:40	1	Dissolved hardness	122	1	mg/L as $CaCO_3$
DWR	PE002000	Lake Perris	Perris Lake @ Intake Tower	Event	8/27/2013 10:00	1	Dissolved copper	0.012	0.001	mg/L
DWR	PE002000	Lake Perris	Perris Lake @ Intake Tower	Event	8/27/2013 10:00	1	Dissolved hardness	123	1	mg/L as $CaCO_3$
DWR	PE002000	Lake Perris	Perris Lake @ Intake Tower	Post-Event	9/3/2013 8:00	1	Dissolved copper	0.01	0.001	mg/L
DWR	PE002000	Lake Perris	Perris Lake @ Intake Tower	Post-Event	9/3/2013 8:00	1	Dissolved hardness	121	1	mg/L as $CaCO_3$

APPENDICES

Dept. of Water Resources WDID# 5B01AP00001

2013 Annual NPDES Report

Pyramid Lake 2013 NPDES Annual Report to Los Angeles Region 4 for NPDES General Permit Water Quality Order 2004-0009-DWQ

2013 Aquatic Plant Control Operations for Pyramid Lake

Annual NPDES Report

Executive Summary

Pyramid Lake is a reservoir on the West Branch of the California Aqueduct at milepost 14.10 within the boundaries of the Los Angeles Regional Water Quality Control Board, Region 4. It has a surface area of 1,300 acres, a storage capacity of 171,200 acre-feet (AF), a length of 25,300 feet, and 21 miles of shoreline.

As a SWP reservoir, Pyramid Lake stores water that is delivered to the City of Los Angeles and other cities of Southern California. It also provides regulated storage for Castaic Powerplant, flood protection along Piru Creek, emergency storage for water deliveries from the West Branch, and various recreational uses including fishing and boating. Much of the shoreline of Pyramid Lake has a steep slope and narrow littoral zone, but the public use areas, docks, and beaches are located in shallow sloping areas and bays. The primary focus of the aquatic plant management efforts at Pyramid Lake is to maintain access, usability, and navigability of these areas, which have become impacted with aquatic weed growth.

The aquatic plant species present are the following: coontail *(Ceratophyllum demersum); s*ago pondweed *(Potamogeton pectinatus); w*idgeongrass *(Ruppia maritima);* and southern naiad *(Najas guadalupensis)*. These plants are all natives to the region, but can grow to nuisance levels when allowed to grow unchecked in shallow areas and controlled aquatic systems. They can form dense surface mats causing difficulty with navigation, as well as limiting water movement and providing conditions conducive to algae and cyanobacteria growth, as well as vector habitat.

In order to manage these water quality issues, the CA Dept.of Water Resources (DWR) developed an Aquatic Pesticide Application Plan (APAP) as directed by the General NPDES permit that allows for the discharge of aquatic herbicides to waters of the U.S. A Notice of Intent (NOI) was filed and the NOI and APAP were submitted to the Regional Water Quality Control Board in order to comply with the provisions of the Water Quality Order 2004-0009-DWQ, Statewide General National Pollution Discharge Elimination System Permit for Discharge of Aquatic Pesticides for Aquatic Weed Control in waters of the United States, General Permit No. CAG990005, CI8794.

AquaTechnex was the contractor charged with implementing aquatic plant management operations on the lake during the 2013 season. This report will summarize the activities conducted under this permit during the summer of 2013. The DWR and the contractor AquaTechnex, LLC were able to comply with all provisions of the APAP requirements during the 2013 treatment season as all treatment information and laboratory results for required monitoring events are available to support the aquatic weed treatment program implemented.

Treatment Program

AquaTechnex performed survey of the entire shoreline in order to determine species present, biovolume, and areas where beneficial uses were impacted by aquatic weed growth. Total acreage of plant was determined (132.3 acres see attached Treatment Area Maps), and an aquatic herbicide was selected that could provide the required level of control, while not impacting the primary use of the reservoir as a potable water supply.

The 2013 treatment program for aquatic weed control at Pyramid Lake was centered around the contact herbicide Littora (diquat dibromide). This herbicide was selected due to its rapid uptake into exposed areas of the target plants, as well as for its rapid dissipation in the water column. In order to minimize the treatment time and the need to close gate structures or limit discharge from the lake, treatment was scheduled for all designated areas in one event. Treatment was performed on 9/17/13. Due to this late season treatment date, much of the originally mapped biomass had senesced and receded form the surface, thus what was originally identified as 132 acres of plant biovolume resulted in only 6.5 acres worth of treatment.

Summary of Monitoring Data

The monitoring data included in the NPDES application logs, and the NPDES Receiving Water Monitoring Reports and the Herbicide Residue reports are attached in Appendix I.

The control of excess aquatic weed growth resulted in open waterway and reduction of the impact on the beneficial uses of the lake. Water quality parameters are generally depressed in areas with severe aquatic weed growth so these treatments benefited the lake in that regard as well.

As outlined in the State General Permit, the USEPA based numeric objectives or criteria for the herbicide(s) used are provided in the table below.

Constituent/Parameter	MUN	Warm or Cold	Other than MUN Warm or Cold	All Designations
Diquat	20µg/L			
Toxicity				Applications shall not cause or contribute to toxicity

The General Permit requires dischargers to monitor their applications. Pre and post treatment water samples were collected and analyzed for the herbicide/algaecide applied in addition to other supporting water quality parameters.

Discussion of BMP's Effectiveness
The BMP's outlined in the APAP were effective in meeting General Permit Requirements.

BMP Modifications
No BMP modifications are recommended at this time as there were no violations of the general permit.

Treatment Map
A map indicating the treatment area has been provided in the appendix to this report.

Type and Amount of Herbicide Used
The aquatic herbicide Littora (diquat) was applied at a rate of 1.15 gallons per acre to approximately 6.5 acres of weed growth, for a total herbicide use of 7.5 gallons.

Aquatic Herbicide/Algaecide	Active Ingredient	Total Quantity used (gallons or pounds)	Total Applications
Littora	Diquat dibromide	gallons	7.5

Treatment Area Calculations
To determine applications rates, the total water volume of the treatment area is obtained by multiplying length x width x depth, and the desired diquat concentration is determined based on the label recommendations for specific areas and plant density.

Gate Structures
DWR maintains the following gate structures on Pyramid Lake. All gates were closed during treatment activity and setbacks were observed from potable water intakes as per label recommendation.

•Raw Water Intake at Vista Del Lago: outflow to water treatment facility

•Angeles Tunnel Intake Slide Gate: bottom draw, supplies water to LADWP potable water outflow to Castaic Lake

•Radial Gate: top draw for storm overflow

•Stream Release Valves: storm water retention area feed to Piru Creek, bottom draw

Sampling Results
Sampling results are included in appendix I.

Proposed APAP Changes
The APAP submitted for Pyramid Lake indicated that the primary nuisance aquatic plant present was Eurasian water milfoil. Vegetation mapping and species identification resulted in no milfoil presence.

End of Annual Report
Appendix I:

Herbicide Application Reports NPDES
Pesticide Application Log Herbicide
Treatment Area Maps
Laboratory Reports
Certification

Appendix I

Date of Application: 9/17/13	**Location:** Pyramid Lake	**Approx. Application Start Time:** 11:00 a.m. **Approx. Application End Time:** 1:30 p.m.
Applicator name: Ian Cormican	APAP Certification: IC	

Discharge Gates or Control Structures

Name:	Date Closed:	Time Closed:	Date Open:	Time Opened:
See above listed gate structures	9/17/13	7:00a.m.	9/18/13	7:00am ***setback observed from control structures resulted in an excess of 4 days required for treated water to reach discharge gates

Calculations to Determine Opening and Closures:

Application Details

Plot Number	**Area (ac. or sq.feet)**	**Average Depth:**	**Product:**	**Product Quantity:**	**Concentration or Rate:**
1	6.5 acres	14feet	Littora (diquat dibromide)	7.5 gallons	1.15 gallons per acre

Date of Application:9/1713	**Location:** Pyramid Lake	**Applicator Name: Ian Cormican**

Attach map showing application area, treatment area, immediately adjacent untreated area, and water bodies receiving treated water.

1. Provide information on surface area and/or volume of application area and treatment area and other information used to calculate dosage and quantity of each pesticide used at each application site:

1a. Application Area – Surface Area: 1,300 acres

1b. Application Area – Volume: 171,200 acre feet

1c. Treatment Area – Surface area: 6.5 acres/91 acre feet

1e. Dosage and Quantity Information for each pesticide used: 7.5 gallons of Littora to treat 6.5 acres at 1.15 gal/acre

Site Description (pond, lake, channel, weed type, percent area impacted,): 6.5 acres of shoreline average depth 14 feet; steep shoreline slope creates a narrow littoral zone, shallow bays were the primary areas impacted, treatment was focused on public use beaches, which were approximately 30% impacted due to late season senescence of aquatic plants

Waterway Appearance (color, clarity, sheen,…): Water clarity good, approximately 65" Secchi; some surface blue green algae, some floating defoliated plants;Weather Conditions (fog, rain, wind,): Clear 79°F, clear, wind at 13mph.

1. **Background Monitoring Parameters:** (u/s or at treatment area up to 24 hours before or at time of treatment)			**Date:** 9/17/13
Physical Sample Type (3 feet below water surface)	**Temperature1**	**Turbidity2**	**Electrical Conductivity/Salinity2**
	27.8°C	**1.6 NTU**	**4200µS/cm**
Chemical Sample Type (3 feet below water surface)	**Active Ingredient**	**Nonylphenol3**	**pH2**
	Diquat- No Detect	N/A	8.68
	Dissolved Oxygen	**Hardness (CaCO3)4**	**GPS latitude and longitude coordinates**
	7.18mg/l	**N/A**	**34°39'41.15""N 118° 45'56.55"W**
2. **Event Monitoring Parameters**: (d/s or immediately adjacent to treatment area immediately after application)			**Date 9/17/13**
Physical Sample Type (3 feet below water surface)	**Temperature1**	**Turbidity2**	**Electrical Conductivity/Salinity2**
	27.6°F	**1.7 NTU**	**4300µS/cm**
Chemical Sample Type (3 feet below water surface)	**Active Ingredient**	**Nonylphenol3**	**pH2**
	Diquat—Non Detect	N/A	8.54
	Dissolved Oxygen2	**Hardness (CaCO3)4**	**GPS latitude and longitude coordinates**
	7.72	**N/A**	**34°39'29.72""N 118° 46'03.30"W**
3. **Post Event Monitoring Parameters:** (w/i treatment area + immediately d/s in flowing water or adjacent to treatment area w/i 1 week)			**Date 9/23/13**
Physical Sample Type (3 feet below water surface)	**Temperature1**	**Turbidity2**	**Electrical Conductivity/Salinity2**
	79.8°F	.46 NTU	**3900µS/cm**
Chemical Sample Type (3 feet below water surface)	**Active Ingredient**	**Nonylphenol3**	**pH2**
	Diquat-No Detect	N/A	7.96
	Dissolved Oxygen2	**Hardness (CaCO3)4**	**GPS latitude and longitude coordinates**
	7.95	N/A	**34°39'41.15""N 118° 45'56.55"W**

***per Permit guidelines, allowable concentration for copper is .095 mg/L*

NA=Not Applicable
mg/L= milligrams per liter
µg/L= micrograms per liter
d/s=downstream
u/s=upstream
NTU=Nephelometric Turbidity Units

Treatment Area Map

Laboratory Reports

CERTIFICATE OF ANALYSIS

Client: AquaTechnex, LLC
70-100 Mirage Cove Drive #28
Rancho Mirage CA, 92270

Attention: Ian Cormican

Phone: (760) 272-5842

Fax: -

Work Order(s): 3I18030

Report Date: 10/01/13 14:19

Received Date: 09/18/13 14:00

Turn Around: Normal

Client Project: Pyramid Lake

NELAP #04229CA ELAP#1132 NEVADA #CA211 HAWAII LACSD #10143

The results in this report apply to the samples analyzed in accordance with the Chain of Custody document. Weck Laboratories, Inc. certifies that the test results meet all NELAC requirements unless noted in the case narrative. This analytical report is confidential and is only intended for the use of Weck Laboratories, Inc. and its client. This report contains the Chain of Custody document, which is an integral part of it, and can only be reproduced in full with the authorization of Weck Laboratories, Inc.

Dear Ian Cormican :

Enclosed are the results of analyses for samples received 09/18/13 14:00 with the Chain of Custody document. The samples were received in good condition, at 2.9 °C and on ice. All analysis met the method criteria except as noted below or in the report with data qualifiers.

Case Narrative:

Reviewed by:

Brandon Gee
Project Manager

AquaTechnex, LLC
70-100 Mirage Cove Drive #28
Rancho Mirage CA, 92270

Date Received: 09/18/13 14:00
Date Reported: 10/01/13 14:19

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Sampled by:	Sample Comments	Lab ID	Matrix	Date Sampled
PL1 Pre Event	I.Cormican		3I18030-01	Water	09/17/13 13:30
PL2 Event	I.Cormican		3I18030-02	Water	09/17/13 14:30

ANALYSES

Conventional Chemistry/Physical Parameters by APHA/EPA/ASTM Methods

Diquat and Paraquat by EPA 549.2

Weck Laboratories, Inc 14859 East Clark Avenue, City of Industry, California 91745-1396 (626) 336-2139 FAX (626) 336-2634

AquaTechnex, LLC
70-100 Mirage Cove Drive #28
Rancho Mirage CA, 92270

Date Received: 09/18/13 14:00
Date Reported: 10/01/13 14:19

3I18030-01 PL1 Pre Event

Sampled: 09/17/13 13:30 **Sampled By:** I.Cormican **Matrix:** Water

Conventional Chemistry/Physical Parameters by APHA/EPA/ASTM Methods

Method: EPA 180.1 Batch: W3I0827 Prepared: 09/18/13 16:08 Analyst: ajp

Analyte	Result	MRL	Units	Dil	Analyzed	Qualifier
Turbidity	**1.6**	0.10	NTU	1	09/18/13 17:20	

Diquat and Paraquat by EPA 549.2

Method: EPA 549.2 Batch: W3I0926 Prepared: 09/20/13 07:40 Analyst: cwh

Analyte	Result	MRL	Units	Dil	Analyzed	Qualifier
Diquat	ND	4.0	ug/l	1	09/24/13 11:46	

AquaTechnex, LLC
70-100 Mirage Cove Drive #28
Rancho Mirage CA, 92270

Date Received: 09/18/13 14:00
Date Reported: 10/01/13 14:19

3I18030-02 PL2 Event

Sampled: 09/17/13 14:30 **Sampled By:** I.Cormican **Matrix:** Water

Conventional Chemistry/Physical Parameters by APHA/EPA/ASTM Methods

Method: EPA 180.1 Batch: W3I0827 Prepared: 09/18/13 16:08 Analyst: ajp

Analyte	Result	MRL	Units	Dil	Analyzed	Qualifier
Turbidity	**1.7**	0.10	NTU	1	09/18/13 17:20	

Diquat and Paraquat by EPA 549.2

Method: EPA 549.2 Batch: W3I0926 Prepared: 09/20/13 07:40 Analyst: cwh

Analyte	Result	MRL	Units	Dil	Analyzed	Qualifier
Diquat	ND	4.0	ug/l	1	09/24/13 11:46	

Weck Laboratories, Inc 14859 East Clark Avenue, City of Industry, California 91745-1396 (626) 336-2139 FAX (626) 336-2634

AquaTechnex, LLC
70-100 Mirage Cove Drive #28
Rancho Mirage CA, 92270

Date Received: 09/18/13 14:00
Date Reported: 10/01/13 14:19

QUALITY CONTROL SECTION

AquaTechnex, LLC
70-100 Mirage Cove Drive #28
Rancho Mirage CA, 92270

Date Received: 09/18/13 14:00
Date Reported: 10/01/13 14:19

Conventional Chemistry/Physical Parameters by APHA/EPA/ASTM Methods - Quality Control

Batch W3I0827 - EPA 180.1

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	% REC Limits	RPD	RPD Limit	Data Qualifiers
Blank (W3I0827-BLK1)				Analyzed: 09/18/13 17:20						
Turbidity	ND	0.10	NTU							
LCS (W3I0827-BS1)				Analyzed: 09/18/13 17:20						
Turbidity	11.0	0.10	NTU	11.0		100	90-110			
Duplicate (W3I0827-DUP1)	**Source: 3I18011-03**			Analyzed: 09/18/13 17:20						
Turbidity	0.0600	0.10	NTU		0.0700			15	10	R-03

Diquat and Paraquat by EPA 549.2 - Quality Control

Batch W3I0926 - EPA 549.2

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	% REC Limits	RPD	RPD Limit	Data Qualifiers
Blank (W3I0926-BLK1)				Analyzed: 09/24/13 11:46						
Diquat	ND	4.0	ug/l							
LCS (W3I0926-BS1)				Analyzed: 09/24/13 11:46						
Diquat	16.9	4.0	ug/l	20.0		84	48-130			
Matrix Spike (W3I0926-MS1)	**Source: 3I17040-01**			Analyzed: 09/24/13 11:46						
Diquat	15.6	4.0	ug/l	20.0	ND	78	46-122			
Matrix Spike Dup (W3I0926-MSD1)	**Source: 3I17040-01**			Analyzed: 09/24/13 11:46						
Diquat	15.5	4.0	ug/l	20.0	ND	78	46-122	0.4	30	

AquaTechnex, LLC
70-100 Mirage Cove Drive #28
Rancho Mirage CA, 92270

Date Received: 09/18/13 14:00
Date Reported: 10/01/13 14:19

Notes and Definitions

R-03	The RPD is not applicable for result below the reporting limit (either ND or J value).
ND	NOT DETECTED at or above the Reporting Limit. If J-value reported, then NOT DETECTED at or above the Method Detection Limit (MDL)
NR	Not Reportable
Dil	Dilution
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference
% Rec	Percent Recovery
Sub	Subcontracted analysis, original report available upon request
MDL	Method Detection Limit
MDA	Minimum Detectable Activity
MRL	Method Reporting Limit

Any remaining sample(s) will be disposed of one month from the final report date unless other arrangements are made in advance.

An Absence of Total Coliform meets the drinking water standards as established by the California Department of Health Services.

The Reporting Limit (RL) is referenced as the Laboratory's Practical Quantitation Limit (PQL) or the Detection Limit for Reporting Purposes (DLR).

All samples collected by Weck Laboratories have been sampled in accordance to laboratory SOP Number MIS002.

Weck Laboratories, Inc 14859 East Clark Avenue, City of Industry, California 91745-1396 (626) 336-2139 FAX (626) 336-2634

CERTIFICATE OF ANALYSIS

Client: AquaTechnex, LLC
70-100 Mirage Cove Drive #28
Rancho Mirage CA, 92270

Attention: Ian Cormican

Phone: (760) 272-5842

Fax: -

Work Order(s): 3I23063

Report Date: 10/10/13 14:59

Received Date: 09/23/13 13:00

Turn Around: Normal

Client Project: PL-3 post Event

NELAP #04229CA ELAP#1132 NEVADA #CA211 HAWAII LACSD #10143

The results in this report apply to the samples analyzed in accordance with the Chain of Custody document. Weck Laboratories, Inc. certifies that the test results meet all NELAC requirements unless noted in the case narrative. This analytical report is confidential and is only intended for the use of Weck Laboratories, Inc. and its client. This report contains the Chain of Custody document, which is an integral part of it, and can only be reproduced in full with the authorization of Weck Laboratories, Inc.

Dear Ian Cormican :

Enclosed are the results of analyses for samples received 09/23/13 13:00 with the Chain of Custody document. The samples were received in good condition, at 10.4 °C and on ice. All analysis met the method criteria except as noted below or in the report with data qualifiers.

Case Narrative:

Reviewed by:

Brandon Gee
Project Manager

AquaTechnex, LLC
70-100 Mirage Cove Drive #28
Rancho Mirage CA, 92270

Date Received: 09/23/13 13:00
Date Reported: 10/10/13 14:59

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Sampled by:	Sample Comments	Lab ID	Matrix	Date Sampled
PL-3 Post Event	Kevin Pulver		3I23063-01	Water	09/23/13 11:00

ANALYSES

Conventional Chemistry/Physical Parameters by APHA/EPA/ASTM Methods

Diquat and Paraquat by EPA 549.2

AquaTechnex, LLC
70-100 Mirage Cove Drive #28
Rancho Mirage CA, 92270

Date Received: 09/23/13 13:00
Date Reported: 10/10/13 14:59

3I23063-01 PL-3 Post Event

Sampled: 09/23/13 11:00 **Sampled By:** Kevin Pulver **Matrix:** Water

Conventional Chemistry/Physical Parameters by APHA/EPA/ASTM Methods

Method: EPA 180.1 Batch: W3I1056 Prepared: 09/23/13 16:09 Analyst: ajp

Analyte	Result	MRL	Units	Dil	Analyzed	Qualifier
Turbidity	**0.46**	0.10	NTU	1	09/24/13 12:51	

Diquat and Paraquat by EPA 549.2

Method: EPA 549.2 Batch: W3I1142 Prepared: 09/25/13 09:59 Analyst: cwh

Analyte	Result	MRL	Units	Dil	Analyzed	Qualifier
Diquat	ND	4.0	ug/l	1	09/26/13 11:40	

AquaTechnex, LLC
70-100 Mirage Cove Drive #28
Rancho Mirage CA, 92270

Date Received: 09/23/13 13:00
Date Reported: 10/10/13 14:59

QUALITY CONTROL SECTION

AquaTechnex, LLC
70-100 Mirage Cove Drive #28
Rancho Mirage CA, 92270

Date Received: 09/23/13 13:00
Date Reported: 10/10/13 14:59

Conventional Chemistry/Physical Parameters by APHA/EPA/ASTM Methods - Quality Control

Batch W3I1056 - EPA 180.1

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	% REC Limits	RPD	RPD Limit	Data Qualifiers
Blank (W3I1056-BLK1)				Analyzed: 09/24/13 12:51						
Turbidity	ND	0.10	NTU							
LCS (W3I1056-BS1)				Analyzed: 09/24/13 12:51						
Turbidity	10.9	0.10	NTU	11.0		99	90-110			
Duplicate (W3I1056-DUP1)	**Source: 3I23057-04**			Analyzed: 09/24/13 12:51						
Turbidity	ND	0.10	NTU		ND					

Diquat and Paraquat by EPA 549.2 - Quality Control

Batch W3I1142 - EPA 549.2

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	% REC Limits	RPD	RPD Limit	Data Qualifiers
Blank (W3I1142-BLK1)				Analyzed: 09/26/13 11:40						
Diquat	ND	4.0	ug/l							
LCS (W3I1142-BS1)				Analyzed: 09/26/13 11:40						
Diquat	15.2	4.0	ug/l	20.0		76	48-130			
Matrix Spike (W3I1142-MS1)	**Source: 3I20039-01**			Analyzed: 09/26/13 11:40						
Diquat	21.3	4.0	ug/l	20.0	ND	106	46-122			
Matrix Spike Dup (W3I1142-MSD1)	**Source: 3I20039-01**			Analyzed: 09/26/13 11:40						
Diquat	17.7	4.0	ug/l	20.0	ND	88	46-122	18	30	

AquaTechnex, LLC
70-100 Mirage Cove Drive #28
Rancho Mirage CA, 92270

Date Received: 09/23/13 13:00
Date Reported: 10/10/13 14:59

Notes and Definitions

ND	NOT DETECTED at or above the Reporting Limit. If J-value reported, then NOT DETECTED at or above the Method Detection Limit (MDL)
NR	Not Reportable
Dil	Dilution
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference
% Rec	Percent Recovery
Sub	Subcontracted analysis, original report available upon request
MDL	Method Detection Limit
MDA	Minimum Detectable Activity
MRL	Method Reporting Limit

Any remaining sample(s) will be disposed of one month from the final report date unless other arrangements are made in advance.

An Absence of Total Coliform meets the drinking water standards as established by the California Department of Health Services.

The Reporting Limit (RL) is referenced as the Laboratory's Practical Quantitation Limit (PQL) or the Detection Limit for Reporting Purposes (DLR).

All samples collected by Weck Laboratories have been sampled in accordance to laboratory SOP Number MIS002.

Weck Laboratories, Inc 14859 East Clark Avenue, City of Industry, California 91745-1396 (626) 336-2139 FAX (626) 336-2634

Attachment D, Standard Provisions and Reporting for Waste Discharge Requirements, Water Quality Order No. 2004-0009-DWQ Statewide General National Pollution Discharge Elimination System Permit for the Discharge of Aquatic Pesticides for Aquatic Weed Control in Waters of the United States General Permit No. CAG 990005.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure 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 o 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 and imprisonment for knowing violations.

X_____

CA Department of Water Resources Date

Algaecide Application Report

Silverwood Reservoir, San Bernardino, CA
PAK27 Algaecide Application

Prepared By:

CLEAN LAKES INC.
2150 Franklin Canyon Road
Martinez, California 94553

Prepared For:

State of California
Department of Water Resources
Southern Field Division
34534 116th Street East
P.O. Box 1187
Pearblossom, CA 93553

July 2013

BACKGROUND INFORMATION: Clean Lakes, Inc. (CLI) was contacted by Tony Meyers the Chief of the Engineering Branch for the State of California Department of Water Resources Southern Field Division. Tony was interested in having CLI develop a proposal to treat a planktonic algae bloom in Silverwood Lake that had been creating issues for the Water Agencies downstream.

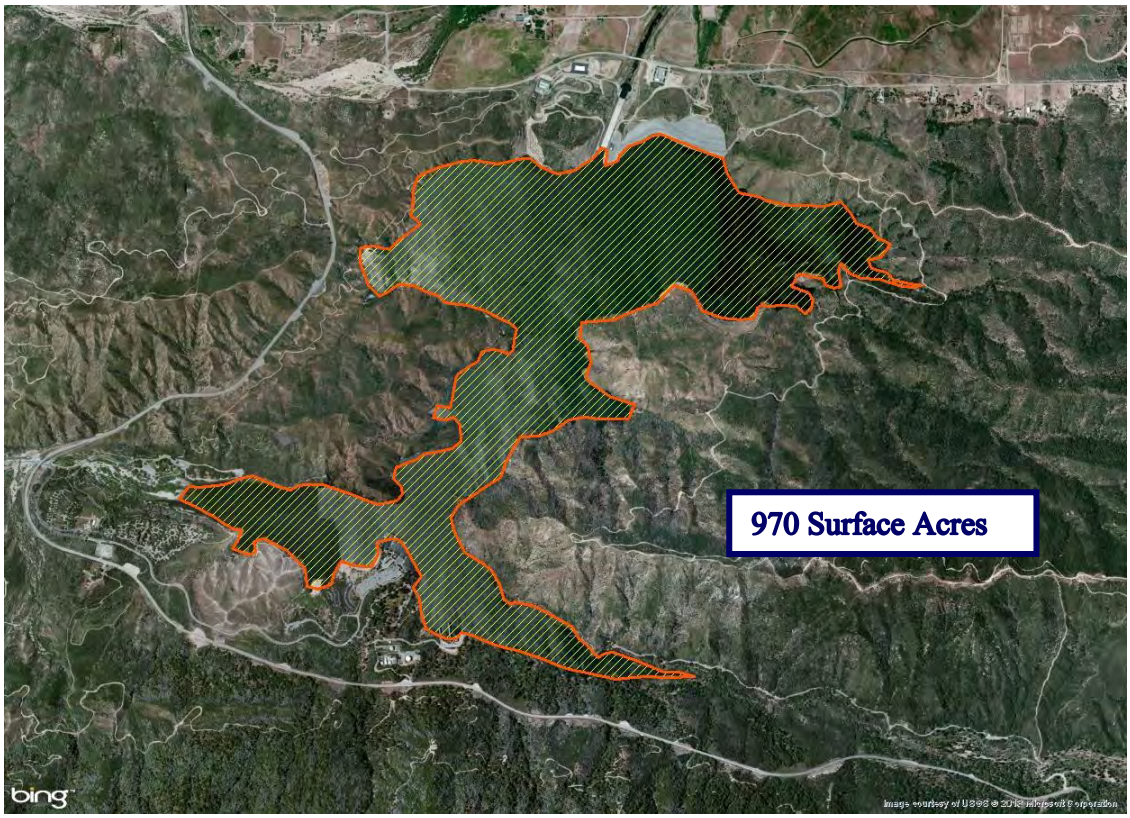
Soon after an agreement was made and Tyler Fowler of CLI developed an Aquatic Pesticide Application Plan (APAP) for the project as well as prepared a Notice of Intent (NOI) to proceed with a treatment in Silverwood Lake. It was determined that the best product for the project was PAK27 for its environmental benefits and success in similar reservoirs. After submitting the APAP, CLI and DWR had several conversations with the Regional Water Quality Control Board in Lahontan about the treatment. In the end the RWQCB determined that they would not stand in the way of the treatment and would let DWR and CLI proceed.

Prior to treatment CLI did a thorough decontamination of all three vessels that would be used for the treatment of Silverwood Lake. This decontamination consisted of washing the entire boat (surface, interior, wells, hulls, and motor) with 180° water and a 9% bleach solution.

SCOPE OF WORK: The Scope of Work was for the treatment of the entire lake (970 acres) for the control of planktonic algae.

SERVICES PROVIDED BY CLI: CLI staff arrived at Silverwood Lake and met with DWR staff at 6:00AM. To start the project DWR staff did an environmental overview of the project site which covered the species of concern in the lake as well as best management practices that CLI could use to avoid any environmental issues while performing the algaecide treatment. This was followed by a Safety meeting in which DWR staff did a safety overview and CLI staff discussed the Site Specific Safety Plan which included the use of the correct personal protection equipment (PPE), potential job hazards, heat illness, etc… as well as the location of the nearest emergency services hospital. After this meeting CLI proceeded with the treatment right around 7:00AM.

- The top four (4) feet of the water column was treated with 15 lbs. of PAK27 per acre ft. for a total of sixty (60) pounds per surface acre.



Work was conducted in compliance with the requirements of the California Department of Pesticide Regulation (DPR), and the State Water Resources Control Board Water Quality Order No. 2004-0009-DWQ (Statewide General National Pollutant Discharge Elimination System Permit for the Discharge of Aquatic Pesticides for Aquatic Weed Control in Waters of the United States (General Permit No. CAG990005)). CLI performed the required NPDES sampling and monitoring for the PAK27 algaecide application which included Pre, Post, and 7-Day Post treatment monitoring and sampling. (The treatment forms and lab results can be found attached at the end of this report).

EQUIPMENT USED: CLI utilized three (3) alumaweld vessels equipped with CLI's Eductor systems which are designed specifically for these types of algaecide applications. There was a crew 0f three (3) CLI staff per vessel one boat driver and two workers to load the PAK27 (50 lb. bags) into the hoppers.

CLI developed a shapefile for the treatment using Arc Map GIS 10.1. The GIS shapefile was loaded into the onboard computer system for vessel guidance and algaecide application data recording. The treatment tracks were automatically recorded via the vessels GPS guidance system.

AQUATIC PESTICIDES: DWR provided the PAK27 algaecide (EPA Registration No. 68660-9) for the project. The algaecide was delivered directly to the lake on the morning of June 25th, 2013.

TREATMENT SITE DATA: The final treatment site data, application rates and total algaecide amount used in the application are outlined in Table 1 below:

DATA TABLE 1 (Plot Data)

CLI Algaecide Application Record 2013 Silverwood Lake					
Site ID	**Site Name**	**Acres**	**Treated Depth**	**Volume Treated (Acre Feet)**	**Product (Lbs.)**
1	**Silverwood Lake**	**970**	**4.00**	**3,880**	**PAK27 58,200**
Total		**970**	**4.00**	**3,880**	**58,200**

LIST OF PROJECT PERSONNEL

CLI PROJECT MANAGER: Tyler Fowler
California (DPR) Qualified Applicator License No. 108730
Cell Phone: 925-766-5256
Email: tfowler@cleanlake.com

CLI PROJECT SUPPORT STAFF: Thomas McNabb (CLI) California (DPR) Pest Control Advisor License No. 72032
Robert Lombardo (CLI) (DPR) Qualified Applicator License No. 79141
Andrew McNabb (CLI) (DPR) Qualified Applicator License No. 127253

SITE SAFETY AND HEALTH OFFICER: Tyler Fowler
Cell Phone: 925-766-5256

EMERGENCY RESPONSE COORDINATOR: Andrew McNabb
Cell Phone: 925-482-7177

Product Label and MSDS: A copy of the algaecide label and the Material Safety Data Sheet for the algaecide used (PAK27) was included in the Silverwood Lake Site Specific Safety Plan which is attached.

Attached Documents:

- **NPDES Treatment Forms**
- **Laboratory results from the PRE, POST and 7-DAY POST NPDES sampling**
- **Aquatic Pest Control Recommendation**
- **Site Specific Safety Plan**
- **PAK27 Label and MSDS**
- **APAP**

END OF AQUATIC PESTICIDE APPLICATION REPORT

06-08-10 revision of Container Disposal

50 LBS. NET WEIGHT (22.68 KILOS)

COPPER SULFATE CRYSTALS

ACTIVE INGREDIENT	BY WEIGHT
COPPER SULFATE PENTAHYDRATE	99.0%
OTHER INGREDIENTS	1.0%
TOTAL	100.0%

CAS #7758-99-8
COPPER AS METALLIC NOT LESS THAN 25%

See back panel for specific pesticidal use directions.

Also for non-pesticidal uses of copper sulfate including but not limited to:

- For Non-Pesticidal Manufacturing and Industrial Uses.
- For manufacturing, repackaging, formulation of algaecides and fungicides.
- For use as foot baths to control hoof rot in cattle.
- For use in preparing Bordeaux mixture.
- For use as a trace mineral for mixing in animal feeds at levels in accord with good feeding and feed manufacturing practices.
- For use as a fertilizer trace mineral for plant growth and used in accord with recommended agronomic practices.

(NOTE: For the states of Wisconsin, California, Oregon and Washington fertilizer recommendations and information, refer to back panel.)

When this product is used as a feed or fertilizer ingredient:
Guaranteed Analysis: Copper (Cu) = 25.0% Derived from Copper Sulfate

KEEP OUT OF REACH OF CHILDREN

DANGER - PELIGRO

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

FIRST AID	
If on skin or clothing:	Take off contaminated clothing. Rinse skin immediately with plenty of water for 15-20 minutes. Call a poison control center or doctor for treatment advice.
If inhaled:	Move person to fresh air. If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably by mouth to mouth, if possible. Call a poison control center or doctor for further treatment advice.
If in eyes:	Hold eye open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue to rinse eye. Call a poison control center or doctor for treatment advice.
If swallowed:	Call poison control center or doctor immediately for treatment advice. Have person sip a glass of water if able to swallow. Do not induce vomiting unless told to do so by the poison control center or doctor. Do not give anything by mouth to an unconscious person.
Notes:	Have the product container or label with you when calling a poison control center or doctor, or going for treatment. In the event of a medical emergency, you may also contact the National Pesticide Information Center at 1-800-858-7378.

CHEM ONE LTD.

This product manufactured for
CHEM ONE LTD.
HOUSTON, TEXAS - **77041**

EPA REG. NO. 56576-1
EPA EST. NO. 52117-MX-001

PRECAUTIONARY STATEMENTS
HAZARDS TO HUMANS AND DOMESTIC ANIMALS
DANGER - PELIGRO

CORROSIVE: Causes eye damage and irritation to the skin and mucous membranes. Harmful or fatal if swallowed. Do not get in eyes, on skin or on clothing. Do not breathe dust or spray mist. May cause skin sensitization reactions to certain individuals.

PERSONAL PROTECTIVE EQUIPMENT

Applicators and other handlers must wear: Long-sleeved shirt and long pants, chemical-resistant gloves made of any waterproof material, shoes plus socks, and protective eyewear. Some materials that are chemical-resistant to this product are listed below. If you want more options, follow the instructions for category A on an EPA chemical resistance category selection chart. Discard clothing and other absorbent materials that have been drenched or heavily contaminated with this product's concentrate. Do not reuse them. Follow manufacturer's instructions for cleaning/maintaining PPE. If no such instructions for washables, use detergent and hot water. Keep and wash PPE separately from other laundry.

USER SAFETY RECOMMENDATIONS:

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

ENVIRONMENTAL HAZARDS

This product is toxic to fish. Direct application of Copper Sulfate to water may cause a significant reduction in populations of aquatic invertebrates, plants and fish. Do not treat more than one-half of lake or pond at one time in order to avoid depletion of oxygen from decaying vegetation. Allow 1 to 2 weeks between treatments for oxygen levels to recover. Trout and other species of fish may be killed at application rates recommended on this label, especially in soft or acid waters. However, fish toxicity generally decreases when the hardness of water increases. Do not contaminate water by cleaning of equipment or disposal of wastes. Consult your local State Fish and Game Agency before applying this product to public waters. Permits may be required before treating such waters.

STORAGE AND DISPOSAL

PROHIBITIONS: Do not contaminate water, food or feed by storage or disposal. Open burning and dumping is prohibited.
STORAGE: Keep pesticide in original container. Do not put concentrate or dilutions of concentrate in food or drink containers.
PESTICIDE DISPOSAL: Pesticide wastes are acutely hazardous. Improper disposal of excess pesticide, spray mixture, or rinsate is a violation of Federal law. If these wastes cannot be disposed of by use according to label instructions, contact your State Pesticide or Environmental Control Agency, or the Hazardous Waste representative at the nearest EPA Regional Office for guidance.
CONTAINER DISPOSAL: Nonrefillable container. Do not reuse or refill this container. Offer for recycling, if available. Completely empty bag into application equipment. Then dispose of empty bag in a sanitary landfill or by incineration, or if allowed by state and local authorities, by burning. If burned, stay out of smoke.

(FOR RIGID, NONREFILLABLE CONTAINERS)
CONTAINER DISPOSAL: Nonrefillable container. Do not reuse or refill this container. Offer for recycling, if available. Triple rinse as follows: Empty the remaining contents into application equipment or a mix tank. Fill the container ¼ full with water and recap. Shake for 10 seconds. Pour rinsate into application equipment or mix tank or store rinsate for later use or disposal. Drain for 10 seconds after the flow begins to drip. Repeat this procedure two more times.

STORAGE AND DISPOSAL
("residential use")

Do not contaminate water, food or feed by storage or disposal.
STORAGE: Store in original container and place in a locked storage area.
CONTAIINER DISPOSAL: Nonrefillable container. Do not reuse or refill this container. **If empty:** Place in trash or offer for recycling, if available. **If partly filled:** Call your local solid waste agency for disposal instructions. Never place unused product down any indoor or outdoor drain..

DIRECTIONS FOR USE

It is a violation of Federal Law to use this product in a manner inconsistent with its labeling.
Do not apply this product in a way that will contact workers or other persons, either directly or through drift. Only protected handlers may be in the area during application. For requirements specific to your State or Tribe, consult the agency responsible for pesticide regulations.

AGRICULTURAL USE REQUIREMENTS

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

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

PPE required for early entry to treated areas that is permitted under the Worker Protection Standard and that involves contact with anything that has been treated, such as plants, soil, or water, is: Coveralls, chemical-resistant gloves made of any waterproof material (such as polyvinyl chloride, nitrile rubber, or butyl rubber), shoes plus socks, and protective eyewear.

NON-AGRICULTURAL USE REQUIREMENTS

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

Applicators and other handlers who handle this pesticide for any use NOT covered by the Worker Protection Standard (40 CFR Part 170) must wear: long-sleeved shirt, chemical-resistant gloves made of any waterproof material (such as polyvinyl chloride, nitrile rubber, or butyl rubber), shoes plus socks, and protective eyewear.

GENERAL INSTRUCTIONS FOR USE

Water hardness, temperature of the water, the type and amount of vegetation to be controlled, and the amount of water flow are to be considered in using Copper Sulfate to control algae. Begin treatment soon after plant growth has started. If treatment is delayed until a large amount of algae is present, larger quantities of Copper Sulfate will be required. Algal growth is difficult to control with Copper Sulfate when water temperatures are low or when the water conditions are hard water. Larger quantities of Copper Sulfate will be required to kill and control algae in water which is flowing than in a body of stagnant water. If possible, curtail the flow of water before treatment and hold dormant for approximately three days after treatment or until the algae have begun to die. When preparing a Copper Sulfate solution in water, the mixing container should be made of plastic or glass: or, a painted, enameled, or copper lined metal container. It is usually best to treat algae on a sunny day when the heavy mats of filamentous algae are most likely to be floating on the surface where it can be sprayed directly. If there is some doubt about the concentration to apply, it is generally best to start with a lower concentration and to increase this concentration until the algae are killed.

Treatment of algae can result in oxygen loss from decomposition of dead algae. This loss can cause fish suffocation. Therefore, to minimize this hazard, treat one-third to one-half of the water area in a single operation and wait 10 to 14 days in between treatments. Begin treatments along the shore and proceed outward in bands to allow fish to move into untreated water. NOTE: If treated water is to be used as a source of potable water, the metallic copper residual must not exceed 1 ppm (4 ppm copper sulfate pentahydrate).

CALCULATIONS FOR THE AMOUNT OF WATER IMPOUNDED AND FOR THE AMOUNT OF COPPER SULFATE TO BE USED: Calculate water volume as follows: (1) Obtain surface area by measuring of regular shaped ponds or mapping of irregular ponds or by reference to previously recorded engineering data or maps. (2) Calculate average depth by sounding in a regular pattern and taking the mean of these readings or by reference to previously obtained data. (3) Multiply surface area in feet by average depth in feet to obtain cubic feet of water volume. (4) Multiply surface area in acres by average depth in feet to obtain total acre-feet of water volume.

CALCULATE WEIGHT OF WATER TO BE TREATED AS FOLLOWS: (1) Multiply volume in cubic feet by 62.44 to obtain total pounds of water, or (2) Multiply volume in acre feet by 2,720,000 to obtain pounds of water.

CALCULATIONS OF ACTIVE INGREDIENT TO BE ADDED: To calculate the amount of Copper Sulfate Pentahydrate needed to achieve the recommended concentration, multiply the weight of water by the recommended concentration of Copper Sulfate. Since recommended concentrations are normally given in parts per million (ppm), it will first be necessary to convert the value in parts per million to a decimal equivalent. For example, 2 ppm is the same as 0.000002 when used in this calculation. Therefore, to calculate the amount of Copper Sulfate Pentahydrate to treat 1 acre-foot of water with 2 ppm Copper Sulfate, the calculation would be as follows:

0.000002 X 2,720,000 = 5.44 lbs. Copper Sulfate Pentahydrate

CALCULATION OF WATER FLOW IN DITCHES, STREAMS, AND IRRIGATION SYSTEMS: The amount of water flow in cubic feet per second is found by means of a weir or other measuring device.

SPECIFIC INSTRUCTIONS

SEWER TREATMENT – ROOT DESTROYER*

ROOT CONTROL GENERAL INFORMATION: Plant roots can penetrate through small cracks and poorly sealed joints of sewer lines. If not controlled, these small roots will continue to grow larger in number causing breakage, reduced flow, and eventually, flow stoppage. Copper sulfate has been known to be an effective means to control roots in residential and commercial sewers.

COMMERCIAL, INSTITUTIONAL, AND MUNICIPAL SEWERS:

ROOT CONTROL IN SEWERS: As a preventive measure, apply into each junction or terminal manhole 2 pounds of Copper Sulfate Crystals every 6 to 12 months. At time of reduced flow (some water flow is essential), add copper sulfate. If flow has not completely stopped, but has a reduced flow due to root masses, add Copper Sulfate Crystals in the next manhole above the reduced flow area. For complete stoppage, penetrate the mass with a rod to enable some flow before treatment.

ROOT CONTROL IN STORM DRAINS: Apply when water flow is light. If no water flow, as in dry weather, use a hose to produce a flow. Apply 2 pounds Copper Sulfate Crystals per drain per year. It may be necessary to repeat treatments 3 to 4 times, at 2 week intervals, if drains become nearly plugged.
SEWER PUMPS AND FORCE MAINS: At the storage well inlet, place a cloth bag containing 2 pounds of Copper Sulfate Crystals. Repeat as necessary.
RESIDENTIAL OR HOUSEHOLD SEWER SYSTEMS:
When a reduced water flow is first noticed, and root growth is thought to be the cause, treat with Copper Sulfate Crystals. It is important not to wait until a stoppage occurs because some water flow is necessary to move the Copper Sulfate Crystals to the area of root growth. Usually, within 3 to 4 weeks, after roots have accumulated sufficient copper sulfate, the roots will die and begin to decay and water flow should increase. As the roots regrow, follow-up treatments with copper sulfate will be required. Applications may be made each year in the spring after plant growth begins, during late summer or early fall, or any time a reduced water flow, thought to be caused by root growth, occurs.
Apply 2-6 pounds Copper Sulfate Crystals two times a year to household sewers. Add Copper Sulfate Crystals to sewer line by pouring about ½ pound increments into the toilet bowl nearest the sewer line and flush, repeat this process until recommended dose has been added, or remove cleanout plug and pour entire recommended quantity directly into the sewer line. Replace the plug and flush the toilet several times.
ROOT CONTROL IN SEPTIC TANK AND LEACH LINES AND LEACH LINE PIPES:
SEPTIC TANKS – The majority of the copper sulfate will settle in the septic tank itself and little will pass into the leach lines. To treat leach line pipes, add 2 to 6 pounds of Copper Sulfate Crystals to the distribution box located between the septic tank and the leach lines. To achieve effective root control in the leach lines it is necessary to transfer Copper Sulfate Crystals from the septic tank to the leach lines. A cleanout plug opening may need to be installed if the distribution box does not have an opening leading to the leach lines.
***NOTE:** Do not apply Copper Sulfate Crystals through sink or tub drains as it will corrode the metal drains.
***NOTE:** Copper sulfate added to an active 300 gallon septic tank at 2, 4 and 6 pounds per treatment will temporarily reduce bacterial action, but it will return to normal approximately 15 days after treatment. Trees and shrubbery growing near a treated line normally are not affected due to only a small portion of their roots being in contact with the copper sulfate. The copper sulfate kills only those roots inside the leach line.
***NOTE:** Do not use as a sewer additive where prohibited by State law. State law prohibits the use of this product in sewage systems in the State of Connecticut. Not for sale or use in the California counties of Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano, and Sonoma for root control in sewers. Not for sale or use in septic systems in the State of Florida.

TO CONTROL ALGAE AND THE POTOMOGETON POND WEEDS, LEAFY AND SAGO, IN IRRIGATION SYSTEMS:
Once the amount of Copper Sulfate required for treating ditches or streams has been calculated, use a continuous application method, selecting proper equipment to supply Copper Sulfate granular crystals as follows:
FOR ALGAE CONTROL – Begin continuous addition application of granular Copper Sulfate when water is first turned into the system and continue throughout the irrigation system, applying 0.1 to 0.2 lbs per cubic ft per second per day.
FOR LEAFY AND SAGO POND WEED CONTROL – Use the same continuous feeder, applying 1.6 to 2.4 pounds Copper Sulfate Pentahydrate per cubic foot per second per day. NOTE: For best control of leafy and sago pond weed, it is essential to begin Copper Sulfate additions when water is first turned into the system or ditch to be treated and to continue throughout the irrigation system. Copper Sulfate becomes less effective as the alkalinity increases. Its effectiveness is significantly reduced when the bicarbonate alkalinity exceeds 150 ppm. Should Copper Sulfate fail to control pond weeds satisfactorily, it may be necessary to treat the ditch with either a suitable approved herbicide or use a mechanical means to remove excess growth. In either case, resume Copper Sulfate addition as soon as possible.
TO CONTROL ALGAE IN IMPOUNDED WATERS, LAKES, PONDS AND RESERVOIRS: There are several methods by which to apply Copper Sulfate to impounded water. Probably the most satisfactory and simplest method is to dissolve the Copper Sulfate crystals in water and to spray this water over the body of water from a boat. A small pump mounted in the boat can easily be used for this purpose. Fine crystals may be broadcast directly on the water surface from a properly equipped boat. A specially equipped air blower can be used to discharge fine crystals at a specific rate over the surface of the water. When using this method, the direction of the wind is an important factor. Do not use this method unless completely familiar with this type of application. Where the situation permits, Copper Sulfate may be applied under the water by dragging burlap bags containing Copper Sulfate. The crystals are placed in burlap bags and dragged through the water by means of a boat. Begin treatment along the shoreline and proceed outward until one-third to one-half of the total area has been treated. Care should be taken that the course of the boat is such as to cause even distribution of the chemical. In large lakes, it is customary for the boat to travel in parallel lines about 20 to 100 feet apart. Continue dragging the burlap bags over the treated area until the minimum dosage is achieved and all crystals have been dissolved. Large or medium size crystals that dissolve slowly should be used with this method.
Copper Sulfate can be applied to impounded waters by injecting a copper sulfate solution in water via a piping system.
CONTROL OF ALGAE AND BACTERIAL ODOR IN SEWAGE LAGOONS AND PITS (Except California):
Application rates may vary depending on amounts of organic matter in effluent stream or retention ponds. Use 2 lbs. of Copper Sulfate Crystals in 60,000 gals. (8,000 cu. ft.) of effluent to yield 1 ppm of dissolved copper. Dosage levels may vary depending upon organic load. Other Organic Sludges: Copper Sulfate Crystal solution must be thoroughly mixed with sludge. Dissolve 2 lbs. in 1-2 gals. of water and apply to each 30,000 gals. of sludge.
Useful formulas for calculating water volume flow rates: Multiply the water volume in cu. ft. times 7.5 to obtain gallons.
Note: 1 C.F.S./Hr. = 27,000 Gals. 1 Acre Foot = 326,000 Gals.
TO CONTROL ALGAE IN IRRIGATION CONVEYANCE SYSTEMS USING THE SLUG APPLICATION METHOD: Make an addition (dump) of Copper Sulfate into the irrigation ditch or lateral at 0.25 to 2.0 lbs. per cubic foot per second of water per treatment. Repeat on approximate 2-week intervals as required. Depending on water hardness, alkalinity and algae concentration, a dump is usually required every 5 to 30 miles. Effectiveness of Copper Sulfate decreases as the bicarbonate alkalinity increases and is significantly reduced when the alkalinity exceeds approximately 150 ppm as $CaCO_3$.
TO CONTROL ALGAE IN RICE (Domestic and Wild) FIELDS: Application should be made when algae have formed on the soil surface in the flooded field. Applications are most effective when made prior to the algae's leaving the soil surface and rising to the water surface. Apply 10-15 pounds Copper Sulfate Crystals per acre to the water surface as either crystals or dissolve in water and make a surface spray. Apply higher rate in deeper water (6 inches or greater).
TO CONTROL TADPOLE SHRIMP IN RICE FIELDS: Application should be made to the flooded fields any time the pest appears from planting time until the seedlings are well rooted and have emerged through the water. Apply 5-10 pounds

Copper Sulfate Crystals per acre. The use rate per acre should be determined by the water depth and flow. Use the lower rate at minimum flow and water depth and the higher rate when water depth and flow are maximum.

STATE	SPECIES	BULLETIN NO.	COUNTY
CALIFORNIA	Solano grass	EPA/ES-85-13	Solano
TENNESSEE	Slackwater Darter	EPA/ES-85-04	Lawrence Wayne Hancock
	Freshwater Mussels	EPA/ES-85-07	Claiborne Hawkins Sullivan
ALABAMA	Slackwater Darter	EPA/ES-85-05	Lauderdale Limestone Madison
VIRGINIA	Freshwater Mussels	EPA/ES-85-06	Grayson Smyth Scott Washington Lee

ENDANGERED SPECIES RESTRICTIONS: It is a violation of Federal Law to use any pesticide in a manner that results in the death of an endangered species or adverse modification of their habitat. The use of this product may pose a hazard to certain Federally designated endangered species known to occur in specific areas within the above counties. ***PLEASE NOTE*** Before using this product in the above counties you must obtain the EPA Bulletin specific to your area. This Bulletin identifies areas within these counties where the use of this pesticide is prohibited, unless specified otherwise. The EPA Bulletin is available from either your County Agricultural Extension Agent, the Endangered Species Specialist in your State Wildlife Agency Headquarters, or the appropriate Regional Office of the U.S. Fish and Wildlife Service. THIS BULLETIN MUST BE REVIEWED PRIOR TO PESTICIDE USE.

COPPER SULFATE REQUIRED FOR TREATMENT OF DIFFERENT GENERA OF ALGAE

The genera of algae listed below are commonly found in waters of the United States. Use the lower recommended rate in soft waters (less than 50 ppm methyl orange alkalinity) and the higher concentration in hard waters (above 50 ppm alkalinity). Always consult State Fish and Game Agency before applying this product to municipal waters.

ORGANISM	¼ to ½ ppm*	½ to 1 ppm*	1 to 1½ ppm*	1½ to 2 ppm*
Cyanophyceae (Blue-green)	Anabaena Anacystis Aphanizomenon Gloeotrichia Gomphosphaeria Polycystis Rivularia	Cylindrospermum Oscillatoria Plectonema	Nostoc Phormidium	Calothrix Symploca
Chlorophyceae (Green)	Closterium Hydrodictyon Spirogyra Ulothrix	Botryococcus Cladophora Coelastrum Draparnaldia Enteromorpha Gloeocystis Microspora Tribonema Zygnema	Chlorella Crucigenia Desmidium Golenkinia Oocystis Palmella Pithophora Staurastrum Tetraedron	Ankistrodesmus Chara Nitella Scenedesmus
Diatomaceae (Diatoms)	Asterionella Fragilaria Melosira Navicula	Gomphonema Nitzschia Stephanodiscus Synedra Tabellaria	Achnanthes Cymbella Neidium	
Protozoa (Flagellates)	Dinobryon Synura Uroglena Volvox	Ceratium Cryptomonas Euglena Glenodinium Mallomonas	Chlamydomonas Hawmatococcus Peridinium	Eudorina Pandorina
	* ¼ - ½ ppm = .67 – 1.3 lbs/acre ft. * ½ - 1 ppm = 1.3 – 2.6 lbs/acre ft.		* 1 – 1½ ppm = 2.6-3.9 lbs/acre ft. * 1½ - 2 ppm = 3.9 – 5.32 lbs/acre ft.	

SCHISTOSOME-INFECTED FRESH WATER SNAILS

For recreational lakes, reservoirs, and ponds, 5.32 -13.3 lbs/acre-ft Copper Sulfate Crystals (i.e., 2-5 ppm copper sulfate), is usually sufficient for treatment of Schistosome-infected fresh water snails. Use surface area in acres multiplied by average depth in feet to determine water volume and application rate. Apply only along shoreline swimming areas and/or

to infected snail beds on a calm sunny day when water temp is at least 60°F. Not allowing swimming for at least 12 hrs following treatment is recommended. If this lower dosage is not sufficient, up to 32 ppm copper sulfate, i.e., 87 lbs/acre (= 2 lbs/1000 sq ft) bottom surface area can be applied. Not allowing swimming for 48 hrs is recommended. Using either dosage, a second application may be made if necessary, 10 to 14 days later. DO NOT make more than two applications a season. Broadcast application using boat, aircraft, or hand equipped with power or hand seeder or underwater dispenser. Do not exceed 1 ppm copper (4 ppm Copper Sulfate) in potable water systems. This labeling must be in the possession of the user at the time of pesticide application. **NOTE : In the State of New York** –For use in recreational lakes, reservoirs and ponds ONLY in areas where infected snail beds have been identified. Apply medium grade crystals by hand broadcast method of application only. This product is a restricted use pesticide in New York State. Pesticide applicator certification or a special use permit is required for sale, possession, or use. Each individual treatment must be approved by the Department of Environmental Conservation. Therefore, you must contact the Pesticide Control Specialist at the appropriate regional office of the Department 30 days in advance of the proposed treatment.

FOOT BATHS FOR CATTLE

Foot baths of Copper Sulfate Crystals can be used as an aid in the treatment of hoof rot in cattle. Prior to treatment, a veterinarian should be consulted to confirm presence of hoof rot. Animals may be walked through a foot bath of 2% (add 2 lbs copper sulfate to 11.8 gals water) to 5% (add 5 lbs copper sulfate to 11.4 gals water) aqueous solution with an immersion time of 5 to 20 min twice daily for a period of time as prescribed by a veterinarian. Keep foot baths clean during treatment period. Do not allow cattle to drink from foot baths as copper sulfate is highly toxic. Follow instructions under Storage and Disposal when solutions are discarded at end of treatment period.

Wisconsin State Copper fertilizer recommendations[a]

	Pounds per Acre					
	Sands		Loams,silts,clays		Organic	
Crop	Bdct[b]	Band	Bdct[b]	Band	Bdct[b]	Band
Lettuce, onion, Spinach	10	2	12	3	13	4
Carrot, cauliflower, celery, alfalfa, clover, corn, oat, radish, sudan grass, wheat	4	1	8	2	12	3
Asparagus, barley, beans, beet, broccoli, mint, pea, potato, rye, soybean	0	0	0	0	0	2

[a]Recommendations are for inorganic sources of copper. Copper chelates can also be used at 1/6 of the rates recommended above. Do not apply copper unless a deficiency has been verified by plant analysis. [b]Bdct = broadcast

Washington, Oregon, and California Fertilizer Use

Information received by the Washington State Dept. of Agriculture regarding the components in this product is available on the internet at http://agr.wa.gov Information regarding the contents and levels of metals in this product is available at the Oregon Dept of Agriculture internet site: http://oda.state.or.us/fertilizer

BORDEAUX SPRAY MIXTURE

Understanding Bordeaux Formulations: If the Bordeaux mixture instructions read 10-10-100, the first figure indicates the number of lbs of Copper Sulfate Crystals. The second figure is the lbs of hydrated spray lime and the third figure is the gallons of water to be used. Use as a full coverage spray to point of runoff.

Preparation of Bordeaux Spray Mixture: Fill a tank 1/4 full with water. Then, with agitator running, mix in Copper Sulfate Crystals through a copper, bronze, stainless steel or plastic screen. Add water so the tank is 3/4 full. Mix in the hydrated spray lime through the screen and finish filling the tank with water.

CROP USE RECOMMENDATIONS

Almond, Apricot, Peach, Nectarine: Shot Hole Fungus – Prepare a 10-10-100 Bordeaux and apply as a dormant spray in late fall or early spring.

Almond, Apricot, Cherry, Peach, Nectarine, Plum, Prune: Brown Rot Blossom Blight – Prepare a 10-10-100 Bordeaux and apply when buds begin to swell.

Apple: Fireblight – Mix 5 lbs of Copper Sulfate Crystals in 100 gals of water and spray uniformly to the point of runoff. Apply in dormant only at silver tip stage. After silver tip, severe burn will occur on any exposed green tissue. Do not mix lime to make a Bordeaux spray for this treatment.

Blueberries: Bacterial Canker – Prepare and apply an 8-8-100 Bordeaux mixture in the fall before heavy rains begin and again 4 weeks later.

Bulbs (Easter Lily, Tulip, Gladiolus): Botrytis Blight – Prepare a 10-10-100 Bordeaux mixture and apply as a foliar spray to 1 acre. Apply for thorough coverage beginning at the first sign of disease and repeat as needed to control disease at 3 to 10 day intervals. Use the shorter intervals during periods of frequent rains or when severe disease conditions persist. Avoid spray just before flower cutting season if residues are a problem.

Caneberries: For leaf and cane spot and Pseudomonas blight, prepare and apply an 8-8-100 Bordeaux mixture in the fall before heavy rains begin and again 4 weeks later.

Cherry (Sweet): Dead Bud, Bacterial Canker (Pseudomonas Syringae) – Prepare a 12-12-100 Bordeaux. Apply at leaf fall and again in late winter before buds begin to swell. In wet cool Northwest U.S. winters, a third spray may be needed between above sprays.

Cherry (Sour): Leaf Spot – Prepare a 10-10-100 Bordeaux. Apply as a full coverage spray after petal fall or as recommended by the State Extension Service.

CITRUS

(NOTE: Adding foliar nutritionals to spray mixtures containing Copper Sulfate Crystals or other products and applying to citrus during the post-bloom period when young fruit is present may result in spray burn.)

Bacterial Blast – Prepare a 10-10-100 Bordeaux spray and apply a spray in late October to early November or before fall rains begin. Make a complete coverage spray using 10 to 25 gals per mature tree.

Lemon, Orange, Grapefruit: Phytophthora Brown Rot - Prepare a 3-4.5-100 Bordeaux mixture only where there is no history of copper injury or use a 3-2-6-100 (Zinc Sulfate-Copper Sulfate Crystals-Hydrated Lime-Gallons of water) Bordeaux mixture. Spray 6 gals on skirt of tree 3 to 4 ft high and 2 to 4 gals on trunk and ground under tree. If P. hibernalis is present, use 10 to 25 gals to completely cover each tree. Apply in November or December just before or after first rain. In severe brown rot season, apply second application in January or February.
Lemon, Orange, Grapefruit: Septoria Fruit, Leaf Spot;Central California – Brown Rot, Zinc, Copper Deficiencies – Prepare a 3-2-6-100 Bordeaux mixture (Zinc Sulfate-Copper Sulfate Crystals-Hydrated Lime Gallons of water) and use 10 to 25 gals to completely cover each tree. Apply in October, November or December before or just after first rain.

Grape: Downy Mildew – Prepare and apply a 2-6-100 Bordeaux spray beginning when downy mildew is detected. Repeat as needed to achieve and maintain control. This mixture and its use will exhibit some phytotoxicity on most varieties.

Grape (Dormant): Powdery Mildew – Apply in spring before bud-swell and before any green tissue is present. Use 4 to 8 lbs of Copper Sulfate Crystals per 100 gals of water. Apply in a high volume spray of 300 gals water per acre. Direct spray to thoroughly wet the dormant vine, especially the bark of the trunk, head or cordons.

Olive: Olive Leaf Spot (Peacock spot), Olive Knot – Prepare a 10-10-100 Bordeaux and apply up to 500 gals per acre. Apply in autumn before heavy winter rains to prevent peacock spot. In wet winters, a repeat spray may be needed in mid-winter. In areas with less than 10 inches of annual rainfall, a 5-5-100 Bordeaux applied in up to 500 gals per acre may be used. To help protect against olive knot, apply a 10-10-100 Bordeaux before heavy rains and again in the spring. Injury may occur in areas of less than 10 inches of rainfall.

Peach: Leaf Curl – Prepare a 10-10-100 Bordeaux and apply at leaf fall or as a dormant spray in late fall or early spring before buds begin to swell.

Potatoes: To enhance vine-kill and suppress late blight, apply 10 lbs. per acre in 10 to 100 gals of water (ground equipment) or in 5 to 10 gals (aerial equipment) with Diquat at vine-kill to enhance vine desiccation and suppress late blight. Additional applications can be made with Diquat if needed to within 7 days of harvest. Copper Sulfate Crystals may be applied alone until harvest to suppress late blight. NOTE: This product can be mixed with Diquat for use on potatoes in accordance with the most restrictive of label limitations and precautions. No label dosage rates should be exceeded.

Walnuts: Walnut Blight – Apply 15 lbs with 10 lbs of lime in 100 gals of water. Make application in early pre-bloom before catkin blooms are showing (10-20% pistilate) before or after rain. Use only if Bordeaux mixture has been shown to be non-phytotoxic in your area. If desired, add one-half gal summer oil emulsion per 100 gals of water. **NOTE**: Addition of summer oil emulsion to pre-bloom and early bloom sprays may result in plant injury.

GENERAL CHEMIGATION INSTRUCTIONS

Apply this product only through one or more of the following types of systems: sprinkler including center pivot, lateral move, end tow, side (wheel) roll, traveler, big gun, solid set, or hand move irrigation system(s). Do not apply this product through any other type of irrigation system. Crop injury, lack of effectiveness, or illegal pesticide residues in the crop can result from nonuniform distribution of treated water. If you have questions about calibration, you should contact State Extension Service specialists, equipment manufacturers or other experts. Do not connect an irrigation system (including greenhouse systems) used for pesticide application to a public water system unless the pesticide label-prescribed safety devices for public water systems are in place. A person knowledgeable of the chemigation system and responsible for its operation or under the supervision of the responsible person, shall shut the system down and make necessary adjustments should the need arise.

Posting of areas to be chemigated is required when 1) any part of a treated area is within 300 feet of sensitive areas such as residential area, labor camps, businesses, day care centers, hospitals, in-patient clinics, nursing homes or any public areas such as schools, parks, playgrounds, or other public facilities not including public roads, or 2) when the chemigated area is open to the public such as golf courses or retail greenhouses. Posting must conform to the following requirements. Treated areas shall be posted with signs at all usual points of entry and along likely routes of approach from the listed sensitive areas. When there are no usual points of entry, signs must be posted in the corners of the treated areas and in any other location affording maximum visibility to sensitive areas. The printed side of the sign should face away from the treated area towards the sensitive area. The signs shall be printed in English. Signs must be posted prior to application and must remain posted until foliage has dried and soil surface water has disappeared. Signs may remain in place

indefinitely as long as they are composed of materials to prevent deterioration and maintain legibility for the duration of the posting period. At the top of the sign shall be the words "KEEP OUT", followed by an octagonal stop sign symbol at least 8 inches in diameter containing the word "STOP". Below the symbol shall be the words "PESTICIDES IN IRRIGATION WATER". All words shall consist of letters at least 2 ½ inches tall, and all letters and the symbol shall be a color that sharply contrasts with their immediate background. This sign is in addition to any sign posted to comply with the Worker Protection Standard.

CHEMIGATION SYSTEMS CONNECTED TO PUBLIC WATER SYSTEMS:

Public water system means a system for the provision to the public of piped water for human consumption if such system has at least 15 service connections or regularly serves an average of at least 25 individuals daily at least 60 days out of the year. Chemigation systems connected to public water systems must contain a functional, reduced-pressure zone, backflow preventer (RPZ) or the functional equivalent in the water supply line upstream from the point of pesticide introduction. As an option to the RPZ, the water from the public water system should be discharged into the reservoir tank prior to pesticide introduction. There shall be a complete physical break (air gap) between the flow outlet end of the fill pipe and the top or overflow rim of the reservoir tank of at least twice the inside diameter of the fill pipe. The pesticide injection pipeline must contain a functional, automatic, quick-closing check valve to prevent the flow of fluid back toward the injection pump. The pesticide injection pipeline must contain a functional, normally closed, solenoid-operated valve located on the intake side of the injection pump and connected to the system interlock to prevent fluid from being withdrawn from the supply tank when the irrigation system is either automatically or manually shut down.
See Treatment Instructions, below.

SPRINKLER CHEMIGATION:

The system must contain functional interlocking controls to automatically shut off the pesticide injection pump when the water pump motor stops, or in cases where there is no water pump, when the water pressure decreases to the point where pesticide distribution is adversely affected. Systems must use a metering pump, such as a positive displacement injection pump (e.g., diaphragm pump) effectively designed and constructed of materials that are compatible with pesticides and capable of being fitted with a system interlock. The system must contain a functional check valve, vacuum relief valve, and low pressure drain approximately located on the irrigation pipeline to prevent water source contamination from backflow. The pesticide injection pipeline must contain a functional, automatic, quick-closing check valve to prevent the flow of fluid back toward the injection pump. This pipeline must also contain a functional, normally closed, solenoid-operated valve located on the intake side of the injection pump and connected to the system interlock to prevent fluid from being withdrawn from the supply tank when the irrigation system is either automatically or manually shut down. The system must contain functional interlocking controls to automatically shut off the pesticide injection pump when the water pump motor stops. The irrigation line or water pump must include a functional pressure switch which will stop the water pump motor when the water pressure decreases to the point where pesticide distribution is adversely affected. Systems must use a metering pump, such as a positive displacement injection pump (e.g., diaphragm pump) effectively designed and constructed of materials that are compatible with pesticides and capable of being fitted with a system interlock.

TREATMENT INSTRUCTIONS:

Do not apply when wind speed favors drift beyond the area intended for treatment. When mixing, fill nurse tank half full with water. Add Copper Sulfate Crystals slowly to tank while hydraulic or mechanical agitation is operating and continue filling with water. Stickers, spreaders, insecticides, nutrients, etc. should be added last. If compatibility is in question, use the compatibility jar test before mixing a whole tank. Because of the wide variety of possible combinations which can be encountered, observe all cautions and limitations on the label of all products used in mixtures. Copper Sulfate Crystals should be added through a traveling irrigation system continuously or at the last 30 minutes of solid set or hand moved irrigation systems. Agitation is recommended.

NOTICE: CHEM ONE LTD. warrants that this product conforms to the chemical description on the label thereof and is reasonably fit for purposes stated on such label only when used in accordance with directions under normal use conditions. It is impossible to eliminate all risks inherently associated with use of this product. Crop injury, ineffectiveness or other unintended consequences may result because of such factors as weather conditions, presence of other materials, or the manner of use or application, all of which are beyond the control of CHEM ONE LTD. To the extent consistent with applicable law, CHEM ONE LTD.shall not be liable for consequential, special or indirect damages resulting from the use or handling of this product. To the extent consistent with applicable law, all such risks shall be assumed by the Buyer. To the extent consistent with applicable law exclusive remedy of any buyer or user of this product for any and all losses, injuries, or damages resulting from or in any way arising from the use, handling or application of this product, whether in contract, warranty, tort, negligence, strict liability or otherwise, shall not exceed the purchase price paid for this product or at CHEM ONE LTD.'s election, the replacement of this product. CHEM ONE LTD. MAKES NO WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE NOR ANY OTHER EXPRESS OR IMPLIED WARRANTY EXCEPT AS STATED ABOVE.

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ENVIRONMENTALLY HAZARDOUS SUBSTANCES
SOLID, N.O.S. (CUPRIC SULFATE) UN3077, RQ

Revisions---

Revised 3-22-06 by notification to restore original language to Specific Instructions---control algae in irrigation conveyance systems
1-31-2006 Bordeaux, storage and disposal, Florida septic systems---changes and additions (Bordeaux) are indicated

Jan 29 2008- remove the 1-800- CLEANUP statement
6-16-08- storage and disposal revide following Pr 2007-4 instructions
6-17-08 Change weight from 22.7 kilos to 22.68 kilos
7-25-08 warranty statement notification
10-29-08- address change for January 2009
06-08-10 add rigid container residue disposal directions

Nautique®

Aquatic Herbicide

SPECIMEN

SePRO

FOR USE IN STILL OR FLOWING AQUATIC SITES SUCH AS POTABLE WATER SOURCES, LAKES, RIVERS, RESERVOIRS, AND PONDS, SLOW-FLOWING OR QUIESCENT WATER BODIES, CROP AND NON-CROP IRRIGATION AND DRAINAGE SYSTEMS (CANALS, DITCHES, AND LATERALS), FISH, GOLF COURSE, ORNAMENTAL, SWIMMING, AND FIRE PONDS AND AQUACULTURE INCLUDING FISH AND SHRIMP.

Active Ingredients	
Copper Ethylenediamine Complex† (CAS# 13426-91-0)	13.2%
Copper Triethanolamine Complex† (CAS# 82027-59-6)	14.9%
Other Ingredients	71.9%
TOTAL	100.0%

†Metallic Copper equivalent = 9.1%

Keep Out of Reach of Children

DANGER / PELIGRO

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

Refer to inside of label booklet for additional precautionary information and directions for use including first aid and storage and disposal.

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

Nautique is a registered trademark of SePRO Corporation
SePRO Corporation 11550 N. Meridian Street,
Suite 600, Carmel, IN 46032, U.S.A.

EPA Reg. No. 67690-10
FPL20130305

EPA Est. No. 067690-NC-001
168405

PRECAUTIONARY STATEMENTS

Hazards to Humans and Domestic Animals

Keep Out of Reach of Children

DANGER / PELIGRO

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

Corrosive. Causes irreversible eye damage. Causes skin burns. May be fatal if absorbed through skin. Harmful if swallowed. Harmful if inhaled. Do not get in eyes, on skin or on clothing. Avoid breathing spray or mist vapor. When handling, wear protective eyewear, clothing and chemical-resistant gloves as described under the section of this label pertaining to Personal Protective Equipment (PPE). Prolonged or frequently repeated skin contact may cause allergic reactions in some individuals. Wash skin thoroughly with soap and water after handling and before eating, drinking, chewing gum, or using tobacco. Remove and wash contaminated clothing before reuse.

For applications in waters destined for use as drinking water, those waters must receive additional and separate potable water treatment. Do not apply more than 1.0 ppm as metallic copper in any waters.

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

Have the product container or label with you when calling a poison control center or doctor, or going for treatment. In case of emergency endangering health or the environment involving this product, call **INFOTRAC** at **1-800-535-5053.**

PERSONAL PROTECTIVE EQUIPMENT (PPE)

Some materials that are chemical-resistant to this product are barrier laminate, butyl rubber ≥14 mils, or nitrile rubber ≥14 mils. If you want more options, follow the instructions for category A on an EPA chemical-resistant category selection chart.

Mixers, loaders, applicators and other handlers must wear the following:

- Coveralls (such as Tyvek suit or similar) worn over long-sleeved shirt and long pants;
- Socks and chemical resistant footwear;
- Chemical-resistant gloves (such as nitrile or butyl rubber);
- Protective eyewear such as goggles, safety glasses, or face shield; and
- A chemical-resistant apron when mixing and loading or cleaning equipment.

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

USER SAFETY RECOMMENDATIONS

Users should:

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

ENVIRONMENTAL HAZARDS

This pesticide is toxic to fish and aquatic invertebrates. Waters treated with this product may be hazardous to aquatic organisms. Treatment of aquatic weeds and algae can result in oxygen loss from decomposition of dead algae and weeds. This oxygen loss can cause fish and invertebrate suffocation. To minimize this hazard, do not treat more than ½ of the water body to avoid depletion of oxygen due to decaying vegetation. Wait at least 10 to 14 days between treatments. Begin treatment along the shore and proceed outwards in bands to allow fish to move into untreated areas. Consult with the State or local agency with primary responsibility for regulating pesticides before applying to public waters, to determine if a permit is required.

Certain water conditions including low pH (<6.5), low dissolved organic carbon (DOC) levels (3.0 mg/L or lower), and "soft" waters (i.e. alkalinity less than 50 mg/L), increases the potential acute toxicity to non-target aquatic organisms. Do not use in waters containing trout or other fish species that are highly sensitive to copper if the alkalinity is less than 50 ppm. Fish toxicity generally decreases when the hardness of water increases. This product must not be used in ornamental ponds containing Koi.

DIRECTIONS FOR USE

It is a violation of Federal Law to use this product in a manner inconsistent with its labeling. Read all directions for use carefully before applying this product. Use only according to label directions.

Do not apply this product in a way that concentrate will contact workers or other persons, either directly or through drift; only protected handlers may be in close proximity to the mixing area or application equipment while in use.

Obtain Required Permits: Consult with appropriate state or local pesticide and/or water authorities before applying this product in or around pubic waters. Permits and posting or treatment notification may be required by State, Tribal or local public agencies.

PRODUCT INFORMATION

Nautique controls a variety of submersed, floating, and emergent aquatic weed species in still or flowing aquatic sites such as potable water sources, lakes, rivers, reservoirs, and ponds, slow-flowing or quiescent water bodies, crop and non-crop irrigation and drainage systems (canals, ditches, and laterals), fish, golf course, ornamental, swimming, and fire ponds and aquaculture including fish and shrimp.

Nautique is formulated with dual chelating agents. This aids in copper uptake by aquatic plants and reduces the precipitation of copper with carbonates and bicarbonates in the water. Nautique has a broad spectrum of activity to weed species that are susceptible to copper.

Treatment Notes

Performance of Nautique is enhanced under certain conditions. It is recommended to consult a SePRO Aquatic Specialist for guidance in implementing a treatment program to achieve optimal results. The following apply to the use of Nautique to achieve optimum effectiveness:

- Treat when growth first begins to appear (if possible) or when target vegetation is actively growing.
- Apply in a manner that will ensure even distribution of the chemical within the treatment area.
- Aquatic weeds typically drop below the surface within 3 to 14 days after treatment. The complete results of treatment will be observed 1 to 4 weeks post-treatment in most cases.
- In heavily infested areas a second application may be necessary. Retreat areas if regrowth begins to appear and seasonal control is desired. Repeating application of Nautique too soon after initial application may have no effect.

Precautions and Restrictions

- Do not apply Nautique directly to, or otherwise permit it to come into contact with any desirable plants as injury may result. Do not apply in such a way that concentrated Nautique comes in contact with crops, ornamentals, grass or other desirable plants.
- Wash spray equipment thoroughly before and after each application.

Spray Drift Management

A variety of factors including weather conditions (e.g., wind direction, wind speed, temperature, relative humidity) and method of application (e.g., ground, aerial, airblast, chemigation) can influence pesticide drift. The applicator must evaluate all factors and make appropriate adjustments when applying this product.

Droplet Size

Apply only as a medium or coarser spray (ASAE standard 572) or a volume mean diameter of 300 microns or greater for spinning atomizer nozzles.

Wind Speed

Do not apply at wind speeds greater than 15 mph. Only apply this product if the wind direction favors on-target deposition (approximately 3 to 10 mph), and there are no sensitive areas within 250 feet downwind.

Temperature Inversions

If applying at wind speeds less than 3 mph, the applicator must determine if a) conditions of temperature inversion exist, or b) stable atmospheric conditions exist at or below nozzle height. Do not make applications into areas of temperature inversions or stable atmospheric conditions.

Other State and Local Requirements

Applicators must follow all state and local pesticide drift requirements regarding application of copper compounds. Where states have more stringent regulations, they must be observed.

Equipment

All aerial and ground application equipment must be properly maintained and calibrated using appropriate carriers or surrogates.

Additional requirements for aerial applications:

- The boom length must not exceed 75% of the wingspan or 90% of the rotor blade diameter.
- Release spray at the lowest height consistent with efficacy and flight safety. Do not release spray at a height greater than 10 feet above the crop canopy unless a greater height is required for aircraft safety.
- When applications are made with a crosswind, the swath must be displaced downwind. The applicator must compensate for this displacement at the up and downwind edge of the application area by adjusting the path of the aircraft upwind.

Additional requirements for ground boom application:

Do not apply with a nozzle height greater than 4 feet above the crop canopy.

APPLICATION INFORMATION

For aquatic weed control (including vascular plants and algae), do not exceed a concentration of 1.0 ppm copper during any single application. Wait at least 10 to 14 days between treatments. When treating aquaculture ponds when fish are present, do not exceed a concentration of 0.4 ppm during any single application when targeting nuisance algae; wait a minimum of 10 days between retreatments.

Target Species

Nautique is a chelated copper formulation that provides effective control of floating, submersed, and emergent aquatic plants having sensitivity to copper including:

Brazilian elodea (Egeria densa)	Pondweed spp.(e.g., sago, American) [1]
Coontail	Salvinia spp. (e.g. giant and common)
Curlyleaf pondweed	Starry stonewort [1]
Duckweed	Thinleaf pondweed
Elodea	Watermilfoil, Eurasian [1]
Eelgrass (Vallisneria) [1]	Water hyacinth
Horned pondweed [1]	Water lettuce
Hydrilla	Widgeon grass
Naiad	

[1] Variable control may be obtained, especially in waters with higher alkalinity, and repeat applications may improve control.

Application Methods

Nautique can be applied directly as a surface spray, subsurface through trailing weighted hoses, by aerial application, or in combination with other aquatic herbicides and algaecides. Surfactants, sinking agents, polymers (except CA), penetrants, or other adjuvants may be combined with Nautique to improve the retention time, sinking, and distribution of the herbicide. Nautique inverts easily using either tank mix or multi-fluid mixer techniques. For submersed plants, invert applications should be made through weighted hoses dragged below the water surface; for heavy infestations, direct application is preferable.

When treating moving water, apply the spray solution counter to the flow of water (unless metering Nautique into flowing water – see the *Flowing Water Treatment* section of this label). Nautique can be applied diluted or undiluted, whichever is most suitable to insure uniform coverage of the area to be treated. Dilution with water may be necessary at the lower application rates and when targeting floating or emergent vegetation. Dilute the required amount of Nautique with enough water to ensure even distribution in the treated area with the type of equipment being used. For best results, dilute Nautique in water to provide a minimum spray mix of 20 to 50 gallons per acre; in areas with heavy weed infestations, a total tank mix of >50 gallons per acre may be necessary.

For effective control, proper Nautique concentrations should be maintained for a minimum of three (3) hours. The rates in Table 1, *Nautique Application Rates*, are based on static or minimal flow situations. Where significant dilution occurs from untreated waters or loss of water within a three (3) hour period, Nautique may have to be metered in (refer to the *Flowing Water Treatment* section of this label).

Use the lower rates for treating soft water (less than 50 ppm alkalinity) or when targeting species with greater susceptibility to Nautique. Use the higher rates for treating less susceptible species, heavier infestations, and/or treating hard water (above 50 ppm alkalinity). Surface applications may be made from shore into shallow water along the shoreline.

Application Rates

Application rates in Table 1 are based on minimal water flow in ponds, lakes, reservoirs, and irrigation conveyance or drainage systems. Treatments that extend chemical contact time with target vegetation will generally result in improved efficacy. In conveyance systems where significant water flow results in rapid off-site movement of Nautique, consult Table 2 and the *Flowing Water Treatment* section of this label for application instructions.

Application rates are calculated by using the following formula to obtain the appropriate Nautique dose/rate:

Gallons of Nautique per surface acre = desired concentration of metallic copper (ppm) **x** average depth of water (feet) **x** 3.0

TABLE 1
Nautique Application Rates

Relative Plant Density	ppm copper	Gallons Per Surface Acre				Liters Per Surface Hectare			
		Depth in Feet†				Depth in Meters†			
		1	2	3	4	0.5	0.75	1.0	1.25
Low Density	0.5	1.5	3.0	4.5	6.0	12.0	24.1	36.1	48.2
	0.6	1.8	3.6	5.4	7.2	14.9	29.8	44.7	59.6
Medium Density	0.7	2.1	4.2	6.3	8.4	17.2	34.4	51.6	68.8
	0.8	2.4	4.8	7.3	9.6	19.5	39.0	58.5	78.0
High Density	0.9	2.7	5.4	8.1	10.8	21.8	43.6	65.4	87.2
	1.0	3.0	6.0	9.0	12.0	24.1	48.2	72.3	96.4

† For depths greater than 4 feet (1.25 meters) add rates given for the sum of the corresponding depths in the chart

Free-Floating Plants

Apply Nautique using a foliar spray at a rate of 8 - 12 gallons/acre for control of water hyacinth, duckweed, and salvinia, and up to 4 - 6 gallons/acre for control of water lettuce (do not exceed 3 gallons/acre foot). Add Nautique and the appropriate surfactant to a minimum of 20 to 50 gallons per acre with water. Use an adequate spray volume to ensure good coverage of the plant. Apply Nautique to the area where the greatest concentration of foliage is located in a manner that will optimize herbicide contact on leaf surfaces.

Tank Mix

Nautique can be tank mixed with other herbicides for control of a broader weed spectrum. Do not mix concentrates in a tank without first adding water. To ensure compatibility, a jar test is recommended before field application. Nautique must not be mixed with any product containing a label prohibition against such mixing and must be used in accordance with the more restrictive of the label limitations and precautions. No label dosage rates should be exceeded.

- **Nautique + Sonar* A.S. Tank Mix (Except California)** - Nautique can be mixed with Sonar A.S. to enhance the submersed weed control spectrum and be applied as a uniform surface spray or injected under the water's surface. For best results, apply this tank mix at a minimum of 0.5 ppm Nautique and 0.03 ppm (30ppb) Sonar A.S. Lower concentrations may be effective on more susceptible species and under certain conditions.
- **Nautique + Diquat Tank Mix** - For best results, apply Nautique/diquat (e.g. Littora*, Reward) combinations in a 2:1 ratio of Nautique:Diquat (e.g. 4 gallons Nautique and 2 gallons Littora* per acre in waters with average depth of 4 feet). Do not exceed maximum labeled rates for any product. For hydrilla control and control of other species with high sensitivity to copper, lower rates of Nautique may also enhance the activity of diquat. Nautique must be applied at a minimum of 0.1 ppm in combination with diquat. Higher rates may be needed in areas with dense weeds.
- **Nautique + Endothall Tank Mix** - For best results apply Nautique/endothall (i.e. dipotassium salt of endothall; Aquathol K – 3 lbs a.i./gallon) combinations at a minimum rate of 1 gallon Nautique per acre foot and 0.75 gallons endothall per acre foot.
- **Tank Mix Adjuvants/Surfactants** - The addition of a surfactant is recommended to improve efficacy on floating and emergent plants. **Silicone surfactants are not recommended for floating plants as they generally can cause the plant to sink causing the spray solution to be washed off the plant.** Observe all cautions and restrictions on the labels of both products used in this mixture. Adjuvants/surfactants may also enhance performance on other species. Consult manufacturer recommendations.

Flowing Water Treatment

Drip System or Metering Pump Application for Canals, Ditches, and Laterals

For optimal control, Nautique should be applied as soon as submersed macrophytes or algae begin active growth or interfere with normal delivery of water (clogging of lateral head gates, suction screens, weed screens, and siphon tubes). Delaying treatment could perpetuate the problem causing massing and compacting of plants. Heavy infestations and low flows may result in pooling or uneven product distribution resulting in unsatisfactory control. Under these conditions repeated applications or increasing the water flow rate during application may be necessary.

To achieve desired control with Nautique herbicide in flowing waters, a minimum exposure period of three hours should be maintained at a concentration of 0.5 to 1.0 ppm. Other factors to consider include: plant species and density of infestation and water temperature and hardness. Longer contact times and the highest rates may be required for less susceptible species and in difficult treatment conditions (e.g. less susceptible weed species, dense weed beds, hard water).

1. Treatment with Nautique requires accurate calculations of water flow rates. Devices that provide accurate flow measurements such as weirs or orifices are the preferred method; however, the volume of water to be treated may also be estimated using the following formula:

   Cubic feet per second (cfs) = average width (feet) **x** average depth (feet) **x** average velocity (feet/second) **x** 0.9

   The velocity can be estimated by determining the length of time it takes a floating object to travel a defined distance. Divide the distance (feet) by the time (seconds) to estimate velocity (feet/seconds). This measure should be repeated 3 times at the intended application site and then calculate the average velocity.

2. After accurately determining the water flow rate in cubic feet per second(s) (cfs) or gallons/minute, find the corresponding drip rate in Table 2. For flow rates not listed in the table, multiply the flow rate by the recommended amount of Nautique in 1 cfs for application rates or use the below formula.

   cfs **x** desired concentration of metallic copper (ppm) = quarts/hour of application

TABLE 2
Nautique Application Drip or Injection Rates For Flowing Water

Water Flow Rate		PPM Copper	Nautique Drip Rate	
cfs	gal/min.		Quart/ hr	ml / min
1	450	0.5 - 1.0	0.5 - 1.0	7.9 - 15.7
2	900	0.5 - 1.0	1.0 - 2.0	15.7 - 31.5
3	1,350	0.5 - 1.0	1.5 - 3.0	23.6 - 47.3
4	1,800	0.5 - 1.0	2.0 - 4.0	31.5 - 63.0
5	2,250	0.5 - 1.0	2.5 - 5.0	39.4 - 78.8
10	4,500	0.5 - 1.0	5.0 - 10.0	78.8 – 157.7
100	45,000	0.5 - 1.0	50 - 100	789 - 1,577

Calculate the amount of Nautique needed to maintain the drip rate for a treatment period of 3 hours by multiplying **quart(s)/hour by 3 or milliliters/minute by 180.** For longer injection periods, multiply dosage rate by desired time in minutes or hours as appropriate.

Rates will target up to 1.0 ppm copper concentration in the treated water for the treatment period. Lower concentrations may be used on susceptible plant species or if longer exposure/injection times are maintained. Introduction of Nautique should be made in the channel at weirs or other turbulence-creating structures to promote the dispersion of the chemical.

Use a drum or tank equipped with a valve or other volume control device that can be calibrated to maintain a constant drip rate. Use a stopwatch and appropriate measuring container to set the desired drip rate. Readjust accordingly if the canal flow rate changes during the treatment period. A small pump or other metering device may be used to meter Nautique into the water more accurately. Application can be made using diluted or undiluted material.

Results can vary depending upon species and density of vegetation, desired distance of control and flow rate, and impact of water quality on Nautique and efficacy. Periodic maintenance treatments may be required to maintain seasonal control (every 2 to 6 weeks). In addition, Nautique can be used in a rotational program with other herbicides labeled for flowing water for an integrated management approach. It is recommended to consult a SePRO Aquatic Specialist to determine optimal use rate location of treatment stations and duration of treatment period under local conditions.

Irrigation Ponds or Reservoirs

When applying to irrigation ponds or reservoirs, it is best to hold water for a minimum of 3 hours before irrigating to ensure proper exposure of Nautique at targeted rates to plants. If water is to be continually pumped from the treated system during application, application techniques (drip, injection, or multiple spray applications) should be made to compensate for dilution of Nautique within the targeted area.

STORAGE AND DISPOSAL

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

Pesticide Storage: Store in a cool dry place. Do not store near feed or foodstuffs. In case of leak or spill, use absorbent materials to contain liquids and dispose in a manner consistent with the pesticide disposal instructions.

Pesticide Disposal: Pesticide wastes are acutely hazardous. Improper disposal of excess pesticide, spray mixture, or rinsate is a violation of Federal Law. If these wastes cannot be disposed of by use according to label instructions, contact your State Pesticide or Environmental Control Agency, or the Hazardous Waste representative at the nearest EPA Regional Office for guidance. Wastes resulting from the use of this product may be disposed of on site or at an approved waste disposal facility.

Nonrefillable Container Handling (rigid, 5 gallons or less): Do not reuse or refill this container. Triple rinse container (or equivalent) promptly after emptying. Triple rinse as follows: empty the remaining contents into application equipment or a mix tank and drain for 10 seconds after the flow begins to drip. Fill the container ¼ full with water and recap. Shake for 10 seconds. Pour rinsate into application equipment or a mix tank, treatment area, or store rinsate for later use or disposal. Drain for 10 seconds after the flow begins to drip. Repeat the procedure two more times. Then offer for recycling (if available) or reconditioning, or puncture and dispose of in a sanitary landfill, or by incineration, or if allowed by state and local authorities, by burning. If burned, stay out of smoke.

Nonrefillable Container Handling (rigid, larger than 5 gal): Do not reuse or refill this container. Triple rinse container (or equivalent) promptly after emptying. Triple rinse as follows: empty the remaining contents into application equipment or a mix tank. Fill the container ¼ full with water. Replace and tighten closures. Tip container on its side and roll it back and forth, ensuring at least one complete revolution, for 30 seconds. Stand the container on its end and tip it back and forth several times. Turn the container over onto its other end and tip it back and forth several times. Empty the rinsate into application equipment or a mix tank, treatment area, or store rinsate for later use or disposal. Repeat this procedure two more times. Then offer for recycling (if available) or reconditioning, or puncture and dispose of in a sanitary landfill, or by incineration, or if allowed by state and local authorities, by burning. If burned, stay out of smoke.

Refillable Container Handling (rigid, larger than 5 gal): Refill this container with pesticide only. Do not reuse this container for any other purpose. Cleaning the container before final disposal is the responsibility of the person disposing of the container. Cleaning before refilling is the responsibility of the refiller. To clean the container before final disposal, empty the remaining contents from this container into application equipment or mix tank. Fill the container about 10 percent full with water. Agitate vigorously or recirculate water with the pump for 2 minutes. Pour or pump rinsate into application equipment, rinsate collection system, or treatment area. Repeat this rinsing procedure two more times. If returning container, seal all openings which have been opened during use. Return the empty container to a collection site designated by SePRO Corporation. If the container has been damaged and cannot be returned according to the recommended procedures, contact SePRO Corporation at 1-800-419-7779 to obtain proper handling instructions.

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

TERMS AND CONDITIONS OF USE

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

WARRANTY DISCLAIMER

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

INHERENT RISKS OF USE

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

LIMITATION OF REMEDIES

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

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

To the extent consistent with applicable law, SePRO Corporation shall not be liable for losses or damages resulting from handling or use of Nautique unless SePRO Corporation is promptly notified of such losses or damages in writing. In no case shall SePRO Corporation be liable for consequential or incidental damages or losses.

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

SePRO Corporation
11550 North Meridian Street, Suite 600
Carmel, IN 46032, U.S.A.

Captain*

Liquid Copper Algaecide

SPECIMEN

SePRO

For use in still or flowing aquatic sites including: golf course, ornamental, fish, irrigation and fire ponds and aquaculture including fish and shrimp; fresh water lakes, ponds, and fish hatcheries; potable water reservoirs, rivers, streams, bays and coves; and crop and non-crop irrigation and drainage systems (canals, laterals and ditches) and chemigation systems.

Active Ingredient	
Copper Ethanolamine Complex† (Mixed CAS#'s 82027-59-6 & 14215-52-2)	28.2%
Other Ingredients	71.8%
TOTAL	100.00%

†Metallic Copper equivalent = 9.1%

Keep Out of Reach of Children

DANGER / PELIGRO

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

Refer to inside of label booklet for additional precautionary information and directions for use including first aid and storage and disposal.

NOTICE: Read the entire label before using. Use only according to label directions. **Before buying or using this product, read *Terms and Conditions of Use, Warranty Disclaimer, Inherent Risks of Use* and *Limitation of Remedies* inside label booklet.**

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SePRO Corporation
11550 North Meridian Street
Suite 600, Carmel, IN 46032, U.S.A.

EPA Reg. No. 67690-9
FPL20110712

PRECAUTIONARY STATEMENTS

Hazards to Humans and Domestic Animals

Keep Out of Reach of Children

DANGER / PELIGRO

Corrosive. Causes irreversible eye damage. Causes skin irritation. Harmful if swallowed. Harmful if absorbed through skin. Harmful if inhaled. Do not get in eyes, on skin, or on clothing. Avoid breathing mist or spray vapor. When handling, wear protective eyewear, clothing, and chemical-resistant gloves as described under the section of this label pertaining to Personal Protective Equipment (PPE). Wash skin thoroughly with soap and water after handling and before eating, drinking, chewing gum, or using tobacco. Remove and wash contaminated clothing before reuse.

For applications in waters destined for use as drinking water, those waters must receive additional and separate potable water treatment. Do not apply more than 1.0 ppm as metallic copper in any waters.

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

(continued)

FIRST AID *(continued)*	
If inhaled	• Move person to fresh air. • If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably mouth-to-mouth if possible. • Call a poison control center or doctor for further treatment advice.
Have the product container or label with you when calling a poison control center or doctor, or going for treatment. In case of emergency endangering health or the environment involving this product, call **INFOTRAC** at **1-800-535-5053**.	

NOTE TO PHYSICIAN: Probable mucosal damage may contraindicate the use of gastric lavage.

PERSONAL PROTECTIVE EQUIPMENT (PPE)

Some materials that are chemical-resistant to this product are barrier laminate, butyl rubber ≥14 mils, or nitrile rubber ≥ 14 mils. If you want more options, follow the instructions for category A on an EPA chemical-resistant category selection chart.

Mixers, loaders, applicators and other handlers must wear the following:

- Coveralls worn over short-sleeved shirt and short pants;
- Socks and chemical resistant footwear;
- Chemical-resistant gloves (such as nitrile or butyl rubber);
- Protective eyewear (such as goggles, safety glasses, or face shield); and
- A chemical-resistant apron when mixing and loading or cleaning equipment.

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

USER SAFETY RECOMMENDATIONS

Users should:

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

ENVIRONMENTAL HAZARDS

This pesticide is toxic to fish and aquatic invertebrates. Waters treated with this product may be hazardous to aquatic organisms. Treatment of aquatic weeds and algae can result in oxygen loss from decomposition of dead algae and weeds. This oxygen loss can cause fish and invertebrate suffocation. To minimize this hazard, do not treat more than ½ of the water body to avoid depletion of oxygen due to decaying vegetation. Wait at least 14 days between treatments. Begin treatment along the shore and proceed outwards in bands to allow fish to move into untreated areas. Consult with the State or local agency with primary responsibility for regulating pesticides before applying to public waters. to determine if a permit is required.

Certain water conditions including low pH (<6.5), low dissolved organic carbon (DOC) levels (3.0 mg/L or lower), and "soft" waters (i.e. alkalinity less than 50 mg/L), increases the potential acute toxicity to non-target aquatic organisms. Do not use in waters containing trout or other fish species that are highly sensitive to copper if the alkalinity is less than 50 ppm. Fish toxicity generally decreases when the hardness of water increases. Captain must not be used in ornamental ponds containing Koi.

DIRECTIONS FOR USE

It is a violation of Federal Law to use this product in a manner inconsistent with its labeling. Read all directions for use carefully before applying this product. Use only according to label directions.

Do not apply this product in a way that concentrate will contact workers or other persons, either directly or through drift; only protected handlers may be in close proximity to the mixing area or application equipment while in use.

Obtain Required Permits: Consult with appropriate state or local pesticide and/or water authorities before applying this product in or around pubic waters. Permits and posting or treatment notification may be required by state, Tribal, or local public agencies.

PRODUCT INFORMATION

Captain is a chelated copper formulation that is effective in controlling a broad range of green and blue-green (cyanobacteria) algae, including filamentous, planktonic and macrophytic. Captain is also an effective herbicide on submersed weed species with susceptibility to copper. The ethanolamines in Captain reduce the precipitation of copper with carbonates and bicarbonates in the water.

Use the lower concentrations/rates in softer water (< 50 ppm alkalinity) or when treating species with greater susceptibility to Captain; use higher concentrations/rates in harder water (> 50 ppm alkalinity) and when treating heavier infestations and/or less susceptible species.

Treatment Notes

Performance of Captain is enhanced under certain conditions. It is recommended to consult a SePRO Aquatic Specialist for guidance in implementing a treatment program to achieve optimal results. The following apply to the use of Captain to achieve optimum effectiveness:

- Treat when growth first begins to appear (if possible) or when target vegetation is actively growing.
- Apply in a manner that will ensure even distribution of Captain within the treatment area.
- Use a high-pressure surface spray application to break up dense floating algal mats.
- In heavily infested areas, a second application may be necessary. Retreat areas if regrowth begins to appear or if seasonal control is desired. Repeating application of Captain too soon after initial application may have no effect.

Precautions and Restrictions

- Do not apply Captain directly to, or otherwise permit it to come into contact with any desirable plants as injury may result.
- Do not apply in such a way that concentrated Captain comes in contact with crops, ornamentals, grass or other desirable plants.
- Wash spray equipment thoroughly before and after each application.
- Contents may cause bluing where marcite has been etched.

Spray Drift Management

A variety of factors including weather conditions (e.g., wind direction, wind speed, temperature, relative humidity) and method of application (e.g., ground, aerial, airblast, chemigation) can influence pesticide drift. The applicator must evaluate all factors and make appropriate adjustments when applying this product.

Droplet Size

Apply only as a medium or coarser spray (ASAE standard 572) or a volume mean diameter of 300 microns or greater for spinning atomizer nozzles.

Wind Speed

Do not apply at wind speeds greater than 15 mph. Only apply this product if the wind direction favors on-target deposition (approximately 3 to 10 mph), and there are no sensitive areas within 250 feet downwind.

Temperature Inversions

If applying at wind speeds less than 3 mph, the applicator must determine if a) conditions of temperature inversion exist, or b) stable atmospheric conditions exist at or below nozzle height. Do not make applications into areas of temperature inversions or stable atmospheric conditions.

Other State and Local Requirements

Applicators must follow all state and local pesticide drift requirements regarding application of copper compounds. Where states have more stringent regulations, they must be observed.

Equipment

All aerial and ground application equipment must be properly maintained and calibrated using appropriate carriers or surrogates.

Additional requirements for aerial applications:

- The boom length must not exceed 75% of the wingspan or 90% of the rotor blade diameter.
- Release spray at the lowest height consistent with efficacy and flight safety. Do not release spray at a height greater than 10 feet above the crop canopy unless a greater height is required for aircraft safety.
- When applications are made with a crosswind, the swath must be displaced downwind. The applicator must compensate for this displacement at the up and downwind edge of the application area by adjusting the path of the aircraft upwind.

Additional requirements for ground boom application:

Do not apply with a nozzle height greater than 4 feet above the crop canopy.

APPLICATION INFORMATION

For aquatic weed control (including algae and vascular plants), do not exceed a concentration of 1.0 ppm copper during any single application; wait a minimum of 14 days between retreatments. (Note: In aquaculture, do not exceed a concentration of 0.4 ppm during any single application when targeting nuisance algae; there are no restrictions on retreatment intervals).

Application Methods and Rates

Surface Spray/Injection Algaecide Application

For effective control, proper rates of Captain should be maintained for a minimum of three hours. The application concentrations/rates in **Table 1** are based on static or minimal flow situations. Where significant dilution occurs from untreated waters or loss of water, within a three hour period, Captain may have to be metered in (refer to the *Drip System or Metering Pump Application for Flowing Water Treatments* section of this label).

Identify the algae growth present as one of the following types: planktonic (suspended), filamentous (mat-forming), or macrophytic algae (chara/nitella).

Determine the surface acreage (1 acre = 43,560 ft.2) and average depth of infested area.

Refer to chart below to determine gallons of Captain to apply per surface acre.

TABLE 1
Captain Application Rates
(Gallons per surface acre)

Algae Type or Species	Dose Rates		Treatment Comments
	PPM Copper	Gallons per Acre Foot	
Planktonic (Suspended)	0.2 - 1.0†	0.6 - 3.0	Apply lower rates for light infestations. Use higher rates on heavy blooms and where algae masses are clumped and accumulated.
Filamentous (Mat-forming)	0.2 - 1.0†	0.6 - 3.0	Apply lower rates for early season applications, light infestations or treatment of regrowth. Apply higher rates on surface mats and species such as *Pithophora*, *Cladophora*, *Lyngbya*, and *Hydrodictyon*.
Macrophytic (Chara/Nitella/Starry Stonewort)	0.4 - 1.0	1.2 - 3.0	Apply lower rates for new infestations or early season growth. Apply higher rates on older, established calcified plants. Apply as close to plant growth as possible.

† For planktonic and filamentous algae, Captain may be applied up to 1.0 ppm when growth conditions require higher rates and for difficult to control species.

For dense infestations of filamentous algae or where the species of *Hydrodictyon, Cladophora* or *Pithophora* are present, apply the higher rate in the rate range. Filamentous algae species are easier to control before floating to the water's surface (when they are forming on the pond/lake bottom). An adjuvant, such as d-limonene or similar surfactant, may be added for enhanced control of floating mats or difficult to control species of algae. Follow surfactant labeling instructions for application rates and use directions.

For planktonic (suspended) algae and free-floating filamentous algae mats, application rates should be based on treating to depths where algae are present (e.g. the upper 3 to 4 feet of water). For dense infestations and in certain other situations, it may be necessary to calculate rates based on the depth of known algae infestation (e.g. > 4 feet) or require treating the entire water column in the target area. To calculate the application rate per surface acre, multiply the application rate in **Table 1** (0.6 to 3.0 Gallon per Acre Foot) by the average depth of infestation, or average water depth if infestation reaches the entire water column.

As a surface or subsurface application, Captain may be applied diluted or undiluted, whichever is most suitable to ensure uniform coverage of the area to be treated. Dilution with water may be necessary at the lower application rates. Dilute the required amount of Captain with enough water to ensure even distribution in the treated area with the type of equipment being used. For best results, dilute Captain in water to provide a minimum spray mix of 20 to 50 gallons per acre; in areas with heavy infestations of filamentous algae, a total tank mix of >50 gallons per acre may be necessary; break up floating algae mats before spraying or while application is being made.

Drip System or Metering Pump Application for Flowing Water Treatments

For Use in Potable Water, Canals, Ditches, and Irrigation and Drainage Systems

For optimal control, apply Captain as soon as algae begin active growth or interfere noticeably with normal delivery of water (clogging of lateral headgates, suction screens, weed screens, and siphon tubes). Delaying treatment could perpetuate the problem causing massing and compacting of plants. Heavy infestations and low flow may cause poor distribution resulting in unsatisfactory control. Under these conditions repeated applications or increasing water flow rate during application may be necessary.

Prior to treatment it is important to accurately determine water flow rates. In the absence of weirs, orifices, or similar devices, which give accurate waterflow measurements, volume of flow can be estimated by the following formula:

Cubic feet per second (cfs) = average width (feet) **x** average depth (feet) **x** average velocity† (feet/second) **x** 0.9

† The velocity can be estimated by determining the length of time it takes a floating object to travel a defined distance. Divide the distance (feet) by the time (seconds) to estimate velocity (feet/seconds). This measure should be repeated 3 times at the intended application site and then calculate the average velocity.

After accurately determining the water flow rate in cfs or gallons/minute, find the corresponding Captain rate in **Table 2** or use the below formula.

cfs **x** desired concentration of copper (ppm) = quarts/hour of application

TABLE 2
Captain Application Rates For Flowing Water

Water Flow Rate		PPM Copper	Captain Rate	
CFS	Gal/min.		Quart/ hr.	mL / min.
1	450	0.2 - 1.0	0.2 - 1.0	3.2 - 15.7
2	900	0.2 - 1.0	0.4 - 2.0	6.3 - 31.5
3	1,350	0.2 - 1.0	0.6 - 3.0	9.5 - 47.3
4	1,800	0.2 - 1.0	0.8 - 4.0	12.6 - 63.0
5	2,250	0.2 - 1.0	1.0 - 5.0	15.8 - 78.5
10	4,500	0.2 - 1.0	2.0 - 10.0	31.5 - 157.7
100	45,000	0.2 - 1.0	20 - 100.0	315 - 1,577

Calculate the amount of Captain needed to maintain the drip rate for a treatment period of 3 hours by multiplying either:

Quarts / hr x 3; Milliliters / Minute x 180; or **Fluid ounces / Minute x 180**

Rates will target 1.0 ppm copper concentration in the treated water for the treatment period. Lower concentrations may be used on highly susceptible algae species or if longer exposure times are maintained. Introduction of the chemical should be made in the channel at weirs or other turbulence-creating structures to promote the dispersion of the chemical. For injection periods longer than three hours (180 minutes), calculate the amount of Captain needed by multiplying the rate by the desired time in minutes or hours, as appropriate.

Use a drum or tank equipped with a valve or other volume control device that can be calibrated to maintain a constant drip rate. Use a stopwatch and appropriate measuring container to set the desired drip rate. Readjust accordingly if the canal flow rate changes during the treatment period. A small pump or other metering device may be used to meter Captain into the water more accurately. Application can be made using diluted or undiluted material.

Results can vary depending upon species and density of algae and vegetation, desired distance of control and flow rate, and impact of water quality on efficacy. Periodic maintenance treatments may be required to maintain seasonal control. It is recommended to consult a SePRO Aquatic Specialist to determine optimal use rate, location of treatment stations and treatment period under local conditions.

Chemigation System Application

Captain may be applied for the maintenance of chemigation systems. To control algae in chemigation systems Captain should be applied continuously during water application. For continuous addition application apply 0.91 - 9.1 gallons of Captain per 1,000,000 (one million) gallons of water (0.3 - 3.0 gallons of Captain per acre-foot of water). This will produce a concentration of 0.1 to 1.0 ppm of copper. Do not exceed 1.0 ppm of copper or 0.91 gallons of Captain per 100,000 gallons of water. For additional guidance regarding specific calibrations or application techniques contact application equipment manufacturer, supplier, or pest control advisor. It is not necessary to agitate or dilute Captain in the supply tank before application to chemigation systems.

TABLE 3
Application Rates for Chemigation Systems

Copper Concentration (ppm)	Amount of Captain			
	Per Acre-foot		Per Million Gallons	
	Gallons	Liters	Gallons	Liters
0.1	0.3	1.1	0.9	3.4
0.2	0.6	2.3	1.8	6.8
0.3	0.9	3.4	2.8	10.6
0.4	1.2	4.5	3.7	14.0
0.5	1.5	5.7	4.6	17.4
0.6	1.8	6.8	5.5	22.8
0.7	2.1	7.9	6.4	24.2
0.8	2.4	9.1	7.3	27.6
0.9	2.7	10.2	8.3	31.4
1.0	3.0	11.3	9.1	34.4

CHEMIGATION SYSTEM APPLICATION

- Apply Captain only through sprinkler and drip irrigation systems including: center pivot, lateral move, end tow, side (wheel) roll, traveler, big gun, solid set, or hand move; flood (basin), furrow, border or drip (trickle) systems.
- Crop injury, lack of effectiveness, or illegal pesticide residues in the crop can result from non-uniform distribution of treated water.
- If you have questions about calibration, contact your SePRO Aquatic Specialist, State Extension Service, equipment manufacturer, or other experts.
- Do not connect an irrigation system (including greenhouse systems) used for pesticide application to a public water system unless the pesticide label-prescribed safety devices for public water systems are in place (refer to the *Chemigation Systems Connected to a Public Water Supply* section of this label).
- A person knowledgeable of the chemigation system and responsible for its operation or under the supervision of the responsible person, shall shut the system down and make necessary adjustments should the need arise. The injection system should be inspected, calibrated, and maintained before application of Captain begins.

Chemigation Systems Connected to a Public Water Supply

- Public water system means a system for the provision to the public of piped water for human consumption if such system has at least 15 service connections or regularly serves an average of at least 25 individuals daily at least 60 days out of the year.
- Chemigation systems connected to public water systems must contain a functional, reduced-pressure zone, back flow preventer (RPZ) or the functional equivalent in the water supply line upstream from the point of pesticide introduction. There shall be a complete physical break (air gap) between the flow outlet end of the fill pipe and the top or overflow rim of the reservoir tank of at least twice the inside diameter of the fill pipe.
- The pesticide injection pipeline must contain a functional, automatic, quick-closing check valve to prevent the flow of fluid back toward the injection.
- The pesticide injection pipeline must contain a functional, normally closed, solenoid-operated valve located on the intake side of the injection pump and connected to the system interlock to prevent fluid from being withdrawn from the supply tank when the irrigation system is either automatically or manually shut down.

- The system must contain functional interlocking controls to automatically shut off the pesticide injection pump when the water pump motor stops or in cases where there is no water pump, when the water pressure decreases to the point where pesticide distribution is adversely affected.
- Systems must use a metering pump, such as a positive displacement injection pump (e.g., diaphragm pump) effectively designed and constructed of materials that are compatible with pesticides and capable of being fitted with a system interlock.
- Do not apply when wind speed favors drift beyond the area intended for treatment.

Sprinkler Chemigation Requirements

- The system must contain a functional check valve, vacuum relief valve, and low pressure drain appropriately located on the irrigation pipeline to prevent water source contamination from back flow.
- The pesticide injection pipeline must contain a functional, automatic, quick-closing check valve to prevent the flow of fluid back toward the injection pump.
- The pesticide injection pipeline must also contain a functional, normally closed, solenoid-operated valve located on the intake side of the injection pump and connected to the system interlock to prevent fluid from being withdrawn from the supply tank when the irrigation system is either automatically or manually shut down.
- The system must contain functional interlocking controls to automatically shut off the pesticide injection pump when the water pump motor stops.
- The irrigation line or water pump must include a functional pressure switch which will stop the water pump motor when the water pressure decreases to the point where pesticide distribution is adversely affected.
- Systems must use a metering pump, such as a positive displacement injection pump (e.g.. diaphragm pump) effectively designed and constructed of materials that are compatible with pesticides and capable of being fitted with a system interlock.
- Do not apply when wind speed favors drift beyond the area intended for treatment.

Floor (Basin), Furrow and Border Chemigation Requirements

- Systems using a gravity flow pesticide dispensing system must meter the pesticide into the water at the head of the field and downstream of a hydraulic discontinuity such as a drop structure or weir box to decrease potential for water source contamination from back flow if water flow stops.
- Systems utilizing a pressurized water and pesticide injection system must meet the following requirements:
  - The system must contain a functional check valve, vacuum relief valve, and low pressure drain appropriately located on the irrigation pipeline to prevent water source contamination from back flow.
  - The pesticide injection pipeline must contain a functional, automatic, quick-closing check valve to prevent the flow of fluid back toward the injection pump.
  - The pesticide injection pipeline must also contain a functional, normally closed, solenoid-operated valve located on the intake side of the injection pump and connected to the system interlock to prevent fluid from being withdrawn from the supply tank when the irrigation system is either automatically or manually shut down.
  - The system must contain functional interlocking controls to automatically shut off the pesticide injection pump when the water pump motor stops.
  - The irrigation line or water pump must include a functional pressure switch which will stop the water pump motor when the water pressure decreases to the point where pesticide distribution is adversely affected.
  - Systems must use a metering pump, such as a positive displacement injection pump (e.g., diaphragm pump) effectively designed and constructed of materials that are compatible with pesticides and capable of being fitted with a system interlock.

Drip (Trickle) Chemigation Requirements

- The system must contain a functional check valve, vacuum relief valve, and low pressure drain appropriately located on the irrigation pipeline to prevent water source contamination from back flow.
- The pesticide injection pipeline must contain a functional, automatic, quick-closing check valve to prevent the flow of fluid back toward the injection pump.
- The pesticide injection pipeline must also contain a functional, normally closed, solenoid-operated valve located on the intake side of the injection pump and connected to the system interlock to prevent fluid from being withdrawn from the supply tank when the irrigation system is either automatically or manually shut down.
- The system must contain functional interlocking controls to automatically shut off the pesticide injection pump when the water pump motor stops.
- The irrigation line or water pump must include a functional pressure switch which will stop the water pump motor when the water pressure decreases to the point where pesticide distribution is adversely affected.
- Systems must use a metering pump, such as a positive displacement injection pump (e.g.. diaphragm pump) effectively designed and constructed of materials that are compatible with pesticides and capable of being fitted with a system interlock.

Submersed Plant Control Applications

Captain can be applied to control hydrilla (*Hydrilla verticillata*), egeria (*Egeria densa*), and other aquatic weeds with susceptibility to copper. Apply Captain at a rate to achieve 0.75 to 1.0 ppm copper (2.3 to 3.0 Gallons Captain/Acre foot). In heavily infested areas, a second application after the 14 day retreatment interval may be necessary.

Tank Mix Applications

Captain can be tank mixed with other herbicides to improve efficacy; and to control algae in areas where heavy algae growth may cover target submersed plant species and interfere with herbicide exposure. Do not mix concentrates in tank without first adding water. To ensure compatibility, a jar test is recommended before field application. Captain must not be mixed with any product containing a label prohibition against such mixing and must be used in accordance with the more restrictive of the label limitations and precautions. No label dosage rates should be exceeded.

Hydrilla Control – Captain + Diquat Tank Mix

Captain can be mixed with diquat (diquat dibromide) at 4 gallons Captain and 2 gallons diquat (Littora*, Reward® - 2 lbs a.i./gallon) per acre. Lower rates of Captain may also enhance the activity of diquat. Captain should be applied at a minimum of 0.1 ppm in combination with diquat. Higher rates may be needed in areas with dense weeds.

STORAGE AND DISPOSAL

Do not contaminate water, food, or feed by storage and disposal.
Pesticide Storage: Store in a cool dry place. Do not store near feed or foodstuffs. In case of leak or spill, use absorbent materials to contain liquids and dispose in a manner consistent with the pesticide disposal instructions.
Pesticide Disposal: Pesticide wastes are acutely hazardous. Improper disposal of excess pesticide, spray mixture, or rinsate is a violation of Federal Law. If these wastes cannot be disposed of by use according to label instructions, contact your State Pesticide or Environmental Control Agency, or the Hazardous Waste representative at the nearest EPA Regional Office for guidance. Wastes resulting from the use of this product may be disposed of on site or at an approved waste disposal facility.
Container Disposal
Nonrefillable Container. DO NOT reuse or refill this container. Triple rinse or pressure rinse container (or equivalent) promptly after emptying; then offer for recycling, if available, or reconditioning, if appropriate, or puncture and dispose of in a sanitary landfill, or by incineration, or by other procedures approved by state and local authorities.
Triple rinse containers small enough to shake (capacity ≤ 5 gallons) as follows: Empty the remaining contents into application equipment or a mix tank and drain for 10 seconds after the flow begins to drip. Fill the container ¼ full with water and recap. Shake for 10 seconds. Pour rinsate into application equipment or a mix tank, or store rinsate for later use or disposal. Drain for 10 seconds after the flow begins to drip. Repeat this procedure two more times.
Triple rinse containers too large to shake (capacity > 5 gallons) as follows: Empty the remaining contents into application equipment or a mix tank. Fill the container ¼ full with water. Replace and tighten closures. Tip container on its side and roll it back and forth, ensuring at least one complete revolution, for 30 seconds. Stand the container on its end and tip it back and forth several times. Turn the container over onto its other end and tip it back and forth several times. Empty the rinsate into application equipment or a mix tank, or store rinsate for later use or disposal. Repeat this procedure two more times.
Pressure rinse as follows: Empty the remaining contents into application equipment or mix tank and continue to drain for 10 seconds after the flow begins to drip. Hold container upside down over application equipment or mix tank, or collect rinsate for later use or disposal. Insert pressure rinsing nozzle in the side of the container and rinse at about 40 PSI for at least 30 seconds. Drain for 10 seconds after the flow begins to drip.
Refillable Container. Refill this container with pesticide only. **DO NOT** reuse this container for any other purpose. Triple rinsing the container before final disposal is the responsibility of the person disposing of the container. Cleaning before refilling is the responsibility of the refiller.
Triple rinse as follows: To clean the container before final disposal, empty the remaining contents from this container into application equipment or mix tank. Fill the container about 10% full with water. Agitate vigorously or recirculate water with the pump for 2 minutes. Pour or pump rinsate into application equipment or rinsate collection system. Repeat this rinsing procedure two more times.
When this container is empty, replace the cap and seal all openings that have been opened during use; return the container to the point of purchase or to a designated location. This container must only be refilled with a pesticide product. Prior to refilling, inspect carefully for damage such as cracks, punctures, abrasions, worn-out threads and closure devices. Check for leaks after refilling and before transport. **DO NOT** transport if this container is damaged or leaking. If the container is damaged, or leaking, or obsolete and not returned to the point of purchase or to a designated location, triple rinse emptied container and offer for recycling, if available, or dispose of container in compliance with state and local regulations.

TERMS AND CONDITIONS OF USE

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

WARRANTY DISCLAIMER

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

INHERENT RISKS OF USE

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

LIMITATION OF REMEDIES

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

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

To the extent consistent with applicable law, SePRO Corporation shall not be liable for losses or damages resulting from handling or use of this product unless SePRO Corporation is promptly notified of such losses or damages in writing. In no case shall SePRO Corporation be liable for consequential or incidental damages or losses.

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

SePRO Corporation
11550 North Meridian Street, Suite 600
Carmel, IN 46032, U.S.A.

PAK® 27
Algaecide

1024.50

Active Ingredient:
Sodium Carbonate Peroxyhydrate.....85.0%
Other Ingredients:.....15.0%
TOTAL.....100.0%

Keep Out of Reach of Children

DANGER

PRECAUTIONARY STATEMENTS
HAZARDS TO HUMANS AND DOMESTIC ANIMALS

DANGER: CORROSIVE
Causes irreversible eye damage and causes skin burns. Do not get in eyes, on skin, or clothing. Wear goggles or face shield and rubber gloves when handling this product. Harmful if swallowed or inhaled. Avoid breathing dust. Wear protective eyewear (goggles, face shield or safety glasses). Wash thoroughly with soap and water after handling and before eating, drinking, chewing gum, using tobacco or using the toilet. Remove contaminated clothing and wash clothing before reuse. Prolonged or frequently repeated skin contact may cause allergic reactions in some individuals. When prolonged or frequently repeated contact could occur, use chemically-resistant gloves and full body clothing.

PHYSICAL AND CHEMICAL HAZARDS
Oxidizing agent. Contact with combustible materials may cause fire. Wet product decomposes exothermically and may cause combustion of organic materials. Pressure may increase due to decomposition in confined spaces or containers.

ENVIRONMENTAL HAZARDS
When applying PAK 27 to water bodies, avoid solid particles from falling on nearby ground where birds and feed may be present. Undissolved particles of sodium carbonate peroxyhydrate may be corrosive to beaks of birds.

Do not discharge effluent containing this product into lakes, streams, ponds, estuaries, oceans or other waters unless in accordance with the requirements of a National Pollutant Discharge Elimination System (NPDES) permit and the permitting authority has been notified in writing prior to discharge. Do not discharge effluent containing this product into sewer systems without previously notifying the local sewage treatment plant authority. For guidance contact your State Water Board or Regional Office of U.S. EPA. For additional information, refer to the product Material Safety Data Sheet.

Net weight: 50 pounds

DIRECTIONS FOR USE
It is a violation of Federal Law to use this product in a manner inconsistent with its labeling. Do not allow the product to come in contact with other pesticide products, cleaners or oxidative agents.

For control of blue-green algae in lakes, ponds, drinking water reservoirs, irrigation, drainage and conveyance ditches, canals, laterals, estuaries, bayous, lagoons, water gardens and water features, impounded water and waste water, and aquaculture. Apply 3.0 to 100 pounds per acre-foot (9.2 to 306.9 pounds / million gallons) of water (equivalent to 0.3 to 10.2 ppm hydrogen peroxide) by broadcasting or use of a mechanical spreader.

Note: Algae control is more easily achieved if treated soon after growth starts. Larger amounts of product may be needed to treat heavier blooms. As little as 2.5 pounds per acre-foot could be used for algaestatic treatment.

Water Treatment – MAXIMUM Dosage Rate by Volume

Gallons	200	500	750	1,000	2,000	10,000	100,000	325,851
Dosage	34g	68g	100g	135g	270g	3 lbs.	30 lbs.	100 lbs.
Acre - ft.	1	9	15	30	60	75	100	
Dosage lbs.	100	900	1,500	3,000	6,000	7,500	10,000	

1 lb. = 454 grams (g) 1 acre-foot = 325,851 gallons

Precaution: Decaying algae can deplete dissolved oxygen which can lead to fish kill, if excessive. Apply with 8 to 10 hours of daylight remaining. Do not reapply within 48 hours. If treating a large lake or heavy bloom, treat 1/3 to 1/2 of the area and wait 2 to 3 days before treating remainder of water. Consult with the State agency with primary responsibility for regulating pesticides before applying to public waters to determine if a permit is needed.

FIRST AID	
Have the product container or label with you when calling a poison control center or doctor, or going for treatment.	
If in eyes	• Hold eye open and rinse slowly and gently with water for 15 - 20 minutes. Remove contact lenses, if present, after the first 5 minutes; then continue rinsing eye. • Call a poison control center or doctor for treatment advice.
If on skin or clothing	• Take off contaminated clothing. • Rinse skin immediately with plenty of water for 15 - 20 minutes. • Call a poison control center or doctor for treatment advice.
If inhaled	• Move person to fresh air. • If person is not breathing, call 911 or an ambulance; then give artificial respiration, preferably mouth-to-mouth, if possible. • Call a poison control center or doctor for further treatment advice.
If swallowed	• Call a poison control center or doctor immediately for treatment advice. • Drink promptly large quantities of water. • Do not induce vomiting unless told to do so by a poison control center or doctor. • Do not give anything by mouth to an unconscious person.
HOTLINE NUMBER	
In case of emergency endangering health or the environment involving this product, call INFOTRAC at 1-800-535-5053.	
NOTE TO PHYSICIAN: Probable mucosal damage may contraindicate the use of gastric lavage.	

STORAGE AND DISPOSAL
DO NOT CONTAMINATE WATER, FOOD OR FEED BY STORAGE AND DISPOSAL
STORAGE: Store in original, closed container in a dry location away from heat and out of direct sunlight. Keep away from combustible material. Do not return unused product to container.
PESTICIDE DISPOSAL: Pesticide wastes are acutely hazardous. Improper disposal of excess pesticide spray mixture, or rinsate, is a violation of Federal Law. For additional information, refer to the product Material Safety Data Sheet.
CONTAINER DISPOSAL: 50 lb Bags/Sacks: Nonrefillable container. Do not reuse or refill this container. Offer for recycling, if available. Completely empty sack [bag] into application equipment. Then dispose of empty sack [bag] in a sanitary landfill or by incineration, or, if allowed by State and local authorities, by burning. If burned, stay out of smoke.

FPO

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USA/+AC2806

EPA No. 68660-9-67690
EPA Est. No. 68660-TX-001
FPL20120730
162401

Lot No._____

Manufactured for: SePRO Corporation 11550 North Meridian Street, Suite 600 Carmel, IN 46032 U.S.A.

Littora®

Landscape and Aquatic Herbicide

SPECIMEN

SePRO

To prevent accidental poisoning, never put this product into food, drink, or other containers. Do not use measuring utensils for subsequent food use. Use strictly in accordance with entire label.

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

Contains 2 pounds diquat cation per one (1) U.S. gallon (3.73 pounds diquat dibromide per gallon).

Keep Out of Reach of Children

CAUTION / PRECAUCIÓN

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

Refer to inside of label booklet for additional precautionary information and directions for use, including First Aid and storage and disposal.

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

®Littora is a registered trademark of SePRO Corporation.

SePRO Corporation
11550 North Meridian Street, Suite 600, Carmel, IN 46032 U.S.A.

EPA Reg. No. 67690-53
FPL20120928

PRECAUTIONARY STATEMENTS

Hazards to Humans and Domestic Animals

Keep Out of Reach of Children

CAUTION / PRECAUCIÓN

Harmful if inhaled. Harmful if swallowed. Causes moderate eye irritation. Avoid breathing spray mist and contact with eyes or clothing.

FIRST AID	
If inhaled	• Move person to fresh air. • If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably mouth-to-mouth, if possible. • Call a poison control center or doctor for further treatment advice.
If swallowed	• Call a poison control center or doctor immediately for treatment advice. • Have person sip a glass of water if able to swallow. • Do not induce vomiting unless told to do so by the poison control center or doctor. • Do not give anything by mouth to an unconscious person.
If in eyes	• Hold eye open and rinse slowly and gently with water for 15 - 20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye. • Call a poison control center or doctor for treatment advice.
Have the product container or label with you when calling a poison control center or doctor, or going for treatment. In case of emergency endangering health or the environment involving this product, call **INFOTRAC** at **1-800-535-5053.**	

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

PERSONAL PROTECTIVE EQUIPMENT (PPE)

Some materials that are chemical-resistant to this product are: barrier laminate, butyl rubber ≥14 mils, nitrile rubber ≥14 mils. If you want more options, follow the instructions for Category A on an EPA Chemical Resistance Category Selection Chart.

Mixers, Loaders, Applicators and Other Handlers Must Wear:

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

Exception: After this product has been diluted to 0.50% Littora or less in water (i.e., the labeled rate for some spot applications), applicators for *AQUATIC SURFACE APPLICATIONS* must, at a minimum, wear (Note: Mixers and loaders for this application method must still wear the PPE as described in the above section.):

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

Exception: At a minimum, applicators for *AQUATIC SUBSURFACE APPLICATIONS* must wear (Note: Mixers and loaders for this application method must still wear the PPE as described in the above section.):

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

USER SAFETY REQUIREMENT

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

ENGINEERING CONTROLS

Mixers and loaders supporting aerial applications are required to use closed systems that provide dermal protection. The closed system must be used in a manner that meets the requirements listed in the Worker Protection Standard (WPS) for agricultural pesticides [40 CFR 170.240(d)(4)]. When using the closed system, mixers and loaders' PPE requirements may be reduced or modified as specified in the WPS.

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

USER SAFETY RECOMMENDATIONS

Users should:

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

ENVIRONMENTAL HAZARDS

This pesticide is toxic to aquatic invertebrates. **For Terrestrial Uses** do not apply directly to water, or to areas where surface water is present, or to intertidal areas below the mean high water mark. Do not contaminate water when disposing of equipment wash waters. **For Aquatic Uses** do not apply directly to water except as specified on this label.

DIRECTIONS FOR USE

It is a violation of Federal Law to use this product in a manner inconsistent with its labeling. Read the entire label. Use strictly in accordance with precautionary statements and directions for use, and with applicable state and federal regulations.

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

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

AGRICULTURAL USE REQUIREMENTS

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

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

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

- Coveralls over long-sleeve shirt and long pants;
- Chemical-resistant gloves;
- Chemical-resistant footwear plus socks;
- Protective eyewear; and
- Chemical-resistant headgear for overhead exposure.

NON-AGRICULTURAL USE REQUIREMENTS

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

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

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

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

PRODUCT OVERVIEW INFORMATION

Littora® Landscape and Aquatic Herbicide is a nonvolatile herbicidal for use as a general herbicide to control weeds in:

- Commercial greenhouses and nurseries;
- Ornamental seed crops (flowers, bulbs, etc. - except in the state of California);
- Landscape, industrial, recreational, commercial, residential, and public areas;
- Turf renovation (all turf areas except commercial sod farms);
- Dormant established turfgrass (bermudagrass, zoysiagrass, nonfood or feed crop); and
- Aquatic areas.

Absorption and herbicidal action is usually quite rapid with effects visible in a few days. Littora controls weeds by interfering with photosynthesis that occurs within green plant tissue. Weeds should be succulent and/or actively growing for best results.

Rinse all spray equipment thoroughly with water after use. Avoid spray drift to crops, ornamentals, and other desirable plants during application, as injury may result. Application to muddy water may result in reduced control. Minimize creating muddy water during aquatic application. Use of dirty or muddy water for Littora dilution may result in reduced herbicidal activity. Avoid applying under conditions of high wind, water flow, or wave action.

Spray Drift Management

Avoiding spray drift at the application site is the responsibility of the applicator. The interactions of many equipment- and weather-related factors determine the potential for spray drift. The applicator is responsible for considering all these factors when making decisions.

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

- The distance of the outermost nozzles on the boom must not exceed ¾ the length of the wingspan or rotor; and
- Nozzles must always point backward parallel with the air stream and never be pointed downward more than 45 degrees.

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

Droplet Size

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

Controlling Droplet Size

Volume - Use high flow rate nozzles to apply the highest practical spray volume. Nozzles with higher rated flows produce larger droplets.

Pressure - Do not exceed the nozzle manufacturer's recommended pressures. For many nozzle types, lower pressure produces larger droplets. When higher flow rates are needed, use higher flow rate nozzles instead of increasing pressure.

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

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

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

Boom Length

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

Application Height

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

Swath Adjustment

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

Wind

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

Temperature and Humidity

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

Temperature Inversions

Applications should not occur during a temperature inversion because drift potential is high. Temperature inversions restrict vertical air mixing, which causes small suspended droplets to remain in a concentrated cloud. This cloud can move in unpredictable directions due to the light variable winds common during inversions. Temperature inversions are characterized by increasing temperatures with altitude and are common on nights with limited cloud cover and light to no wind. They begin to

form as the sun sets and often continue into the morning. Their presence can be indicated by ground fog; however, if fog is not present inversions can also be identified by the movement of smoke from a ground source or an aircraft smoke generator. Smoke that layers and moves laterally in a concentrated cloud (under low wind conditions) indicates an inversion, while smoke that moves upward and rapidly dissipates indicates good vertical air mixing.

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

USE IN COMMERCIAL GREENHOUSES AND NURSERIES

For general weed control in commercial greenhouses (beneath benches), field grown and container stock, and other similar areas, Littora may be applied pre- or post-plant preemergence in field grown ornamental nursery plantings or post-emergence as a directed spray. Littora may also be applied preemergence in ornamental seed crops (except in the state of California).

Avoid contact with desirable foliage as injury may occur. Do not use on food or feed crops.

Spot spray: Apply 1-2 quarts of Littora plus the labeled rate of a 75% or greater nonionic surfactant per 100 gallons of water, or 0.75 ounces (22 milliliters) of Littora plus the labeled rate of a 75% or greater nonionic surfactant per 1 gallon of water.

Broadcast: Apply 1-2 pints of Littora in a minimum of 15 gallons of water per acre. Add the labeled rate of a 75% or greater nonionic surfactant per 100 gallons of spray mixture. Use an adequate spray volume to insure good coverage.

USE IN ORNAMENTAL SEED CROPS (FLOWERS, BULBS, ETC.) [EXCEPT IN THE STATE OF CALIFORNIA]

For pre-harvest desiccation of ornamental seed crops. NOT FOR FOOD OR FIBER CROPS.

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

USE IN LANDSCAPE, INDUSTRIAL, RECREATIONAL, COMMERCIAL, RESIDENTIAL, AND PUBLIC AREAS

Littora provides fast control of broadleaf and grassy weeds in industrial, recreational, golf course, commercial, residential, and public areas. Littora is a nonselective herbicide that rapidly kills undesirable above ground weed growth in 24-36 hours. Avoid application of Littora to desirable plants.

Littora is a contact/desiccant herbicide; it is essential to obtain complete coverage of the target weeds to get good control. Improper application technique and/or application to stressed weeds may result in unacceptable weed control. For best results, apply to actively growing, young weeds. Difficult weeds (such as perennial or deeply-rooted weeds) can often be controlled by tank mixing Littora with other systemic-type herbicides. Refer to other product labels for specific application directions.

For residual weed control, tank mix Littora with a preemergent herbicide labeled for the intended use site. When mixing Littora with another herbicide, it is recommended to mix just a small amount to first determine if the mixture is physically compatible before proceeding with larger volumes.

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

- **Grounds maintenance weed control:** Littora can be used as a spot or broadcast spray to control weeds in public, commercial and residential landscapes, including landscape beds, lawns, golf courses and roadsides. Littora can also be used for weed control around the edges and non-flooded portions of ponds, lakes and ditches.
- **Trim and Edge weed control:** Littora can be used to eliminate undesired grass and broadleaf plant growth in a narrow band along driveways, walkways, patios, cart paths, fence lines, and around trees, ornamental gardens, buildings, other structures, and beneath noncommercial greenhouse benches. Vegetation control with Littora is limited to the spray application width. Do not exceed the labeled rate of Littora as excessive rates may result in staining of concrete-based materials.

  Littora, since it does not translocate systemically, can be used as an edging or pruning tool when precisely applied to select areas of grass or to undesirable growth on desirable ornamental bedding plants, ground covers, etc.
- **Industrial weed control:** Littora can be used as a spot or broadcast spray either alone or in combination with other herbicides as a fast burndown or control weeds in rights-of-ways, railroad beds/yards, highways, roads, dividers and medians, parking lots, pipelines, pumping stations, public utility lines, transformer stations and substations, electric utilities, storage yards, and other non-crop areas.

Spot spray: Apply either 1-2 quarts of Littora plus the labeled rate of a 75% or greater nonionic surfactant per 100 gallons water, or 0.75 ounces (22 milliliters) Littora plus the labeled rate of a 75% or greater nonionic surfactant per 1 gallon of water.

Broadcast: 1-2 pints of Littora per acre in sufficient water to ensure good spray coverage. Add the labeled rate of 75% or greater nonionic surfactant per 100 gallons spray mixture. Greater water volumes are necessary if the target plants are tall and/or dense. It is recommended that 60 gallons or greater water volume be used to obtain good coverage of dense weeds.

USE IN TURF RENOVATION (ALL TURF AREAS EXCEPT COMMERCIAL SOD FARMS)

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

For **suppression** of regrowth and quick desiccation of treated turfgrass, Littora may be mixed with other systemic nonselective or systemic post-emergence grassy weed herbicides. Refer to other product labels for specific application directions and restrictions.

Avoid spray contact with, or spray drift to, foliage of ornamental plants or food crops. Do not graze livestock on treated turf or feed treated thatch to livestock.

USE IN DORMANT ESTABLISHED TURFGRASS (BERMUDAGRASS, ZOYSIAGRASS), NONFOOD OR FEED CROP

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

Apply 1-2 pints Littora per acre in 20-100 gallons of spray mix by ground as a broadcast application. Add the labeled rate of a 75% or greater nonionic surfactant per 100 gallons of spray mixture.

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

†For control of Little Barley, apply Littora prior to the mid-boot stage.

USE IN AQUATIC AREAS

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

Obtain Required Permits: Consult with appropriate state or local pesticide and/or water authorities before applying this product in or around pubic waters. Permits and posting or treatment notification may be required by state, tribal, or local public agencies.

Treatment of dense weed areas may result in oxygen loss from decomposition of dead weeds. This loss of oxygen may cause fish suffocation. Therefore, to minimize this hazard, do not treat more than 1/2 of the water body area at one time and wait 14 days between treatments when susceptible plants are mature and have grown to the water's surface, or when the treatment would result in significant reductions in total plant biomass. Waters having limited and less dense weed infestations may not require partial treatments.

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

and/or

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

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

Treated water may be used according to the water use restrictions set forth in Table 1 or when an approved assay or analytical method establishes that the water does not contain more than the designated maximum contaminant level goal (MCLG) of 0.02 mg/l (ppm) of diquat dibromide (calculated as the cation).

TABLE 1: WATER USE RESTRICTIONS FOLLOWING APPLICATIONS WITH LITTORA (Days)

Application Rate (gallons/ surface acre)	Drinking	Fishing and Swimming	Livestock/ Domestic Animals Consumption	Irrigation to Turf and Landscape Ornamentals††	Irrigation to Food Crops and Production Ornamentals††
≥ 2	3 days	0	1 day	3 days	5 days
1	2 days	0	1 day	2 days	5 days
0.75	2 days	0	1 day	2 days	5 days
0.50	1 day	0	1 day	1 day	5 days
Spot Spray† (< 0.5)	1 day	0	1 day	1 day	5 days

†Add a nonionic surfactant (with at least 75% of the constituents active as a spray adjuvant) at the rate recommended by the manufacturer.

††For preparing agricultural sprays for food crops, turf or ornamentals (to prevent phytotoxicity), do not use water treated with Littora before the specified time period.

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

No applications are to be made in areas where commercial processing of fish, resulting in the production of fish protein concentrate or fish meal, is practiced.

Littora may be applied by backpack, airboat, spray handgun, helicopter, airplane, or similar application equipment that results in thorough spray coverage.

Floating and Marginal Weed Control

Littora may be applied by backpack, airboat, spray handgun, helicopter, airplane, or similar application equipment that results in thorough spray coverage.

- Cattails, *Typha* spp.
- Duckweed, including *Lemna* spp.
- Frog's Bit†, *Limnobium spongia*
- Pennywort (*Hydrocotyle* spp.)
- *Salvinia* spp. (including *S. molesta*)
- Water hyacinth, *Eichhornia crassipes*
- Water lettuce, *Pistia stratiotes*

†Not for use in California

Spot Treatment: Apply Littora at 2 to 4 quarts per 100 gallons spray carrier (0.5 - 1.0% solution) with an approved aquatic surfactant or wetting agent at 0.25 - 1.0% v/v (1 quart to 1 gallon per 100 gallons water; refer to the surfactant label for product-specific rates). For cattail control, Littora should be applied prior to flowering at the maximum application rate (8 quarts of Littora /100 gallons spray carrier) plus the wetting agent. Repeat treatments may be necessary for complete control.

Spray to completely wet target weeds but not to runoff. Densely packed weeds or mats may require additional applications due to incomplete spray coverage. Re-treat as needed. For best results, re-treat weed escapes within 2 weeks of the initial treatment.

Broadcast Treatment: Apply Littora at the rate of 0.5 - 2.0 gallons per surface acre in sufficient carrier along with 16-32 ounces per acre of an aquatic surfactant or wetting agent (refer to the surfactant label for product specific rates). Re-treat as necessary for densely populated weed areas. Good coverage is necessary for control of the target weeds.

For duckweed control, apply Littora at 1 - 2 gallons/acre.

Submersed Weed Control

To control submersed weeds apply Littora in water at 0.5 - 2.0 gallons per surface acre (per 4 foot water depth), or up to 0.5 gallons/acre foot in water with an average depth greater than 4 feet deep. For severe weed infestations or when treating more difficult to control species, use 0.5 gallons/acre foot of water. Refer to Table 2 for application rates.

- Algae††, *Spirogyra* spp. and *Pithophora* spp.
- Bladderwort, *Utricularia* spp.
- Brazilian Elodea, *Egeria densa*
- Coontail, *Ceratophyllum demersum*
- Elodea, *Elodea* spp.
- Hydrilla, *Hydrilla verticillata*
- Naiad, *Najas* spp.
- Pondweeds†, *Potamogeton* spp.
- Watermilfoils (including Eurasian), *Myriophyllum* spp.

†Littora controls *Potamogetan* species except Richardson's pondweed, *P. richardsonii*.

††Suppression only. For control of *Spirogyra* and/or *Pithophora*, use Littora in a tank mix with an approved algaecide.

TABLE 2: GALLONS OF LITTORA PER SURFACE ACRE†

Application Rate (gallons/acre)	Average Water Depth			
	1 Foot	2 Feet	3 Feet	4 Feet††
1	0.25 gal.	0.50 gal	0.75 gal.	1.0 gal.
2	0.50 gal	1.0 gal.	1.5 gals.	2.0 gals.

†For water depths ≤ 2 feet including shorelines, do not exceed 1 gallon per surface acre.

††In treatment areas with an average water depth greater than 4 feet, apply a maximum of 0.5 gallons per acre foot of water.

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

Bottom Placement: Where submersed weeds such as hydrilla, bladderwort, or coontail are growing in deeper water and are less mature (e.g. not to the surface of the water) and/or where the water is slowly moving through the weed growth, the use of an application method (such as invert emulsion carrier or long-trailing hoses) to inject Littora near the bottom with weighted hoses may improve control.

Surface Application for Submerged Aquatic Weeds: Apply the recommended rate of Littora as a spray in sufficient carrier to fully cover the target area. Applications should be made to ensure complete coverage of the weed areas. In mixed weed populations, use the high rate of application as indicated by weeds present. For dense submersed weeds or water over 2 feet deep, a surface spray is not recommended (Littora should be applied subsurface in these situations.)

Tank Mixes With Other Aquatic Herbicides/Algaecides: For severe weed or algae infestations, the use of an approved algaecide either as a pretreatment to the Littora application or in a tank mix, may result in enhanced weed control.

When tank mixing, read and follow the labeled precautionary statements, directions for use, weeds controlled, and other restrictions for each tank mix product. **Use in accordance with the most restrictive label limitations and precautions of the products used in the tank mix.** Do not exceed any labeled rate or dose. To ensure compatibility, a jar test is recommended before field application of any tank mix combination. Consult with SePRO Corporation for latest tank mix recommendations.

Littora + Komeen*

The addition of Komeen, or other copper-based herbicides/algaecides, with Littora may improve control on some species, such as hydrilla. For best results, apply 2 gallons Littora in combination with 4 gallons of Komeen (0.8 lbs a.i./gallon) per acre. For hydrilla control and control of other species with high sensitivity to copper, lower rates of Komeen may also enhance the activity of Littora. Apply copper at a minimum of 0.1 ppm in combination with Littora. Higher rates may be needed in areas with dense weeds.

NOTE: For Drinking (Potable) Water

- The drinking (potable) water restrictions for applications of Littora plus endothall are to ensure that consumption of water by the public is allowed only when the concentration of endothall in the water is less than the MCL (Maximum Contamination Level) of 0.1 ppm. Applicators should consider the unique characteristics of the treated waters to assure that endothall concentrations in potable drinking water do not exceed 0.1 ppm at the time of consumption.
- For applications of Littora plus endothall, the drinking water setback distance from functioning potable water intakes is ≥ 600 feet. Note: Existing potable water intakes that are no longer in use, such as those replaced by a connection to a municipal water system or a potable water well, are not considered to be functioning potable water intakes.

STORAGE AND DISPOSAL

Do not contaminate water, food, or feed by storage and disposal.
Pesticide Storage: Keep pesticide in original container. Do not put concentrate or dilute into food or drink containers. Do not contaminate feed, foodstuffs, or drinking water. Do not store or transport near feed or food. Store at temperatures above 32°F.
Pesticide Disposal: Open dumping is prohibited. Pesticide wastes are toxic. Improper disposal of excess pesticide, spray mixture, or rinsate is a violation of Federal law. If these wastes cannot be disposed of by use according to label instructions, contact your State Pesticide or Environmental Control Agency, or the Hazardous Waste representative at the nearest EPA Regional Office for guidance.
Nonrefillable Container Disposal (rigid, 5 gallons or less): Do not reuse or refill this container. Triple rinse container (or equivalent) promptly after emptying. Triple rinse as follows: Empty the remaining contents into application equipment or a mix tank and drain for 10 seconds after the flow begins to drip. Fill the container ¼ full with water and recap. Shake for 10 seconds. Pour rinsate into application equipment or a mix tank or store rinsate for later use or disposal. Drain for 10 seconds after the flow begins to drip. Repeat the procedure two more times. Then offer the container for recycling (if available) or reconditioning, or puncture and dispose of in a sanitary landfill, or incineration, or, if allowed by State and local authorities, by burning. If burned, stay out of smoke.

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

TERMS AND CONDITIONS OF USE

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

WARRANTY DISCLAIMER

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

INHERENT RISKS OF USE

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

LIMITATION OF REMEDIES

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

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

To the extent consistent with applicable law, SePRO Corporation shall not be liable for losses or damages resulting from handling or use of this product unless SePRO Corporation is promptly notified of such losses or damages in writing. In no case shall SePRO Corporation be liable for consequential or incidental damages or losses.

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

REF82542-14-061010

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

APPENDIX K

DWR GHG Emissions Reduction Plan Consistency Determination Form

For Projects Using Contractors or Other Outside Labor

Print Form

This form is to be used by DWR project managers to document a DWR CEQA project's consistency with the DWR Greenhouse Gas Emissions Reduction Plan. This form is to be used only when DWR is the Lead Agency and when contractors or outside labor and equipment are use to implement the project.

Additional Guidance on filling out this form can be found at:
dwrclimatecange.water.ca.gov/guidance_resources.cfm

The DWR Greenhouse Gas Emissions Reduction Plan can be accessed at:
http://www.water.ca.gov/climatechange/CAP.cfm

California Department of Water Resources
1416 9th Steet
Sacramento, CA
95814
dwrclimatechange.water.ca.gov
www.water.ca.gov/climatechange

Project Name:	Application of Copper to SWP to Control Aquatic Weeds and
Environmental Document type:	Mitigated Negative Declaration
Manager's Name:	Jeff Janik
Manager's email:	Jeff.Janik@water.ca.gov
Division:	Operations and Maintenance
Office, Branch, or Field Division	Environmental Assessment Branch

Short Project Description:

To minimize the impact of aquatic weeds and algae on State Water Project (SWP) water quality and conveyance, DWR plans to apply copper on an as-needed basis throughout the growing season at O'Neill Forebay, Quail Lake, Pyramid Lake, and Silverwood Lake. DWR regularly applies copper at other SWP facilities under a categorical exception obtained in 2004 and achieves control of aquatic weeds and algae without degrading water quality. DWR proposes to begin applying copper to O'Neill Forebay, Quail Lake, Pyramid Lake, and Silverwood Lake to control aquatic weeds and algal blooms under the new statewide NPDES permit Water Quality Order 2013-0002-DWQ. Receiving water monitoring procedures for the new statewide NPDES permit will adhere to the Monitoring and Reporting Program described in Attachment C of the permit. The monitroing would support DWR's treatment of reservoirs with copper sulfate crystals, chelated copper products, and EarthTec® to control aquatic weeds and algal blooms. Some of the copper applications by helicopter and by boat will be done with the assistance of contract labor.

Project GHG Emissions Summary

Total Construction Emissions	355	$mtCO_2e$
Maximum Annual Construction Emissions	71	$mtCO_2e$

☒ All other emissions from the project not accounted for above will occur as ongoing operational, maintenance, or business activity emissions and therefore have already been accounted for and analyzed in the GGERP.

Extraordinary Construction Project Determination

Do total project construction emissions exceed 25,000 $mtCO_2e$ for the entire construction phase or exceed 12,500 $mtCO_2e$ in any single year of construction.

○ Yes - Addition analysis is required, consult with C4

◉ No - Additional analysis not required

Project GHG Reduction Plan Checklist

☐ All Project Level GHG Emissions Reduction Measures have been incorporated into the design or implementation plan for the project. (Project Level GHG Emissions Reduction Measures)

Or

☒ All feasible Project Level GHG Emissions Reduction Measures have been incorporated into the design or implementation plan for the project and and Measures not incorporated have been listed and determined not be apply to the proposed project (include as an attachment)

☒ Project does not conflict with any of the Specific Action GHG Emissions Reduction Measures (Specific Action GHG Emissions Reduction Measures)

Would implementation of the project result in additional energy demands on the SWP system of 15 GWh/yr or greater?

○ Yes ◉ No

If you answered Yes, attach a Renewable Power Procurement Plan update approval letter from the DWR SWP Power and Risk Office.

Is there substantial evidence that the effects of the proposed project may be cumulatively considerable notwithstanding the proposed project's compliance with the requirements of the DWR GHG Reduction Plan?

○ Yes ◉ No

If you answered Yes, the project is not eligible for streamlined analysis of GHG emissions using the DWR GHG Emissions Reduction Plan. (See CEQA Guidelines, section 15183.5, subdivision (b)(2).)

Based on the information provided above and information provided in associated environmental documentation completed pursuant to the above referenced project, the DWR CEQA Climate Change Committee has determined that the proposed project is consistent with the DWR Greenhouse Gas Reduction Plan and the greenhouse gasses emitted by the project are covered by the plan's analysis.

Project Manager Signature: Date: 2/3/14

C4 Approval Signature: Date: 2/7/14

Attachments:

☒ GHG Emissions Inventory

☒ List and Explanation of excluded Project Level GHG Emissions Reduction Measures

☐ Plan to update Renewable Energy Procurement Plan from DWR SWP Power and Risk Office

Application of Copper to the State Water Project to Control Aquatic Weeds and Algal Blooms

- Inventory and Calculation of Greenhouse Gas Emissions

Line	**Emissions from Construction Equipment (based on maximum number of applications expected over a 5-year NPDES permit period)**							
1	**Type of Equipment**	**Maximum Number per Day**	**Total Operation Days**	**Total Operation Hours[1]**	**Fuel Consumption Per Hour[2]**	**Total Fuel Consumption (gal. jet fuel)**	**CO_2e/gal jet fuel [*]**	**Total CO_2 Equivalent Emissions (metric tons)**
2	Helicopter (Either Bell 206B3 or Bell 206L3)	1	100	800	36	28,800	0.010	281
3	*Subtotal (jet fuel use)*					28,800		281
4	**Type of Equipment**	**Maximum Number per Day**	**Total Operation Days**	**Total Operation Hours[1]**	**Fuel Consumption Per Hour[2]**	**Total Fuel Consumption (gal. gasoline)**	**CO_2e/gal gasoline[3]**	**Total CO_2 Equivalent Emissions (metric tons)**
5	Boats (such as Lund 1600SS Alaskan (aluminum hull), 50 HP motor)	3	25	600	0.75	450	0.009	4
6	*Subtotal (jet fuel use)*					450		4
7				0		-	0.010	-
8				0		-	0.010	-
9				0		-	0.010	-
10				0		-	0.010	-
11				0		-	0.010	-
12				0		-	0.010	-
13				0		-	0.010	-
14				0		-	0.010	-
15				0		-	0.010	-
16				0		-	0.010	-
17				0		-	0.010	-
18				0		-	0.010	-
19				0		-	0.010	-
20				0		-	0.010	-
21				0		-	0.010	-
22				0		-	0.010	-
23				0		-	0.010	-
24				0		-	0.010	-
25	**TOTAL**					**29,250**		**285**

26 [1] An 8-hour work day is assumed.

27 [2] California Air Resource Board Offroad 2007 Emissions Inventory fuel consumption factors

28 [3] World Resources Institute-Mobile combustion CO_2 emissions tool, June 2003 Version 1.2

29 [*] Emission Factors for Greenhouse Gas Inventories (U.S. EPA), http://www.epa.gov/climateleadership/documents/emission-factors.pdf, accessed 1/29/2014.

30 **Emissions from Transportation of Construction Workforce (based on maximum number of applications expected over a 5-year NPDES permit period)**

31	**Average Number of Workers per Day**	**Total Number of Workdays**	**Average Distance Travelled (round trip)**	**Total Miles Travelled**	**Average Passenger Vehicle Fuel Efficiency[4]**	**Total Fuel Consumption (gal. gasoline)**	**CO_2e/gal gasoline [3]**	**Total CO_2 Equivalent Emissions (metric tons)**
32	4	125	265.2	132600	17.2	**7709.3**	0.009	**69**

33 [4] U.S. DOT Research and Innovative Technology Administration Bureau of Transportation Statistics Table 4-23: http://www.rita.dot.gov/bts/sites/rita.dot.gov.bts/files/publications/national_transportation_statistics/html/table_04_23.html (accessed 1/30/2014)

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Emissions from Transportation of Construction Materials

Trip Type	Total Number of Trips	Average Trip Distance	Total Miles Travelled	Average Semi-truck Fuel Efficiency	Total Fuel Consumption (gal. diesel)	CO_2e/gal Diesel [3]	Total CO_2 Equivalent Emissions (metric tons)
Delivery						0.010	0
Spoils						0.010	0
TOTAL							**0**

Construction Electricity Emissions

	MWh of electricity	$mtCO2_e$/ MWh [5]	CO_2 e emissions
Electricity Needed		0.310	0

[5] eGRID2010 Version 1.0, February 2011 (Year 2007 data) *CAMX-WECC sub-region* .

Total Construction Activity Emissions 355 (from lines 25, 32, 39, and 43)

Total Years of Construction

Expected Start Date of Construction

Estimated Project Useful life 5 Years

Average Annual Total GHG Emissions[7] 71 **MT CO_2 equivalents**

[7] short-term construction emissions amortized over life of project

List and Explanations of Excluded Project Level GHG Emissions Reduction Measures

Project Name: Application of Copper to the State Water Project to Control Aquatic Weeds and Algal Blooms

Environmental Document Type: Mitigated Negative Declaration

Project Manager: Diane Shimizu

This project involves the periodic application of copper-based aquatic herbicides and algaecides to four reservoirs of the State Water Project: O'Neill Forebay, Quail Lake, Pyramid Lake, and Silverwood Lake. DWR applies copper for two main purposes: 1) to control cyanobacteria (bluegreen algae) that can produce taste and odor compounds and 2) to control aquatic weeds and attached algae that can negatively impact conveyance of water supplies for municipal, irrigation and industrial purposes.

To the extent possible, the contractors will implement the BMPs identified in Appendix B of the *Greenhouse Gas Emissions Reduction Plan*. However, given the nature of this project, BMPs 3, 4, 5, 11, 12, 13, and 14 do not apply as explained below.

BMP 3 and BMP 11. DWR is proposing to treat existing reservoirs with aquatic herbicides and algaecides, therefore the impacts of electricity usage associated with construction activities does not apply to this project.

BMP 4, BMP 5, and BMP 13. Application of aquatic herbicides and algaecides does not involve the production of concrete.

BMP 12. The project does not involve hauling of materials using heavy-duty class 7 or class 8 semi-trucks or 53-foot or longer box type trailers.

BMP 14. This project does not involve the construction of any structures. Therefore, it will not generate the construction waste types and volumes that are generally addressed by construction debris recycling and diversion programs. Used aquatic pesticide containers resulting from the copper applications will be disposed of according to product label requirements.

California Department of Water Resources
Application of Copper to the State Water Project to Control Aquatic Weeds and Algal Blooms

Certification of the Mitigated Negative Declaration and Mitigation Monitoring and Reporting Plan

Project Description

The California Department of Water Resources (DWR) prepared a Draft Initial Study and Mitigated Negative Declaration (IS/MND) in accordance with the California Environmental Quality Act (CEQA) and CEQA Guidelines to evaluate the environmental impacts of the proposed Application of Copper to the State Water Project to Control Aquatic Weeds and Algal Blooms Project. DWR's intent with regards to this project is to apply copper complexes including copper sulfate, chelated copper compounds (Komeen® and Nautique®), and EarthTec® on an as-needed basis to control aquatic weeds and algal blooms so that the blooms do not degrade drinking water through elevated tastes and odors, production of algal toxins, clogging of filters, and reduction in water flows. To implement this project, DWR has applied for authorization to apply copper compounds under the General NPDES Permit No. 2013-0002-DWQ. In addition, DWR is seeking a categorical exception from the toxics standards for copper under section 5.3 of the State Water Resources Control Board's State Implementation Plan (SIP).

Project Location

DWR's State Water Project reservoirs: 1) O'Neill Forebay, Merced County, 37°4'46.103"N, 121°2'53.37"W; 2) Quail Lake, Los Angeles County, 34°46'18.156"N, 118°44'49.629"W; 3) Pyramid Lake, Los Angeles County, 34°39'14.054"N, 118°46'19.483"W; and 4) Silverwood Lake, San Bernardino County, 37°17'30.214"N, 117°19'29.851"W

Lead Agency Contact Information

Agency Name: California Department of Water Resources
Contact Person: Anthony Chu

Mailing Address: 1416 Ninth St., P.O. Box 942836, Sacramento, CA 94236 0001

Phone: (916) 653-9978

Findings

As discussed in the draft IS/MND and Response to Comments on the Draft Mitigated Negative Declaration, the proposed project has environmental impacts in the areas of 1) biological resources and 2) hydrology and water quality. These impacts would be reduced to less than significant levels with the implementation of four mitigation measures identified in the Final MND. A description of these impacts and the corresponding mitigation measures follow.

1. The project has the potential to impact nesting birds during application of copper sulfate by helicopter. This impact would be reduced to a less than significant level with the implementation of *Mitigation Measure BIO-1: Impact Avoidance to Nesting Birds*. The Mitigation Monitoring and Reporting Program (MMRP) for this project addresses implementation of this mitigation measure.

2. Application of copper sulfate by helicopter has the potential to impact fish and wildlife resources within or adjacent to the project site. This impact would be reduced to a less than significant level with the implementation of *Mitigation Measure BIO-2: Focused Biological Surveys*. The MMRP for this project addresses implementation of this mitigation measure.

3. Application of copper sulfate by helicopter in O'Neill Forebay has the potential to impact special status plants. Therefore, *Mitigation Measure BIO-3: Special Status Plant Surveys at O'Neill Forebay* will be implemented to reduce this impact to a less than significant level. The MMRP for this project addresses implementation of this mitigation measure.

4. The application of compounds to DWR reservoirs has the potential to raise dissolved copper levels above receiving water limitations. This impact would be reduced to a less than significant level with the implementation of *Mitigation Measure HYDRO-1: Submit the Proper Regulatory Documents (NPDES Permit and APAP)*. The MMRP for this project addresses implementation of this mitigation measure.

Certification

As the Lead Agency, DWR has determined that it has complied with CEQA for the project identified above, and that the project is described in adequate and sufficient detail to allow the project's implementation.

I certify that the CEQA analysis for this project encompasses all aspects of the work to be completed.

[signature]	5/28/2014	Anthony Chu, Chief, Environmental Assessment Branch	
Authorized Representative (Signature)	Date	Authorized Representative (Printed Name and Title)	

Notice of Determination

Appendix D

To:

☒ Office of Planning and Research

U.S. Mail: P.O. Box 3044, Sacramento, CA 95812-3044

Street Address: 1400 Tenth St., Rm 113, Sacramento, CA 95814

☐ County Clerk
County of: _____
Address: _____

From:

Public Agency: CA Department of Water Resources
Address: 1416 9th Street
Sacramento, CA 95814
Contact: Jeff Janik
Phone: (916) 653-5688

Lead Agency (if different from above):

Address: _____

Contact: _____
Phone: _____

SUBJECT: Filing of Notice of Determination in compliance with Section 21108 or 21152 of the Public Resources Code.

State Clearinghouse Number (if submitted to State Clearinghouse): 2014032086

Project Title: Application of Copper to the State Water Project to Control Aquatic Weeds and Algal Blooms

Project Applicant: Department of Water Resources

Project Location (include county): O'Neill Forebay (Merced Co.), Quail Lake (Los Angeles Co.), Pyramid Lake (Los Angeles Co.), and Silverwood Lake (San Bernardino Co.)

Project Description:
To minimize the impact of aquatic weeds and algae on SWP water quality and conveyance, DWR plans to apply copper, on an as-needed basis throughout the growing season, at O'Neill Forebay (Merced County), Quail Lake (Los Angeles County), Pyramid Lake (Los Angeles County), and Silverwood Lake (San Bernardino County). DWR currently applies copper at other SWP facilities under a categorical exception obtained from the State Water Resources Control Board in 2004 pursuant to section 5.3 of the State Implementation Plan (SIP). In applying copper, DWR is able to achieve control of nuisance aquatic weeds and algae without degrading water quality.

This is to advise that the California Department of Water Resources (☒ Lead Agency or ☐ Responsible Agency) has approved the above described project on May 28, 2014 (date) and has made the following determinations regarding the above described project.

1. The project [☐ will ☒ will not] have a significant effect on the environment.
2. ☐ An Environmental Impact Report was prepared for this project pursuant to the provisions of CEQA.
   ☒ A Negative Declaration was prepared for this project pursuant to the provisions of CEQA.
3. Mitigation measures [☒ were ☐ were not] made a condition of the approval of the project.
4. A mitigation reporting or monitoring plan [☒ was ☐ was not] adopted for this project.
5. A statement of Overriding Considerations [☐ was ☒ was not] adopted for this project.
6. Findings [☒ were ☐ were not] made pursuant to the provisions of CEQA.

This is to certify that the final EIR with comments and responses and record of project approval, or the negative Declaration, is available to the General Public at:
Department of Water Resources, 1416 9th Street, Room 620, Sacramento, CA 95814

Signature (Public Agency): _____ Title: Chief, Environmental Assessment Br.

Date: 5/28/2014 Date Received for filing at OPR: _____

RECEIVED
MAY 28 2014
STATE CLEARING HOUSE

Authority cited: Sections 21083, Public Resources Code.
Reference Section 21000-21174, Public Resources Code.

Revised 2011