Use of Copper To Control Algae and Aquatic Vegetation In Drainage Conveyances and Basins

California Environmental Quality Act Initial Study And Mitigated Negative Declaration

November 20, 2014

City of Sacramento
Department of Utilities
Sacramento, CA 95822
Contact: William Roberts
(916) 808-6955

Prepared by:
Blankinship & Associates, Inc.
1590 Drew Avenue, Suite 120
Davis, CA 95618
Contact: Stephen Burkholder
(530) 757-0941

Submitted to:
State Water Resources Control Board
1001 I Street
Sacramento, CA 95814
Contact: Russell Norman
(916) 323-5598

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1.0 PROJECT DESCRIPTION

1.1 Introduction and Environmental Setting

The City of Sacramento (herein referred to as "City") covers approximately 100 square mile, with a population of about 475,000 people. The City of Sacramento, Department of Utilities (herein referred to as "Department") is the entity responsible for water, storm drainage, and sewer services. The Department maintains and operates the drainage system for the City to allow surface water to flow to collection points, prevent flooding, and is able to pump water from its collection points, detention basins, and canals. The Department's drainage system facilities are designed to provide urban flood protection in a series of drainage zones throughout the City. The drainage system includes a large network of storm drains, detention basins, creeks, ditches, canals, pumping stations, and underground pipes to convey urban runoff and stormwater. Refer to **Figure 1.**

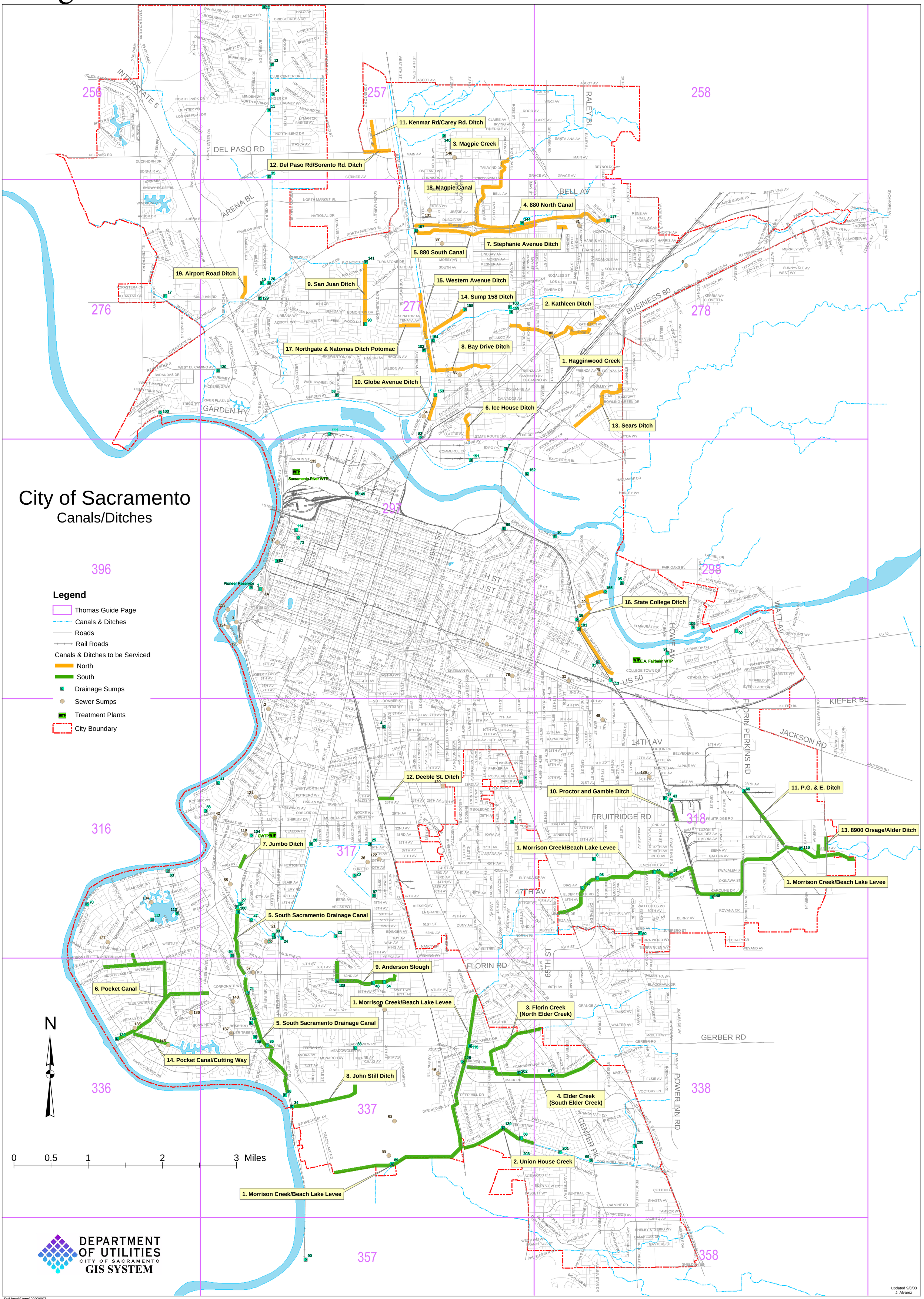
The Department's drainage system receives urban runoff and drainage throughout the year and stormwater runoff during wet months. Efficient conveyance of urban runoff and stormwater is critical to the Department's mission of flood control. The Department maintains the canals, creeks, ditches, detention basins, and pump stations to ensure efficient conveyance and sufficient capacity in drainage system facilities. Generally urban runoff flows into underground pipes that discharge directly into pumping stations, into drainage channels terminating at pumping stations and/or into detention basins that are also controlled by pumping stations.

The Department experiences issues resulting in reduced capacity and impeded flow in its aboveground, controlled drainage facilities due to the presence of aquatic vegetation. Additionally, detention basins and channels in residential areas are prone to infestation by nuisance vegetation and algae that can create mosquito breeding habitat, citizen complaints of odor, and impede efficient water flow.

Using Integrated Pest Management (IPM) techniques, the Department plans to apply aquatic herbicides containing copper on an "as-needed" basis to achieve aquatic weed control necessary for efficient water conveyance. Depending on algae or aquatic weed presence, density, and species type(s), aquatic herbicides containing copper may be applied at locations throughout the Department's controlled conveyance system and basins. Applications may be made if the Department's IPM thresholds are met, or are expected to be met, based on the weather, weed density, weed growth or predicted growth, water flow, water level in the system, or resident complaints. Some years, aquatic herbicides my not be used if thresholds are not met. Applications of aquatic herbicides are typically made between April and November. Applications may be made throughout the Department's drainage conveyance and basin system as needed. No aquatic herbicide applications are made directly to the American or Sacramento Rivers. For drainage water to leave the Department's system, it must be actively pumped out from the conveyance system or basin before it enters the American or Sacramento Rivers. Pumping of drainage water to the river does not typically occur during or shortly after applications of copper-containing herbicides.

The "Project" is defined as the Department's short-term or seasonal applications of aquatic herbicides that contain copper to drainage conveyances and basins to control algae and aquatic vegetation as needed for the efficient movement of stormwater and urban runoff, and prevent nuisance conditions.

Figure 1.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14. Sump 158 Ditch
2. Kathleen Ditch
17. Northgate & Natomas Ditch Potomac
8. Bay Drive Ditch
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10. Globe Avenue Ditch
6. Ice House Ditch
13. Sears Ditch
12. Deeble St. Ditch
10. Proctor and Gamble Ditch
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INTERSTATE 5
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ARENA BL
RALEY BL
BELL AV
BUSINESS 80
29TH ST
H ST
J ST
S ST
US 50
WATT AV
HOWE AV
FLORIN PERKINS RD
65TH ST
FLORIN RD
FRUITRIDGE RD
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DEPARTMENT OF UTILITIES
CITY OF SACRAMENTO
GIS SYSTEM
Updated 9/8/03
J. Alvarez
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1.2 Regulatory Setting

On June 4, 2004, The State Water Resources Control Board (SWRCB) released the Statewide General National Pollutant Discharge Elimination System (NPDES) Permit for the Discharge of Aquatic Pesticides for Aquatic Weed Control in Waters of the United States, #CAG990005. This permit expired in May 2009, but was administratively continued until November 30, 2013. The Statewide General National Pollutant Discharge Elimination System (NPDES Permit for Residual Aquatic Pesticide Discharges to Water of the United States from Algae and Aquatic Weed Control Applications ("Permit") was adopted on March 5, 2013 and became available on December 1, 2013 (SWRCB 2013). The Permit requires compliance with the following:

- The Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries in California (aka the State Implementation Plan, or SIP) (SWRCB, 2000)
- The California Toxics Rule (CTR) (CTR, 2000)
- Applicable Regional Water Quality Control Board (RWQCB) Basin Plan Water Quality Objectives (WQOs) (RWQCB, 2003)

The SIP assigns effluent limitations for CTR priority pollutants, including the aquatic herbicide copper. Further, the SIP prohibits discharges of priority pollutants in excess of applicable water quality criteria outside the mixing zone.[1]

Although the SIP prohibits the discharge of copper in excess of applicable water quality criteria into receiving waters, Section 5.3 of the SIP allows for short-term or seasonal exceptions if determined to be necessary to implement control measures either (1) for resource or pest management conducted by public entities to fulfill statutory requirements, or (2) regarding drinking water conducted to fulfill statutory requirements under the federal Safe Drinking Water Act or the California Health and Safety Code. Exceptions may also be granted for draining water supply reservoirs, canals, and pipelines for maintenance, for draining municipal storm water conveyances during cleaning or maintenance, or for draining water treatment facilities during cleaning or maintenance. The Department has concluded that it meets one or more of the criteria for gaining a Section 5.3 SIP exception.

Permittees who elect to use a SIP exception must satisfactorily complete several steps, including preparation and submission of an application and California Environmental Quality Act (CEQA) document to SWRCB. Consistent with Section IX.C.1.a. of the Permit, entities may be added to Attachment G of the Permit if they have qualified for a SIP Section 5.3 exception[2]. Accordingly, when the application and CEQA process is complete, and a short-term or seasonal exemption from meeting the receiving water limit for copper is granted, Attachment G of the Permit will be revised to list the Department's exemption and the Department may apply aquatic herbicides in accordance with the Permit as revised. This document must be

[1] Mixing Zone is defined in the SIP as "a limited volume of receiving water that is allocated for mixing with a wastewater discharge where water quality criteria can be exceeded without causing adverse effects to the overall waterbody."

[2] The SWRCB has indicated that the Permit may be re-opened for additional CEQA document submission on an as-needed basis.

submitted to the SWRCB for the permittee to be placed on Attachment G of the Permit, and subsequently be afforded coverage.

1.3 Required Approvals

The SWRCB must approve the Department's application for a SIP Section 5.3 exception to the CTR criterion for copper. The Department will submit the following documents to the SWRCB for acceptance:

a. A detailed description of the proposed action;
b. The proposed method of completing the action;
c. A time schedule;
d. A discharge and receiving water quality monitoring plan (before project initiation, during project implementation, and after project completion, with the appropriate quality assurance and quality control procedures);
e. Contingency plans (to the extent applicable);
f. CEQA documentation and notification of potentially affected agencies; and

Upon completion of each seasonal or short-term application of aquatic herbicides that contain copper, the Department shall provide certification by a qualified biologist that the receiving water beneficial uses have been restored.

1.4 Required Notifications

1.4.1 California Department of Fish and Wildlife

At the beginning of each season, prior to applications of copper, the Department will send a written notification of intent to use copper to the California Department of Fish and Wildlife (CDFW).

1.4.2 NPDES Aquatic Pesticide Permit Notifications

Every calendar year, at least 15 days prior to the first application of copper-containing aquatic herbicide, the Department will notify potentially affected public agencies. The Department may post the notification on its website if possible. The notification must include the following information:

1. A statement of the Department's intent to apply algaecide or aquatic herbicide(s);
2. Name of algaecide and aquatic herbicide(s);
3. Purpose of use;
4. General time period and locations of expected use;
5. Any water use restrictions or precautions during treatment; and
6. A phone number that interested persons may call to obtain additional information from the Department.

1.5 Standard Operating Procedures

The Department implements an Integrated Pest Management (IPM) program for algae and aquatic weed control. The IPM program involves scouting for algae and aquatic weed presence in Department conveyances and basins to determine if the locations and densities exceed or are likely to exceed treatment thresholds. If algae or aquatic weeds are present in locations and densities that exceed thresholds above which control is needed, the Department may make applications of copper-containing aquatic herbicides on an "as-needed" basis to achieve the aquatic weed control necessary to maintain the system's design capacity and flow, or prevent nuisance conditions due to odors or mosquito-breeding habitat.

Prior to application copper-containing aquatic herbicides, the following tasks will be accomplished:

1. A written recommendation is prepared by a DPR-licensed Pest Control Advisor (PCA). A PCA undergoes 40 hours of training every 2 years on issues including health and safety and prevention of exposure to sensitive receptors. The written recommendation prepared by the PCA must evaluate proximity of occupied buildings and people, health and environmental hazards and restrictions, and a certification stating that alternatives and mitigation measures that substantially lessen any significant adverse impact on the environment have been considered, and if feasible, adopted. Refer to **Appendix D**.

2. All Department personnel applying herbicides review and strictly adhere to the aquatic herbicide product label that has clear and specific warnings that alert users to hazards that may exist. An example of a specific product label for an herbicide that contains copper is included in **Appendix E**.

3. All Department personnel applying herbicides review and consult the aquatic herbicide Material Safety Data Sheet (MSDS) (an example is provided in **Appendix E)**, and the DPR Worker Health and Safety Branch Pesticide Safety Information Series (PSIS). The PSIS and the MSDS have specific information that describes precautions to be taken during the use of the aquatic herbicide.

4. The condition of water conveyances or basins being treated is field-evaluated to ensure that the application is necessary, feasible, and can be conducted safely and according to label. This evaluation considers target weed or algae species, level of infestation, water and flow conditions, alternate control methods, and amount of aquatic herbicide to be applied.

5. Notifications, as needed, are sent to the potentially affected public agencies and the California Department of Fish and Wildlife (CDFW).

6. Prior to an application, Department personnel inspect and seal any emergency spill structures, as necessary if control structures are leaking. The Department will coordinate with pump operators to confirm that pumps, if present, will remain off during application.

During and after an aquatic herbicide application, the following task will be accomplished:

1. Control small leaks (< 1 gallon per minute) that may develop at control structures with sand bags, installation of additional plastic around boards, temporary dikes, pumps, or by lowering the level of treated water below the elevation of the leak if necessary or practicable. Continue coordination with pump operators that pumps, if present, remain off during application.

   This action will effectively prevent the release of water treated with aquatic herbicide from leaving a water conveyance or basin.

2.0 INITIAL STUDY

This document was prepared in a manner consistent with Section 21064.5 of the California Public Resources Code and Article 6 of the State CEQA Guidelines (14 California Code of Regulations).

This Initial Study, Environmental Checklist, and evaluation of potential environmental effects were completed in accordance with Section 15063 of the *State CEQA Guidelines* to determine if the proposed Project could have any potentially significant effect on the physical environment, and if so, what mitigation measures would be imposed to reduce such impacts to less-than-significant levels.

An explanation is provided for all determinations, including the citation of sources as listed in Section *5.* A "No Impact" or a "Less-than-Significant Impact" determination indicates that the proposed Project would not have a significant effect on the physical environment for that specific environmental category.

Mitigation measures will be implemented to reduce the potentially significant impacts to less-than-significant levels.

2.1 CEQA Initial Study & Environmental Check List Form

1. Project Title: Use of Copper to Control Algae and Aquatic Vegetation in Drainage Conveyances and Basins

2. Lead Agency Name and Address: City of Sacramento, Department of Utilities
1395 35th Avenue
Sacramento, California 95822

3. Contact Person & Phone Number: William Roberts, Superintendent of Drainage Collection
(916) 808-6955

4. Project Location: Sacramento County, California

5. Project Sponsor's Name and Address: See #2. above

6. General Plan Land Use Designation: Airport/Residential/Flood Control/Commercial

7. Zoning: Industrial/Commercial/Residential

8. Description of Project: See Section 1.0

9. Surrounding Land Uses and Setting: Agriculture/Airport/Residential/Commercial

10. Other Agencies Whose Approval is Required: See Sections 1.3 and 1.4

2.2 Environmental Factors Potentially Affected

The environmental factor checked below would be potentially affected by the proposed Project, involving at least one impact that is a 'Potentially Significant Impact" as indicated by the checklist on the following pages:

☐ Aesthetics	☐ Agriculture Resources	☐ Air Quality
☒ Biological Resources	☐ Cultural Resources	☐ Geology/Soils
☐ 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	

2.3 Determination (To be completed by lead agency)

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 because appropriate mitigation measures are in place. 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 (EIR) 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 EIR 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.

William Roberts — Signature

11/20/14 — Date

William Roberts — Printed Name

City of Sacramento, Department of Utilities — For

3.0 EVALUATION OF ENVIRONMENTAL IMPACTS

3.1 Aesthetics

		Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
	Would the Project:				
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 surrounding?	☐	☐	☐	☒
d)	Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area?	☐	☐	☐	☒

Discussion

Items a) & b): ***No Impact.*** There are no designated scenic vistas, state scenic highways, or scenic resources in the vicinity of the Project sites, therefore no impact would occur.

Item c): ***No Impact.*** The Project involves the short-term or seasonal application of aquatic herbicides that contain copper to drainage conveyances and basins in water bodies within the Department's jurisdiction to control a variety of algae and/or aquatic vegetation. These algae or aquatic weeds are typically at or below the water surface. Upon control, the removal of these weeds would be unnoticed and would not degrade the visual character of the Project site.

Item d): ***No Impact.*** The Project is done during the daylight hours, therefore no light sources are needed and no light or glare is produced.

3.2 Agriculture Resources

		Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
	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?	☐	☐	☐	☒
c)	Involve other changes in the existing environment which, due to their location or nature, could result in conversion of Farmland, to non-agricultural use?	☐	☐	☐	☒

Discussion

Items a) through c): ***No Impact.*** The Project will not convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance to non-agricultural use, conflict with existing zoning or agricultural use, or a Williamson Act contract, or otherwise result in the conversion of Farmland to non-agricultural use.

3.3 Air Quality

	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
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 and 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

Items a) & b): ***No Impact.*** The Project requires the use of pick-up trucks or other service vehicles for purposes of transporting aquatic herbicides to locations where they are needed. Pick-up trucks are also used for purposes of site reconnaissance before, during, and after application of aquatic herbicides. Short-term vehicle emissions will be generated during aquatic herbicide application; however, they will be minor and only be applied on an "as-needed" basis throughout the year. To minimize impacts, all equipment will be properly tuned and muffled and unnecessary idling will be minimized. Generally one or two vehicles are used for the transport and application of the herbicide. As needed, the Department may use a small generator or gas-powered pump during the course of application. The Department may also use a boat with a small outboard motor in some locations where application from the banks is not feasible. None of the above vehicles or application equipment is expected to conflict with air quality plans or violate air quality standards.

The Department is located in the Sacramento Valley Air Basin (SVAB), which includes the following counties: Butte, Colusa, East Solano, Glenn, Placer, Sacramento, Shasta, Sutter, Tehama, Yolo, and Yuba. The application of aquatic herbicides does not conflict with the Sacramento Metro Region 2013 Air Quality Management Plan, violate any air quality

standards, or contribute to an existing or projected violation based on data available from the Sacramento Metropolitan Air Quality Management District.

Item c): ***No Impact.*** Levels of ozone and suspended matter ($PM_{2.5}$) in Sacramento County have exceeded California Clean Air standards, and therefore the area is considered a "nonattainment" area for these pollutants. Sacramento was re-designated as in attainment for PM_{10} standards as there have been no measured violations since 1998. Although Sacramento County is nonattainment for both $PM_{2.5}$ and ozone California Clean Air standards, the Project will not increase either of these criteria pollutants.

Items d) & e): ***No Impact.*** Aquatic herbicides containing copper will be applied by Department personnel. Applications will take place in Department conveyances and basins. While some applications may take place in more urban areas, these are typically brief in duration and made infrequently (i.e. one or two days per year). Applications are not typically made near schools, health care facilities, or day care facilities, thereby eliminating exposure to these sensitive receptors and creating no impact. Similarly, there will be no objectionable odors that affect a substantial number of people as a result of the application of copper-containing aquatic herbicides.

3.4 Biological Resources

	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
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 Game 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, or regulations, or by the California Department of Fish and Game or U.S. Fish and Wildlife Service?	☐	☐	☐	☒
c) Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (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 Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan?	☐	☐	☐	☒

Discussion

Item a): **Less Than Significant Impact.** A list of current special status species was compiled from the California Department of Fish and Wildlife (CDFW) California Natural Diversity Database (CNDDB), and the U.S. Fish and Wildlife Service (USFWS), Sacramento Office. Once this list was compiled, a preliminary assessment of the Project area was performed to characterize the actual habitats present on-site and the likelihood of special status species occurrence.

A summary of the listed species, their conservation status, and whether or not they were considered for evaluation of potential impact is presented in **Table 1.** Species habitat and rationale for removal from further consideration is presented in **Table** 1 and more detailed species life history information can be found in **Appendix A.** Physical, chemical and toxicological data on copper is presented in **Appendix B.**

With two exceptions, no special status species has habitat in or near Department drainage conveyances and basins, or is otherwise expected to be exposed to aquatic herbicides used for the Project.

The two terrestrial species that may be at risk are the western pond turtle (WPT) and the giant garter snake (GGS). A GGS could move from adjacent upland land parcels, constructed habitat, or natural water bodies near the Department's conveyances and basins, and enter treated water bodies. WPTs may bask on the shore of conveyances or basins, particularly on concrete aprons, or on logs or other floating structures in slow moving or static parts of conveyances or basins; they may enter the water when startled or to forage for prey. Once in a treated conveyance or basin, a WPT or GGS may be exposed to copper through contact with treated water, ingestion of treated water, or consumption of prey items that may have had contact with treated water.

Table 1. Species and Habitat Summary

Common Name	Scientific Name	Status	Habitat	Habitat is not Present in Project Area; Species Eliminated from Further Consideration	Habitat is Present in Project Area; Species Eliminated from Further Consideration for Reasons Given (see numbered notes)	Potential Risk is Present from Project Activities
AMPHIBIAN						
California tiger salamander	*Ambystoma californiense*	FT,ST, SCSC	Herbaceous wetland, temporary pool; Grassland/herbaceous, Savanna, Woodland - Hardwood; Benthic, Burrowing in or using soil		X (1)	
western spadefoot	*Spea hammondii*	SCSC	Lowlands to foothills; grasslands, open chaparral, pine-oak woodlands. Prefers shortgrass plains, sandy or gravelly soil. Fossorial. Breeds in temporary rain pools and slow-moving streams		X (2)	

Common Name	Scientific Name	Status	Habitat	Habitat is not Present in Project Area; Species Eliminated from Further Consideration	Habitat is Present in Project Area; Species Eliminated from Further Consideration for Reasons Given (see numbered notes)	Potential Risk is Present from Project Activities
BIRD						
Cooper's hawk	*Accipiter cooperii*		Woodland, chiefly of open, interrupted, or marginal type; nest sites mainly in riparian growths of deciduous trees		X (3)	
tricolored blackbird	*Agelaius tricolor*	SCSC	Fresh-water marshes of cattails, tule, bulrushes and sedges; Cropland/hedgerow, Grassland/herbaceous		X (3)	
grasshopper sparrow	*Ammodramus savannarum*	SCSC	Dense grasslands on rolling hills, lowland plains, in valleys & on hillsides on lower mountain slopes	X		
golden eagle	*Aquila chrysaetos*		Rolling foothills, mountain areas, sage-juniper flats, and desert	X		
great egret	*Ardea alba*		Colonial nester in large trees; rookery sites located near marshes, tide-flats, irrigated pastures, and margins of rivers and lakes		X (4)	
great blue heron	*Ardea herodias*		Colonial nester in tall trees, cliffsides, and sequestered spots on marshes		X (4)	
burrowing owl	*Athene cunicularia*	SCSC	Agriculture/rangeland, grassland, parks with open ground squirrel burrows	X		

Common Name	**Scientific Name**	**Status**	**Habitat**	**Habitat is not Present in Project Area; Species Eliminated from Further Consideration**	**Habitat is Present in Project Area; Species Eliminated from Further Consideration for Reasons Given** (see numbered notes)	**Potential Risk is Present from Project Activities**
ferruginous hawk	*Buteo regalis*		Open grasslands, sagebrush flats, desert scrub, low foothills & fringes of Pinyon-Juniper habitats	X		
Swainson's hawk	*Buteo swainsoni*	ST, SCSC	Cropland/hedgerow, Desert, Grassland/herbaceous, Savanna, Woodland - Mixed	X		
western snowy plover	*Charadrius alexandrinus nivosus*	FT, SCSC	Sandy beaches, alkali lakeshores and dry evaporation ponds; un-vegetated open areas, primarily in sand dunes, for nest sites	X		
mountain plover	*Charadrius montanus*	SCSC	Recently plowed fields, sparsely vegetated fields, and pastureland with little to no vegetative growth	X		
western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	SE	Open woodland parks, deciduous riparian woodland; requires patches of at least 10 hectares (25 acres) of dense riparian forest with a canopy cover of at least 50 percent in both the understory and overstory	X		
snowy egret	*Egretta thula*		Colonial nester, with nest sites situated in protected beds of dense tules		X (4)	
white-tailed kite	*Elanus leucurus*		Rolling foothills and valley margins with scattered oaks and river bottomlands or marshes next to deciduous woodland		X (3)	

Common Name	**Scientific Name**	**Status**	**Habitat**	**Habitat is not Present in Project Area; Species Eliminated from Further Consideration**	**Habitat is Present in Project Area; Species Eliminated from Further Consideration for Reasons Given** (see numbered notes)	**Potential Risk is Present from Project Activities**
merlin	*Falco columbarius*		Seacoast, tidal estuaries, open woodlands, savannahs, edges of grasslands and deserts, farms and ranches	X		
California black rail	*Laterallus jamaicensis coturniculus*	CNPS-1	Freshwater marshes, wet meadows, shallow margins of saltwater marshes bordering larger bays; areas with water depths of about 1 inch; dense vegetation for nesting habitat	X		
song sparrow ("Modesto" population)	*Melospiza melodia*	SCSC	Fresh-water marshes and riparian thickets	X		
black-crowned night heron	*Nycticorax nycticorax*		Colonial nester, usually in trees, occasionally in tule patches		X (4)	
osprey	*Pandion haliaetus*		Forages for fish in bays, fresh water lakes, and rivers; tree-top nesters with large nests	X		
double-crested cormorant	*Phalacrocorax auritus*		Colonial nester on coastal cliffs, offshore islands, and along lake margins in the interior of the state		X (4)	
white-faced ibis	*Plegadis chihi*		Shallow fresh-water marsh	X		

Common Name	Scientific Name	Status	Habitat	Habitat is not Present in Project Area; Species Eliminated from Further Consideration	Habitat is Present in Project Area; Species Eliminated from Further Consideration for Reasons Given (see numbered notes)	Potential Risk is Present from Project Activities
purple martin	*Progne subis*	SCSC	Inhabits woodlands, low elevation coniferous forest of douglas-fir, ponderosa pine, & Monterey pine	X		
bank swallow	*Riparia riparia*	ST	riparian and other lowland habitats; requires vertical banks/cliffs with fine soils		X (5)	
least Bell's vireo	*Vireo bellii pusillus*	FE, SE	Summer resident of Southern California in low riparian in vicinity of water or in dry river bottoms; nests placed along margins of bushes or on twigs projecting into pathways, usually willow, *Baccharis*, mesquite		X (5)	
yellow-headed blackbird	*Xanthocephalus xanthocephalus*	SCSC	Nests in freshwater emergent wetlands with dense vegetation and deep water; often along borders of lakes or ponds		X (5)	
FISH						
Sacramento perch	*Archoplites interruptus*	SCSC	Historically found in the sloughs, slow-moving rivers, and lakes of the central valley	X		
Delta smelt	*Hypomesus transpacificus*	FT, SE	Sacramento-San Joaquin River Delta; seldom found at salinities > 10 ppt	X		

Common Name	**Scientific Name**	**Status**	**Habitat**	**Habitat is not Present in Project Area; Species Eliminated from Further Consideration**	**Habitat is Present in Project Area; Species Eliminated from Further Consideration for Reasons Given** (see numbered notes)	**Potential Risk is Present from Project Activities**
steelhead - Central Valley DPS	*Oncorhynchus mykiss irideus*	FT	Sacramento River and San Joaquin Rivers and their tributaries	X		
chinook salmon - Sacramento River winter-run ESU	*Oncorhynchus tshawytscha*	FE, SE, CNPS-1	Sacramento river below Keswick Dam; spawns in the Sacramento River but not in tributary streams	X		
chinook salmon - Central Valley spring-run ESU	*Oncorhynchus tshawytscha*	FT, ST	Sacramento River and tributaries	X		
Sacramento splittail	*Pogonichthys macrolepidotus*	SCSC	Lakes, Slow-moving Rivers with Vegetated Floodplain, Tidal Estuarine Marsh	X		
longfin smelt	*Spirinchus thaleichthys*	ST, SCSC	Found in open waters of estuaries, prefer salinities of 15-30 ppt, but may be found in completely freshwater to almost pure seawater	X		
eulachon	*Thaleichthys pacificus*	FT, SCSC	Found in Klamath river, Mad River, Redwood creek & in small numbers in Smith river & Humboldt Bay tributaries	X		
INVERTEBRATE						
Blennosperm vernal pool andrenid bee	*Andrena blennospermatis*		Bees nest in the uplands around vernal pools; oligolectic on vernal pool	X		

Common Name	**Scientific Name**	**Status**	**Habitat**	**Habitat is not Present in Project Area; Species Eliminated from Further Consideration**	**Habitat is Present in Project Area; Species Eliminated from Further Consideration for Reasons Given** (see numbered notes)	**Potential Risk is Present from Project Activities**
andrenid bee	*Andrena subapasta*		Collects pollen primarily from *Arenaria californica* but also *Orthocarpus erianthus* & *Lasthenia* sp.	X		
Conservancy fairy shrimp	*Branchinecta conservatio*	FE	Vernal pools	X		
vernal pool fairy shrimp	*Branchinecta lynchi*	FT	Vernal pools	X		
midvalley fairy shrimp	*Branchinecta mesovallensis*		Vernal pools in the Central Valley	X		
Sacramento Valley tiger beetle	*Cicindela hirticollis abrupta*		Sandy floodplain habitat in the Sacramento valley	X		
valley elderberry longhorn beetle	*Desmocerus californicus dimorphus*	FT	Riparian areas; on valley elderberry plants	X		
hairy water flea	*Dumontia oregonensis*		Vernal pools. In California, known only from Mather field.	X		

Common Name	Scientific Name	Status	Habitat	Habitat is not Present in Project Area; Species Eliminated from Further Consideration	Habitat is Present in Project Area; Species Eliminated from Further Consideration for Reasons Given (see numbered notes)	Potential Risk is Present from Project Activities
Ricksecker's water scavenger beetle	*Hydrochara ricksecker*i		Aquatic, vernal pool habitat	X		
vernal pool tadpole shrimp	*Lepidurus packardi*	FE	Vernal pools	X		
California linderiella	*Linderiella occidentalis*		Seasonal pools in unplowed grasslands with old alluvial soils underlain by hardpan or in sandstone depressions	X		
Antioch multilid wasp	*Myrmosula pacifica*		Sand dunes in the Sacramento-San Joaquin River Delta	X		
MAMMAL						
pallid bat	*Antrozous pallidus*	SCSC	Deserts, grasslands, shurblands, woodlands & forests. Most common in open, dry habitats with rocky areas for roosting		X (3)	
silver-haired bat	*Lasionycteris noctivagans*		Primarily a coastal and montane forest dweller feeding over streams, ponds, & open brushy areas	X		
western red bat	*Lasiurus blossevillii*	SCSC	Along riparian and agricultural areas in broadleaf tree communities throughout the Central Valley		X (3)	

Common Name	Scientific Name	Status	Habitat	Habitat is not Present in Project Area; Species Eliminated from Further Consideration	Habitat is Present in Project Area; Species Eliminated from Further Consideration for Reasons Given (see numbered notes)	Potential Risk is Present from Project Activities
hoary bat	*Lasiurus cinereus*		Prefers open habitats or habitat mosaics, with access to trees for cover and open areas or habitat edges for feeding		X (3)	
American badger	*Taxidea taxus*	SCSC	Most abundant in drier open stages of most shrub, forest, and herbaceous habitats, with friable soils	X		
PLANT						
Ferris' milk-vetch	*Astragalus tener var. ferrisiae*	CNPS-1	Grassland	X		
alkali milk-vetch	*Astragalus tener var. tener*	CNPS-1	Alkali areas of floodplains; vernal pools	X		
heartscale	*Atriplex cordulata var. cordulata*	CNPS-1	Saline or alkaline soils in chenopod scrub, valley and foothill grassland	X		
brittlescale	*Atriplex depressa*	CNPS-1	Alkaline clay soils in chenopod scrub, meadows, vernal pools, and valley and foothill grassland	X		
San Joaquin spearscale	*Atriplex joaquinana*	CNPS-1	Alkaline clay soils in chenopod scrub, meadows, vernal pools, and valley and foothill grassland	X		

Common Name	**Scientific Name**	**Status**	**Habitat**	**Habitat is not Present in Project Area; Species Eliminated from Further Consideration**	**Habitat is Present in Project Area; Species Eliminated from Further Consideration for Reasons Given** (see numbered notes)	**Potential Risk is Present from Project Activities**
big-scale balsamroot	*Balsamorhiza macrolepis*	CNPS-1	Chaparral, valley and foothill grassland, cismontane woodland	X		
watershield	*Brasenia schreberi*	CNPS-2	Lakes, ponds and slow-moving streams; 0.5-3 m deep		X (6) (7)	
bristly sedge	*Carex comosa*	CNPS-2	Marshes and swamps		X (6) (8)	
hispid salty bird's-beak	*Chloropyron molle ssp. hispidum*	CNPS-1	Meadows and seeps, playas, valley and foothill grassland	X		
palmate-bracted salty bird's-beak	*Chloropyron palmatum*	FE, SE, CNPS-1	Chenopod scrub, valley and foothill grassland	X		
Bolander's water-hemlock	*Cicuta maculata var. bolanderi*	CNPS-2	Marshes and swamps, coastal, fresh or brackish water		X (6) (9)	
Brandegee's clarkia	*Clarkia biloba ssp. brandegeeae*		Chaparral, cismontane woodland, lower montane coniferous forest	X		

Common Name	**Scientific Name**	**Status**	**Habitat**	**Habitat is not Present in Project Area; Species Eliminated from Further Consideration**	**Habitat is Present in Project Area; Species Eliminated from Further Consideration for Reasons Given** (see numbered notes)	**Potential Risk is Present from Project Activities**
Peruvian dodder	*Cuscuta obtusiflora var. glandulosa*	CNPS-2	Freshwater marshes and swamps		X (6) (9)	
dwarf downingia	*Downingia pusilla*	CNPS-2	Valley and foothill grassland (Mesic sites), vernal pools	X		
Boggs Lake hedge-hyssop	*Gratiola heterosepala*	SE, CNPS-1	Clay soils at the margins of lakes and vernal pools		X (8)	
woolly rose-mallow	*Hibiscus lasiocarpos var. occidentalis*	CNPS-1	Freshwater Marsh		X (6) (9)	
Ahart's dwarf rush	*Juncus leiospermus var. ahartii*	CNPS-1	Vernal pools, valley and foothill grassland	X		
Red Bluff dwarf rush	*Juncus leiospermus var. leiospermus*	CNPS-1	Chaparral, valley and foothill grassland, cismontane woodland, vernal pools, meadows and seeps	X		
Delta tule pea	*Lathyrus jepsonii var. jepsonii*	CNPS-1	Estuarine salt marshes and tidally influenced river banks, slough edges and levees		X (6) (9)	

Common Name	**Scientific Name**	**Status**	**Habitat**	**Habitat is not Present in Project Area; Species Eliminated from Further Consideration**	**Habitat is Present in Project Area; Species Eliminated from Further Consideration for Reasons Given** (see numbered notes)	**Potential Risk is Present from Project Activities**
legenere	*Legenere limosa*	CNPS-1	Vernal pools	X		
Heckard's pepper-grass	*Lepidium latipes var. heckardii*	CNPS-1	Grassland, Vernal Pools	X		
Mason's lilaeopsis	*Lilaeopsis masonii*	CNPS-1	Freshwater and brackish marshes, riparian scrub	X		
Delta mudwort	*Limosella australis*	CNPS-2	Riparian scrub, freshwater and brackish marshes		X (6) (9)	
Baker's navarretia	*Navarretia leucocephala ssp. bakeri*	CNPS-1	Grassland, Coniferous Forest, Oak Woodland, Vernal Pools	X		
pincushion navarretia	*Navarretia myersii ssp. myersii*	CNPS-1	Vernal pools	X		
Colusa grass	*Neostapfia colusana*	FT, SE, CNPS-1	Vernal pools	X		

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slender Orcutt grass	*Orcuttia tenuis*	FT, SE, CNPS-1	Vernal pools	X		
Sacramento Orcutt grass	*Orcuttia viscida*	FE, SE, CNPS-1	Vernal pools	X		
bearded popcornflower	*Plagiobothrys hystriculus*	CNPS-1	Vernal pools, valley and foothill grassland	X		
Sanford's arrowhead	*Sagittaria sanfordii*	CNPS-1	Marshes and swamps		X (6) (8)	
marsh skullcap	*Scutellaria galericulata*	CNPS-2	Marshes and swamps, meadows and seeps		X (6) (9)	
side-flowering skullcap	*Scutellaria lateriflora*	CNPS-2	Meadows and seeps, marshes and swamps		X (6) (9)	
Suisun Marsh aster	*Symphyotrichum lentum*	CNPS-1	Marshes and swamps (brackish and freshwater)		X (6) (9)	

Common Name	Scientific Name	Status	Habitat	Habitat is not Present in Project Area; Species Eliminated from Further Consideration	Habitat is Present in Project Area; Species Eliminated from Further Consideration for Reasons Given (see numbered notes)	Potential Risk is Present from Project Activities
saline clover	*Trifolium hydrophilum*	CNPS-1	Marshes and swamps, valley and foothill grassland, vernal pools		X (6) (9)	
Crampton's tuctoria or Solano grass	*Tuctoria mucronata*	FE, SE, CNPS-1	Vernal pools, valley and foothill grassland	X		
REPTILE						
western pond turtle	*Emys marmorata*	SCSC	Thoroughly aquatic turtle of ponds, marshes, rivers, streams & irrigation ditches, usually with aquatic vegetation			X
giant garter snake	*Thamnophis gigas*	FT, ST	Prefers freshwater marsh and low gradient streams, has adapted to drainage canals and irrigation ditches			X

Table 1 Numbered Notes:

(1) Species not present in water during application due to aestivation (summer-time dormancy).

(2) This is a terrestrial species that is known to enter water only during parts of its' reproductive cycle. This period of time does not coincide with the application period of aquatic herbicides.

(3) Species not likely to have any exposure as its target prey base consists of terrestrial species.

(4) Species may forage in the shallow water at the margins of Department conveyances or basins. Given the large amount of potential foraging area, the food items from treated areas would likely only constitute an insignificant percentage of the total diet. Therefore, no risk due to copper exposure is anticipated.

(5) Species forage for emergent aquatic insects over water. Given the large amount of potential foraging area, the emergent aquatic insects from treated areas would likely only contribute an insignificant percentage of the total diet. Therefore, no risk due to copper exposure is anticipated.

(6) According to The CalFlora Database, no reported occurrences of these species exist within the project area.

(7) Direct exposure to stalks and leaves in addition to indirect root zone exposure may occur following treatment. However, leaf exposure is not likely to have any effect due to the plant's mucous membrane. Watershield is considered resilient to copper toxicity as copper treatments have been shown as ineffective in controlling watershield (DiTomaso 2013).
(8) Not a submerged aquatic plant. Therefore exposure to copper treated water is indirect, if any. Exposure will only occur through root uptake of soil water. Aquatic herbicide concentration in root zone water is not expected to be sufficient to cause impaired growth or cause death.
(9) Not an emergent plant and therefore does not grow in standing water but may grow on moist banks of conveyances or basins. Exposure to treated water containing aquatic herbicides is indirect, if any. Exposure will only occur through root uptake of soil water; however, chemical properties of copper-containing herbicides make it unlikely that copper will be able to move through soil pore water to the roots of the plant. Aquatic herbicide concentration in root zone water is not expected to be sufficient to cause impaired growth or cause death.

Table 1 Status Abbreviation:

FE = Federally Listed as Endangered
FT = Federally Listed as Threatened
FD = Federally Delisted
SCSC = State Listed Species of Concern
SE = State Listed as Endangered
ST = State Listed as Threatened
CNPS-1 = California Native Plant Society Listed, Rare, Threatened, or Endangered in CA only
CNPS-2 = California Native Plant Society Listed Rare, Threatened, or Endangered

(Continued Item a): Discussion)

Methods for Estimating Risk

The United States Environmental Protection Agency (USEPA) has developed Toxicity Reference Values (TRVs) for many chemicals. However, published TRVs generally do not exist for herbicides. Therefore, herbicide-specific TRVs were derived as part of this document (USEPA 1999). Endpoints from studies available from the published literature or government reports and databases can be used to establish TRVs. The endpoints used to estimate risk of copper to the giant garter snake (GGS) and western pond turtle (WPT) were found in USEPA's OPP database (2014).

The USEPA (1989) suggests applying a 20X safety factor to median toxicity values for aquatic threatened or endangered species and a 10X safety factor for terrestrial threatened or endangered species.

Often, no herbicide-specific toxicity results are available for various taxonomic groups. For example, database and literature searches for copper toxicity testing of reptiles did not yield any useable studies. In this case, avian (bird) toxicity endpoints were used in place of specific toxicity values for the GGS and WPT. The uncertainty involved with using avian endpoint data to estimate risk to a reptile species does not require the application of an additional safety factor (USEPA 2004).

Once a TRV has been derived, it may be compared to an exposure estimate to evaluate whether an adverse effect for a given species is likely to occur. Exposures are estimated using parameters from the Wildlife Exposure Factors Handbook (1993). If an estimated exposure is lower than the derived TRV, the exposure scenario is not considered to pose a risk.

Risk is estimated by comparing the estimated environmental concentration (EEC) an organism may be exposed to the derived TRV to estimate a risk. Risk may be present when the EEC divided by the TRV is greater than or equal to 1.0. Risk is likely not present if the result is less than 1.0.

$$\text{Risk} = \text{EEC/TRV}$$

Where:
EEC = Estimated Environmental Concentration
TRV = derived Toxicity Reference Value

Copper Discussion

Since no useable published TRVs for copper was available for the GGS or WPT, the approach used here was to select the most sensitive avian endpoint found in the USEPA's OPP database. The most sensitive endpoint for birds is 357.9 mg copper/kg body weight (OPP 2014). This endpoint was used for derivation of a reptilian TRV by applying the recommended 10X safety factor for threatened terrestrial species. The derived reptilian TRV of 35.79 mg copper/kg body weight was used to determine if the exposure to copper-treated water presents a risk to the GGS or WPT.

Use of a standard water intake factor (multiplier used to estimate water intake based on metabolic need and body weight), and an estimate of the concentration of copper in water the GGS or WPT might drink or indirectly consume was calculated. Indirect consumption includes, but is not limited to dietary intake of fish and aquatic invertebrates. The methodology for estimating this value is contained in USEPA's Wildlife Factors Handbook (1993). From this, the amount of copper consumed per kg of body weight per day was calculated and compared to the TRV to assess the extent of risk.

It was estimated that applications of copper at the maximum label application rate (2.0 mg/L) will not lead to a dietary exposure greater than or equal to the dietary TRV for GGS or WPT of 35.79 mg copper/kg body weight/day. Thus, copper applied to the Department's conveyances and basins for aquatic weed and algae control does not appear to pose risk to the GGS or WPT.

A literature search was done to assess the impacts, if any, of fish toxicity on a loss of prey for the GGS or WPT. Acute copper toxicity data to aquatic species is summarized in **Appendix B**. Mortality data to fish is varied depending on form of copper, species of fish, and study details. Median Lethal Concentration (LC_{50}) data for the fish studies reviewed indicates a wide range of values, from 26 ppb to 57,000 ppb. Given the wide range of available data it is difficult to estimate the potential risk to fish in Department conveyances or basins. However, given the species of fish anticipated to be present in Department

conveyances and basins, the most sensitive relevant fish (bluegill) LC_{50} is 1300 ppb. The Department's typical target copper application rate or water concentration of 1000 ppb suggest it is unlikely that fish mortality will occur. Given the short-term duration of bioavailable dissolved copper in the water column and the infrequent (i.e., once per year) use of copper-containing herbicide applications, impacts to fish, if any, are not likely to affect the food base of GGS or WPT.

To educate Department staff working in the conveyances and basins of the potential presence of the GGS and WPT, a qualified biologist shall conduct a worker's environmental awareness program (WEAP). The WEAP training will be completed prior to application of aquatic herbicides containing copper to control vegetation in Department conveyances and basins. The WEAP will include, at a minimum, species identification, a description of suitable habitat for the species, and measures to implement in the event that this species is found during application. This training shall instruct personnel to recognize GGS and WPT, their habitats and life histories.

Item b): ***No Impact.*** The Project will take place in the Department's conveyances and basins, therefore, will not impact any riparian habitat or other sensitive natural community identified in local or regional plans, policies, or regulations, or by the California Department of Fish and Wildlife or U.S. Fish and Wildlife Service.

Item c): ***No Impact.*** The Project will take place in the Department's conveyances and basins and, therefore, will not impact any upland habitat or wetlands. However, the assessment of risk for species that live in these areas was considered. Specifically, the risk to GGS and WPT was assessed and it was concluded that the use of aquatic herbicides containing copper does not pose an unacceptable risk to either species.

Item d): ***No Impact.*** Water present in the Department's conveyances and basins is predominantly comprised of stormwater and urban runoff. The Department's drainage conveyances and basins are not directly connected to natural watercourses; project activities will not adversely influence movement of any native, resident or migratory fish.

Items e) and f): ***No Impact.*** The Project does not conflict with, and has no impact to any local policies, ordinances, or plans protecting biological resources.

3.5 Cultural Resources

	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
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

Items a) through d): ***No Impact.*** The Project is confined to the Department's drainage conveyances and basins. No known historical or archaeological resource, unique paleontological resource, unique geologic feature, or human remains in or out of formal cemeteries will be impacted.

3.6 Geology and Soils

	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
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-related 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?	☐	☐	☐	☒
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 wastewater disposal systems where sewers are not available for the disposal of wastewater?	☐	☐	☐	☒

Discussion

Items a) through e): ***No Impact.*** The Project consists of applying aquatic herbicides that contain copper to drainage conveyances and basins within the jurisdiction of the Department. The Project does not include any new structures, ground disturbances, or other elements that could expose persons or property to geological hazards. There would be no risk of landslide or erosion of topsoil. The Project would not require a septic or other wastewater system, as workers would use existing facilities.

3.7 Hazards and Hazardous Materials

	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
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?	☐	☐	☒	☐
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

Items a & b): **Less Than Significant Impact.** The Project would involve handling aquatic herbicides which are regulated hazardous materials. Acute exposure to humans of the undiluted, formulated product can cause eye, skin, and respiratory irritation, and can be harmful if swallowed. Refer to the representative MSDS presented in **Appendix E**. Use of this material would create a potential for spills that could affect worker safety and the environment. The spills could occur potentially at Department facilities, at the point of application, or during transport.

The Department handles, stores, and transports aquatic herbicides and disposes of containers in accordance with federal, state, and county requirements and manufacturer's recommendations. This approach is supplemented by the following components of the Department's aquatic vegetation management program, which would be applied to the use of herbicides that include copper:

1. Department personnel that make aquatic herbicide applications are themselves, or under the direct supervision of, a DPR-licensed Qualified Applicator Certificate or License holder (QAC/QAL). Expertise and training used by these personnel mitigate potentially significant impacts.

2. A written recommendation is prepared by a DPR-licensed Pest Control Advisor (PCA). A PCA undergoes 40 hours of training every 2 years on issues including health and safety and prevention of exposure to sensitive receptors. The written recommendation prepared by the PCA must evaluate proximity of occupied buildings and people, and health and environmental hazards and restrictions, and include a certification that alternatives and mitigation measures that substantially lessen any significant adverse impact on the environment have been considered and if feasible, adopted. Refer to **Appendix D.**

3. All Department personnel applying herbicides review and strictly adhere to the aquatic herbicide product label that has clear and specific warnings that alert users to hazards that may exist. Examples of specific product labels are included in **Appendix E**.

4. All Department personnel applying herbicides review and consult the aquatic herbicide Material Safety Data Sheet (MSDS) (an example is provided in **Appendix E)**, and the DPR Worker Health and Safety Branch Pesticide Safety Information Series (PSIS). The PSIS and the MSDS have specific information that describes precautions to be taken during the use of the aquatic herbicides.

5. Department personnel's familiarity with and implementation of the DPR PSIS series mitigates potentially significant impacts. For example, the PSIS series describes the personal protective equipment (PPE) needed for the safe handling of aquatic herbicides,

including goggles, disposable coveralls, gloves and respirators.

6. The condition of the water conveyance(s) or basin(s) being treated is field-evaluated to ensure that the application is necessary, feasible and can be conducted safely and according to label. This evaluation considers target weed species, level of infestation, water and flow conditions, alternate control methods, and amount of aquatic herbicide to be applied.

7. Prior to an application, the water operator will confirm no water is being pumped out of the drainage conveyance(s) or basin(s) being treated.

8. The location(s) at which the aquatic herbicide is introduced into the water is staffed until the application is complete. Department staff performing inspections are in continuous cell phone or radio contact with staff making the application. In the event that a pump is accidentally turned on during an application event, addition of aquatic herbicide stops. Not until the pump is turned off does aquatic herbicide application resume.

Item c): ***Less Than Significant Impact.*** There are schools located within ¼ mile of locations were applications may be made. However, applicators will be present at the herbicide application sites and will not let unauthorized people (including students) near herbicide application equipment. Herbicide applications do not result in a release of copper to the air so no airborne risk is present. Once copper has been applied to the water, there are no restrictions on contact with the water.

Item d): ***No Impact.*** The Project sites are not listed on any hazardous waste site lists compiled in Government Code Section 65962.5.

Items e) & f): ***No Impact.*** Sacramento Executive Airport is located within the Department boundaries. The Project does not result in a safety hazard for people working in at the airport.

Item g): ***No Impact.*** The Project will not impact emergency evacuation routes because public roadways are not be affected by the Project.

Item h): ***No Impact.*** The Project will not increase fire hazards at the Project sites. Truck access and parking near application sites is done in such a manner so as to minimize muffler contact with dry grass.

3.8 Hydrology and Water Quality

	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
Would the Project:				
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 (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?	☐	☐	☐	☒
f) Otherwise substantially degrade water quality?	☐	☐	☐	☒
g) Place housing within100-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

The Department implements an IPM program for algae and aquatic weed control pursuant to the applicable NPDES permit. The IPM program involves the scouting of algae and aquatic weed locations and densities, establishment of thresholds above which control is needed, and making applications of aquatic herbicides on an "as-needed" basis to achieve the algae and aquatic weed control necessary to convey water.

Depending on algae or aquatic weed presence, aquatic herbicides containing copper may be applied as necessary between the months of April and November. Some years, no copper-containing aquatic herbicides will be used. Treatments may be made to only small sections, or may be made throughout the Department's conveyances or basins.

Copper-containing aquatic herbicide applications will be done over a short duration (typically less than approximately 36 hours per location) and not all water conveyances or basins will be treated at the same time, for the same length of time, or treated every year. Depending on weed presence, some water conveyances or basins may not get treated at all while others may require multiple treatments the same season. Copper-based herbicides will be discussed for checklist item a.) above. All other checklist items will be discussed together at the end of this section.

Prior to aquatic herbicide applications, the following tasks will be accomplished:

1. A written recommendation is prepared by a DPR-licensed Pest Control Advisor (PCA). A PCA undergoes 40 hours of training every 2 years on issues including health and safety and prevention of exposure to sensitive receptors. The written recommendation prepared by the PCA must evaluate proximity of occupied buildings and people, and health and environmental hazards and restrictions, and include a certification that alternatives and mitigation measures that substantially lessen any significant adverse impact on the environment have been considered and if feasible, adopted. Refer to **Appendix D.**

2. All Department personnel applying herbicides review and strictly adhere to the aquatic herbicide product label that has clear and specific warnings that alert users to hazards that may exist. An example of a specific product label is included in **Appendix E**.

3. All Department personnel applying herbicides review and consult the aquatic herbicide Material Safety Data Sheet (MSDS) (an example is provided in **Appendix E**), and the

DPR Worker Health and Safety Branch Pesticide Safety Information Series (PSIS). The PSIS and the MSDS have specific information that describes precautions to be taken during the use of the aquatic herbicide.

4. The condition of the water conveyance or basin being treated is field-evaluated to ensure that the application is necessary, feasible and can be conducted safely and according to label. This evaluation considers target weed species, level of infestation, water and flow conditions, alternate control methods, and amount of aquatic herbicide to be applied.

5. Prior to an application, the water operator will confirm no water is being pumped out of the conveyance(s) or basin(s) being treated.

6. The location at which the aquatic herbicide is introduced into the water conveyance or basin is continuously staffed until the application is complete. Department staff who are performing a water conveyance or basin inspection are in continuous cell phone or radio contact with staff at the head of the water conveyance or basin where the aquatic herbicide is being introduced into the system. In the event that pumps are turned on while the application is being made, the addition of aquatic herbicide stops. Not until the pump is turned off does aquatic herbicide application resume.

Overview of Aquatic Herbicide Use

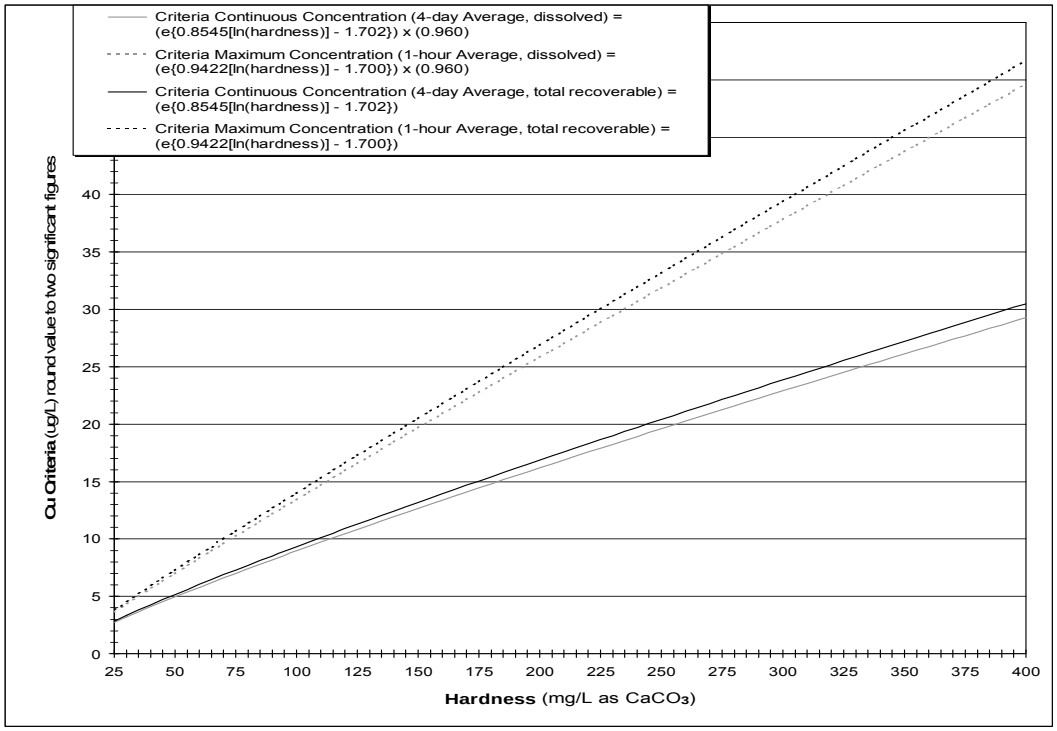
Depending on weed presence, aquatic herbicides containing copper may be applied as necessary at different locations between the months of April and November. Some years, no copper-containing aquatic herbicides will be applied.

Item a): **Potentially Significant Unless Mitigation Incorporated**. As presented in Section 1.2, the Department intends to obtain coverage under the 2013 General Permit that requires compliance with the SIP and the CTR. The Department is also requesting an exception under Section 5.3 of the SIP to allow short-term or seasonal applications of aquatic herbicides that contain copper.

Copper Discussion

Applications of copper-based aquatic herbicides according to label direction typically require concentrations of copper between 500 and 2,000 μg/L. Water quality criteria for copper as described in the CTR and by the Central Valley RWQCB (RWQCB 2003) are hardness-dependent. Refer to **Figure 2**. Department water varies in hardness throughout the season.

Figure 2. Cu Criteria Dependence on Hardness



Based on the relation of copper criteria to hardness, the Permit defined copper concentration criteria for a continuous dissolved concentration (4 day average) would be:

$$\text{Continuous Dissolved Copper Concentration} = e^{\{0.8545[\ln(\text{hardness})]-1.702\}} \times (0.960)$$

For example, if a basin has a hardness of 229 mg $CaCO_3$/L, the continuous dissolved concentration (4 day average) water quality criteria for copper in Department conveyances or basins will be the following:

Continuous Dissolved Concentration (4 day Average) 18.18 µg/L

These water quality criteria may be exceeded within the treatment area, shortly after application, and downstream of the point of aquatic herbicide use (i.e., outside of the treatment area or in "receiving waters") when applied at labeled rates. Accordingly, because label application rates may exceed the CTR water quality criteria, the Department is obtaining a SIP exception.

As a result of both dilution and uptake, copper-containing aquatic herbicides, as they will be applied in Department drainage conveyances and basins, rapidly dissipate and/or become permanently insoluble and as a result are not bioavailable shortly after application (CDFA 2002; Trumbo 1997, 1998; WA DOE 2004). When copper is applied according to label direction, its half-life is between 3 and 19 hours due to a combination of precipitation, absorption by biota, adsorption by particulate matter, and adsorption or complexation with organic matter. Refer to **Appendix C.**

Given a starting concentration of 2000 µg/L and a conservative half-life of 19 hours, soluble copper in the water column can reasonably be expected to decrease according to **Table 2** below:

Table 2. Anticipated Rate of Dissolved Copper Removal from the Water Column

Time (Hours)	Time (Days)	Copper Concentration (µg/L)
0	0	2,000
6	0.25	1,607
12	0.5	1,291
24	1	833
48	2	347
72	3	145
96	4	60
120	5	25
144	6	10
168	7	4.4
192	8	1.8
216	9	0.76
240	10	0.32
264	11	0.13
288	12	0.05
312	13	0.02

As **Table 2** shows, only a short-term (less than 6 days) copper water quality criteria exceedance is expected to occur in Department conveyances or basins.

In addition to using a hardness based approach to quantifying copper water quality criteria, the USEPA suggests the use of another model, described below, to analyze and/or predict toxicity of bioavailable copper in the water column. In the 2007 revision of Aquatic Life Ambient Freshwater Quality Criteria-Copper (USEPA 2007), the USEPA recommended the Biotic Ligand Model (BLM) as a more accurate approach for assessing toxicity and deriving freshwater quality criteria for copper. The BLM supplements USEPA's previously published recommendation of using the hardness-based estimation and better accounts for the reduction in copper bioavailability that results from competitive binding of copper to other molecules in the water column.

The BLM was developed to predict copper toxicity to aquatic organisms in relation to water quality parameters including pH, hardness, alkalinity, and dissolved organic carbon (DOC). According to the BLM, copper bioavailability is strongly influenced by these parameters. The free cupric ion (Cu^{2+}) is the primary driver of copper bioavailability and toxicity in aquatic ecosystems (EPA 2007).

In order to derive freshwater quality criterion for copper, the BLM uses ten water quality inputs: temperature; pH; dissolved organic carbon (DOC); major cations including calcium

(Ca), magnesium (Mg), sodium (Na), potassium (K); major anions including sulfate (SO_4), chloride (Cl); and alkalinity. Copper may be measured for comparison with site-specific criteria, but it is not required as an input to the model to determine copper freshwater quality criteria. The BLM-based water quality criterion for copper may be more or less stringent than the hardness-based criteria depending on the water quality parameters. However, it is more accurate than hardness-based criteria because it is based on copper bioavailability to aquatic species.

The BLM may also be used to predict copper toxicity and speciation in varying water conditions. When the model is run in toxicity prediction mode, it predicts the concentration of dissolved copper that produces a particular endpoint (e.g. NOAEL, LOAEL, or LC_{50}) for the selected aquatic species. When run in speciation prediction mode, the model can determine the various forms (e.g. $CuCO_3$, Cu^{2+}, copper bound to DOC) and concentrations of copper in the water when known copper concentration in water is input in the model.

Using the Biotic Ligand Model in copper speciation prediction mode, a total of 27 graphs have been generated to illustrate how variations in water quality parameters including pH, hardness, alkalinity, and dissolved organic carbon (DOC) influence the concentration of bioavailable Cu^{2+} (see **Appendix C**). Generally, an increase in one or more of the four water parameters lowers the concentration of the Cu^{2+} species, thereby lowering the bioavailability of copper. Water quality analyses completed to determine pH, hardness, alkalinity and DOC in support of this MND indicate that the Biotic Ligand Model Graphs 26 and 27 in **Appendix C** are the most relevant for details on copper speciation under typical conditions observed Department conveyances and basins.

When used according to label directions by qualified personnel, impacts of copper-containing aquatic herbicides have no significant impact. The Department will implement the following mitigation measure for applications of copper to reduce any potentially significant impacts to less than a significant level: These mitigation measures for applications of copper are:

HWQ-1. As required by the SIP and the SWRCB general permit for the application of aquatic herbicides, the Department will prepare and execute an Aquatic Pesticide Application Plan (APAP). The APAP calls for surfacewater sampling and analysis before, during, and after aquatic herbicide application to assess the impact, if any, that the Project may have on beneficial uses of water. Additionally, consistent with SIP exception requirements, the Department will arrange for a qualified biologist to assess impacts to receiving water beneficial uses.

Item b): ***No Impact.*** The Project will not involve any construction activities or require the use of groundwater and therefore there is no impact on groundwater recharge or supplies.

Items c), d), & e): ***No Impact.*** The Project will not involve construction of any structures that would alter drainage patterns or increase storm water runoff. The Project will not increase erosion or siltation on- or off-site. No streambeds will be altered. No increase in drainage capacity of local storm sewers will be required.

Item f): See response to item a).

Items g), h), i), & j): ***No Impact.*** Since the Project involves no new construction, no housing or other structures will be placed within a designated 100-year floodplain. The Project will not

alter the floodplain or have the potential to redirect flood flows. The Project will not be subject to tsunami or inundation due to mudflows. Nor will the Project expose personnel to a substantial risk due to seiche waves or from flooding as a result of a catastrophic levee or dam failure.

3.9 Land Use Planning

	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
Would the Project:				
a) Physically divide an established community?	☐	☐	☐	☒
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

Item a): ***No Impact.*** The Project will be implemented within the Department's existing drainage conveyances and basins. Nearby housing will not be affected. The Project will not result in any division of an established community.

Item b): ***No Impact.*** The Project will not create any new land uses or alter any existing uses and would not conflict with any applicable land use plan, policy or agency regulation.

Item c): ***No Impact.*** Refer to Section 3.4, item f). The Project does not conflict with any known plans.

3.10Mineral Resources

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

Discussion

Items a) & b): ***No Impact.*** The Project involves the addition of aquatic herbicides to the Department's drainage conveyances and basins and has no impact on the availability of any known mineral resource recovery or locally-important mineral resource recovery site.

3.11Noise

	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
Would the Project result in:				
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?	☐	☐	☐	☒
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

Items a) through d): ***No Impact.*** Project activity primarily occurs in Department conveyances and basins . Project activity in urban areas is consistent with ambient noise from adjacent roads and other typical urban activities. Application equipment includes the use of one or two pick-up trucks, and occasionally a small generator and an outboard boat motor. The incidental

noise and vibration generated by the use of small engines or pick-up trucks is temporary and inconsequential and thus will have no impact.

Items e) & f): ***No Impact.*** Sacramento International Airport, Sacramento Executive Airport, and Mather Air Force Base are located within the Department boundaries. However, the Project will not result in excessive noise levels for people working or living within these areas.

3.12 Population and Housing

	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
Would the Project:				
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 units, necessitating the construction of replacement housing elsewhere?	☐	☐	☐	☒
c) Displace substantial numbers of people, necessitating the construction of replacement housing elsewhere?	☐	☐	☐	☒

Discussion

Items a) through c): ***No Impact.*** No new homes, roads or other infrastructure will be required. No displacement of existing homes or people will occur.

3.13Public Services

	Potentially Significant Impact	Potentially Significant Unless 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

Item a): ***No Impact.*** The Project will not alter or require the construction of new schools, parks, or other public facilities, nor will it increase the need for police and fire services beyond existing conditions.

3.14Recreation

	Potentially Significant Impact	Potentially Significant Unless 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 effect on the environment?	☐	☐	☐	☒

Discussion

Items a) & b): ***No Impact.*** The Project will take place in the Department's drainage conveyances and basins. Department policy strictly prohibits swimming in its drainage conveyances and basins. Treatment of aquatic vegetation improves the ability of the Department to transport water for efficient conveyance of urban and stormwater drainage purposes, minimize the presence of nuisance conditions, and will have no impact on recreational activities.

3.15Transportation/Traffic

	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
Would the Project:				
a) Cause an increase in traffic which is substantial in relation to the existing traffic load and capacity of the street system (i.e., result in a substantial increase in either the number of vehicle trips, the volume to capacity ratio on roads, or congestion at intersections)?	☐	☐	☐	☒
b) Exceed, either individually or cumulatively, a level of service standard 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 result 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) Result in inadequate parking capacity?	☐	☐	☐	☒
g) Conflict with adopted policies, plans, or programs supporting alternative transportation (e.g., bus turnouts, bicycle racks)?	☐	☐	☐	☒

Discussion

Items a) & b): ***No Impact.*** The Project involves the use of light duty trucks that will not cause an increase in traffic that is substantial in relation to the existing traffic load and capacity of the county roads in the Project area. Generally, activity related to the Project is limited to one or two vehicles at any given time.

Item c): ***No Impact.*** The Project has no influence on air traffic.

Items d) through g): ***No Impact.*** The Project does not involve changes in road design or encourage incompatible road or highway uses. Further, the Project does not impact emergency access or parking. Lastly, the Project does not impact or conflict with adopted policies, plans, or programs supporting alternative transportation.

3.16 Utilities and Service Systems

	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
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?	☐	☐	☐	☒
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

Items a) & b), and e) through g): ***No Impact.*** The Project will not discharge to a wastewater treatment plant and does not generate any solid waste. All containers used to store and transport aquatic herbicides are typically returned to the vendor for reuse.

Item c): ***No Impact.*** The Project will not require the construction of new storm water drainage facilities or expansion of existing facilities.

Item d): ***No Impact.*** The Project involves the treatment of aquatic vegetation in water conveyances used to transport urban runoff and stormwater drainage and has no known influence on the entitlements or resources utilized by the Department.

3.17Mandatory Findings of Significance

	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
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?	☐	☐	☒	☐

Item a): **Potentially Significant Unless Mitigation Incorporated.** The Project involves the use of copper-based aquatic herbicides introduced into the Department's drainage conveyances and basins at concentrations that may temporarily exceed CTR water quality objectives. Significant evidence suggests that when used according to label directions by qualified personnel, any CTR exceedance will likely be short-term and impacts of these aquatic herbicides are less than significant.

However, the Department will implement mitigation (**HWQ-1**) to reduce any potential impacts to less than a significant level.

Although copper containing aquatic herbicides are a hazardous material, under the standard

operating procedures that will be used by Department personnel, there is a less than a significant potential for impact.

Item b): **Less Than Significant Impact.** The cumulative impacts of continued application of copper-based herbicides is not precisely known. However, studies examining the relationship between sediment copper concentration and toxicity support the conclusion that sediment-bound copper is not bioavailable. Deaver *et al.* (1996) compared limnetic water and copper-amended sediment toxicity to *Hyalella azteca*, an epibenthic detritivore sentinel species, and found that sediment concentrations were not predictive of copper toxicity across various water and sediment conditions. The limnetic water median lethal concentration (LC_{50}) of the free cupric ion, however, varied by <4% in the sediment-toxicity tests, indicating that the form of copper associated most strongly with toxicity (i.e. the bioavailable fraction) in its aquatic phase rather than sediment-bound copper. These results are corroborated by those of Suedel *et al.* (1996) which showed that copper toxicity to several aquatic organisms, including fish, water fleas, a midge, and an amphipod species, were correlated with overlying (limnetic) water concentration rather than sediment or pore water concentration. As noted in the IS/MND, copper-containing herbicides rapidly dissipate and/or become permanently insoluble, and as a result, are not bioavailable shortly after application (CDFA 2002; Trumbo 1997, 1998; WA DOE 2004).

Toxicity studies have also been conducted using water and sediment samples from copper herbicide application sites. Gallagher et al. (2005) collected water and sediment samples from a 20,234 hectare lake treated for 10 years in some areas with Komeen, a form of chelated copper applied annually at concentrations of 1 mg Cu/L. This rate of application is similar to the rate and application interval to what the Department anticipates using. The Gallagher study also looked at untreated areas to assess bioavailability to *Hyalella azteca* and *Ceriodaphnia dubia*. No statistical differences in response of either *H. azteca* or *C. dubia* to treated (16.3-18.0 mg Cu/kg) and untreated (0.3 mg Cu/kg) sediments were observed when compared to control sediments. In a 10-day exposure study by Huggett *et al.* (1999), sediments were collected from Steilacoom Lake (WA) and amended with $CuSO_4$ (800-2,000 mg Cu/kg dry weight) to assess copper bioavailability to *H. azteca, Chironomous tentans,*and *C. dubia*. When comparing the no observable adverse effect concentrations (NOECs) derived under these experimental conditions (906-2,010 mg Cu/kg) with the current concentrations of copper in the lake sediment (180-1,110 mg Cu/kg), it is apparent that the sediment-bound copper in the lake is not bioavailable to the three species.

Mitigation has been incorporated into the Project (**HWQ-1**). This mitigation reduces the impact to a less than a significant.

Item c): **Less Than Significant Impact.** As a result of implementation of Department standard procedures as described in the Hazards and Hazardous Materials section, any hazard/hazardous material impacts to the human beings is reduced to a less than a significant level.

4.0 MITIGATION MEASURES

4.1 Hydrology & Water Quality

HWQ-1. As required by the SIP and the SWRCB general permit for the application of aquatic herbicides, the Department will revise its Aquatic Pesticide Application Plan (APAP) to reflect the use, monitoring and reporting of copper-containing aquatic herbicides upon being listed on the SIP Exception list of the permit. The APAP will call for surface water sampling and analysis before, during, and after Project completion to assess the impact, if any, that the Project may have on beneficial uses of water. Additionally, consistent with SIP exception requirements, the Department will arrange for a qualified biologist to assess impacts to receiving water beneficial uses.

4.2 Mitigation Monitoring and Reporting Program

Mitigation HWQ-1 is the implementation of the Department's Aquatic Pesticide Application Plan (APAP) that requires surface water sampling, analysis, visual monitoring, and reporting as a condition of the NPDES Aquatic Permit issuance. The Department's APAP has been reviewed and approved by the SWRCB and reporting to them is done annually by March 1. Implementation of the APAP mitigates any significant environmental effects of aquatic herbicide use.

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6.0 PERSONS AND AGENCIES CONTACTED

1.) Joel Trumbo, CDFW

7.0 LIST OF PREPARERS

1.) Roxanne Dilley, Associate Civil Engineer, City of Sacramento
2.) Mick Smith, Drainage Collection Supervisor, City of Sacramento
3.) William Roberts, Superintendent of Drainage Services, City of Sacramento
4.) Michael S. Blankinship, PE, PCA, Blankinship & Associates, Inc.
5.) David Bonnar, Staff Scientist, Blankinship & Associates, Inc.
6.) Stephen Burkholder, Project Scientist, Blankinship & Associates, Inc.
7.) Ryan Beil, Staff Scientist, Blankinship & Associates, Inc.

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Appendix A

(Species Descriptions)

Approach

A Habitat Assessment of the City of Sacramento, Department of Utilities project site was conducted by Blankinship & Associates, Inc. staff to characterize the habitats present on-site and the likelihood of special status species occurring on the project site.

A list of these special species was compiled using a records search of the California Natural Diversity Database (CNDDB), and current species information from the U.S. Fish and Wildlife Service, Sacramento Office website. Location specific species data is available from both of these sources, and organized geographically into 7.5 minute U.S.G.S. quads. The CNDDB database was queried using the boundary map for the Department, and selecting all 8 quads that intersect with the Department's boundaries. In addition, a buffer area made up of the outlying quads adjacent to the original 8 quads was selected for the query, resulting in a total of 24 quads. This approach was used to identify species that might be located in the surrounding areas, but not necessarily reported to CNDDB as a sighting event within the Department boundaries.

Habitat requirements of each of the species were reviewed to determine whether habitat existed within the project area that would meet that species' needs. The breeding or foraging habitat of animals and the habitat requirements of plant species likely to occur in the project area are fully described below.

Amphibians

California Tiger Salamander (*Ambystoma californiense*)
California tiger salamanders are restricted to the Central Valley of California and to lower elevations to the west. Some populations have been extirpated due to urbanization and conversion of native grasslands and wetlands to agriculture (Fisher and Shaffer 1996 in Petranka 1998). They breed in fish-free, seasonally ephemeral ponds. Juveniles and adults are fossorial and are rarely seen other than during the winter breeding season. Breeding migrations occur from November to March (Storer 1925 in Petranka 1998). They commonly use California ground squirrel (*Spermophilus beecheyi*) or valley pocket gopher (*Thomomys bottae*) burrows for summer aestivation. During the summer when herbicide applications will be made, adults will be underground aestivating. Additionally, Department conveyances and basins would be not suitable habitat for developing tadpoles due to the presence of fish, so exposure to herbicides introduced to conveyances or basins is unlikely.

Western Spadefoot Toad (*Spea* (=*Scaphiopus*) *hammondii*)
Western spadefoot toads are almost completely terrestrial, entering water only to breed (see Dimmitt and Ruibal 1980 in Jennings and Hayes 1994). Western spadefoots become surface active following relatively warm (> 10.0-12.8ºC) rains in late winter-spring and fall, emerging from burrows in loose soil to a depth of at least 1 m (Stebbins 1972 in Jennings and Hayes 1994, A. McCready, pers. comm. in Jennings and Hayes 1994), but surface activity may occur in any month between October and April if enough rain has fallen (Morey and Guinn 1992 in Jennings and Hayes 1994, S. Morey, pers. comm. in Jennings and Hayes 1994). Since western spadefoot toads are not likely to enter water during the season when algae or aquatic weeds will need to be controlled in Department conveyances or basins, it is not likely that they would be exposed to herbicides introduced to conveyances or basins for the control of algae or aquatic weeds.

Birds

Cooper's Hawk (*Accipiter cooperii)*
Cooper's Hawks inhabit various types of mixed and deciduous forests and open woodlands, including small woodlots, riparian woodlands in dry country, open and pinyon woodlands, and forested mountainous regions (GRIN, 2014), but they can also be found in leafy suburbs of cities (Cornell, 2014). Cooper's Hawks typically build their nests 25-50 feet high in trees, such as pines, oaks, Douglas-firs, beeches, and spruces, on flat ground or in dense woods. These hawks are mainly aerial foragers, most commonly feeding on a variety of medium-sized birds such as European starlings, mourning doves, and rock pigeons. In western habitats, Cooper's Hawks

are known to include chipmunks, hares, mice, squirrels, bats, and other mammals in their diets (Cornell, 2014). Because Cooper's Hawks' target prey base consists of terrestrial species, the risk posed by treating Department conveyances or basins with aquatic herbicides is considered insignificant.

Tricolored Blackbird (*Agelaius tricolor*)
Breeding habitat of tricolored blackbirds includes large marshes (Payne 1969 in Beedy and Hamilton 1999). Nesting colonies are generally in emergent aquatic vegetation, but may also be found in trees along streams, weed patches, and grain and alfalfa fields, mustard, safflower, thistle, along an irrigation ditch, or in trees along a river (Orians 1960, 1961). In the Central Valley of California, breeding colonies were described where nests were placed in cattail-bulrush in dry and irrigated pasture; cattail in dry grassland, along a creek, rice and wheat fields, or dry and irrigated pasture; and in blackberry in dry grassland and along a creek (Crase and DeHaven 1977). Tricolored blackbirds forage in cultivated row crops, orchards, vineyards, and heavily grazed rangelands, but these are considered low-quality forage habitats. High quality forage areas included irrigated pastureland, lightly grazed rangeland, dry seasonal pools, mowed alfalfa fields, feedlots, and dairies (Beedy and Hamilton 1997 in Beedy and Hamilton 1999). In the Central Valley of California, nestling tricolored blackbirds were fed 86% animal matter on a volumetric basis, 11.2% plant matter, and 2.7% grit. The animal matter was primarily insects (79% of total diet) with the majority being beetles (61% of total diet). Plant matter was split evenly between cultivated grains such as oats, wheat and miscellaneous plant matter (Crase and DeHaven 1977). Since tricolored blackbirds are unlikely to feed directly from the treated conveyances or basins, the risk posed by aquatic herbicide applications for the control of algae or aquatic weeds is insignificant.

Great Egret (*Ardea alba*)
Great egrets forage in open areas, such as along the edges of lakes, large marshes, and shallow coastal lagoons and estuaries. They also forage along rivers in wooded areas (Kaufman 1996). Great egrets forage in freshwater, marine, and estuarine wetlands, shallow water of ponds, and regularly use uplands habitats (Palmer 1962 in NatureServe 2004; McCrimmon et al. 2001). They forage in water up to about 28 cm (Powell 1987 in McCrimmon et al. 2001). In the Sacramento Valley, they commonly forage in rice fields. Great egrets eat mostly fish. Other diet items include crustaceans, frogs, salamanders, snakes, and aquatic insects. In upland areas, they consume grasshoppers, and rodents (Kaufman 1996). Great egrets feed their nestlings many small fish during each feeding bout (Mock 1985). The potential exists for great egrets to feed on prey exposed to herbicides in conveyances and basins. Given the large foraging area of the great egret, fast depuration rates of copper by fish, exposure to food items form treated areas would only contribute an insignificant percentage of the total diet. The risk of applying copper to Department conveyances or basins for the control of algae or aquatic weeds is insignificant.

Great Blue Heron (*Ardea herodias*)
Great blue herons can travel long distances from a nesting colony to a feeding area, up to 34.1 km from the nesting colony (Pfeifer 1979). Because they can range so widely, the nesting colony with its large nest trees does not need to be adjacent to sufficient foraging habitat for all nesting adults and great blue herons can forage in water bodies that do not have adjacent nest trees. They forage in any kind of calm, shallow freshwater (Kaufman 1996) as well as in grasslands, marshes, and along riverbanks. Great blue herons consume a variety of prey, including fish, insects, mammals, amphibians, and crustaceans. Fish are the predominant prey (Butler 1992). The potential exists for a great blue heron to feed on prey exposed to herbicides in conveyances and basins. Given the large foraging area of the great blue heron, fast depuration rates of copper by fish, exposure to food items form treated areas would only contribute an insignificant percentage of the total diet. The risk of applying copper to Department conveyances or basins for the control of algae or aquatic weeds is insignificant.

Snowy Egret (*Egretta thula*)
Snowy egrets inhabit marshes, lakes, ponds, lagoons, mangroves, and shallow coastal habitats (NatureServ 2014). They are known to nest in trees or shrubs or, in some areas, on ground or in marsh vegetation often with other colonial water birds. Snowy egrets are known to forage in habitats and conditions ranging from small salt-marsh pools to large freshwater marshes (Cornell 2014). Snowy egrets may feed on small fish, frogs, snakes, lizards, crustaceans, worms, snails, and insects. The potential exists for a snowy egret to feed on prey exposed to herbicides in conveyances and basins Given the large foraging area of the snowy egret, fast depuration rates

of copper by fish, exposure to food items form treated areas would only contribute an insignificant percentage of the total diet. The risk of applying copper to Department conveyances or basins for the control of algae or aquatic weeds is insignificant.

White-tailed Kite (*Elanus leucurus)*
White-tailed kites inhabit low elevation grassland, agricultural, wetland, oak-woodland, or savannah habitats. Riparian areas adjacent to open areas are also used. Lightly grazed or ungrazed fields generally support larger prey populations, and are therefore preferred. Intensively cultivated areas are also used (Dunk 1995). Nests in trees (Stendell 1972 in Dunk 1995). They prefer to forage in ungrazed grasslands (Bammann 1975 in Dunk 1995), wetlands dominated by grasses, and fence rows and irrigation ditches with residual vegetation adjacent to grazed lands (Bammann 1975 in Dunk 1995). They primarily eat small mammals (Dunk 1995). Because they prey mostly on small mammals, white-tailed kites are not likely to be exposed to algaecides or aquatic herbicides applied to Department conveyances or basins for control of algae or aquatic weeds.

Black-crowned Night-Heron (*Nycticorax nycticorax*)
Black-crowned night-herons have a wide-geographic distribution and are known to inhabit marshes, swamps, wooded streams, mangroves, shores of lakes, ponds, lagoons as well as salt water, brackish, and freshwater situations (NatureServ 2014; Cornell 2014). They are colonial nesters and tend to lay eggs in platform nests in groves of trees near coastal marshes or on marine islands, swamps, marsh vegetation, and in many other situations. As opportunistic feeders, they are known to prey on small animals including fish, amphibians, and invertebrates obtained in shallow water and have also been known to prey on small mammals and young birds on land (Cornell 2014). The potential exists for black-crowned night-heron to feed on prey exposed to herbicides in conveyances and basins. Given the large foraging area of the black-crowned night heron, fast depuration rates of copper by fish, exposure to food items form treated areas would only contribute an insignificant percentage of the total diet. The risk of applying copper to Department conveyances or basins for the control of algae or aquatic weeds is insignificant.

Double-crested Cormorant (*Phalacrocorax auritus)*
Double-crested Cormorants are colonial waterbirds that seek aquatic bodies big enough to support their mostly fish diet, but may also form breeding colonies on smaller lagoons or ponds up to 40 miles away from their feeding area. This cormorants' habitat must include access to high, airy perches, such as rocks, wires, and tops of dead trees, in order to dry off their feathers after fishing. Nesting colonies are typically formed in clusters of trees near water, either on the ground or in the trees. Double-crested Cormorants hunt while swimming on the surface of the water, then diving and chasing fish underwater using their webbed feet. Their diet is almost exclusively fish, with few insects, crustaceans, or amphibians (Cornell, 2014). Although the Double-crested Cormorant may forage in the shallow water of some Department conveyances and basins, given the large amount of potential foraging area, the food items from treated conveyances and basins would likely only contribute an insignificant percentage of the total diet. Therefore, risk due to copper exposure is anticipated to be insignificant.

Bank Swallow (*Riparia riparia*)
Bank swallows breed along ocean coasts, rivers, streams, lakes, reservoirs, and wetlands (Cramp *et al*. 1988 in Garrison 1999, Turner and Rose 1989 in Garrison 1999, American Ornithologists' Union 1998 in Garrison 1999). They require vertical banks, cliffs, and bluffs in alluvial, friable soils for nesting. Bank swallows forage while flying and consume flying or jumping insects and occasionally eat terrestrial and aquatic insects or larvae (Garrison 1999). They feed over lakes, ponds, rivers and streams, meadows, fields, pastures, and bogs. They occasionally feed over forests and woodlands (Stoner 1936 in Garrison 1999, Gross 1942 in Garrison 1999, Turner and Rose 1989 in Garrison 1999). During the breeding season, they generally forage within 200 m of their nests for feeding the nestlings (Mead 1979 in Garrison 1999, Turner 1980 in Garrison 1999). The only area where bank swallows might nest is along the Sacramento River. They generally forage within 200 m of nesting areas while they have young in June and July (Garrison 1999). Bank swallows could feed on emergent insects over Department conveyances and basins near the Sacramento River. The comparative quality and quantity of foraging habitat immediately along and over the river is much greater than that along the Department conveyances or basins. It is unlikely for bank swallows to gather the majority of their prey from

treated conveyances or basins, so the risk to bank swallows from treating conveyances or basins with aquatic herbicides for the control of algae or aquatic weeds would be insignificant.

Least Bell's Vireo (*Vireo bellii pusillus)*
Least Bell's Vireos inhabit riparian vegetation along meandering rivers and are typically found throughout the Sacramento and San Joaquin Valleys. They breed among fairly dense riparian shrubbery, preferably where flowing water is present. Least Bell's Vireos favor willow, wild rose, and other dense vegetation for nesting. Nests are typically built about 1 m above the ground (CDPR, 2003). The Least Bell's Vireo forages by gleaning and hovering (Salata, 1983), and its diet consists of a wide variety of insect types including bugs, beetles, grasshoppers, moths, and particularly caterpillars (Chapin 1925; Bent 1950). Although the Least Bell's Vireo forages for emergent aquatic insects over water, given the large amount of potential foraging area, the emergent aquatic insects from treated conveyances or basins would likely contribute an insignificant percentage of the total diet. Therefore, risk due to copper exposure is anticipated to be insignificant.

Yellow-headed Blackbird (*Xanthocephalus xanthocephalus)*
Yellow-headed Blackbirds breed in prairie wetlands, mountain meadows, quaking aspen parklands, and shallow areas of marches, ponds, and rivers. They attach their nests to vegetation overhanging water. Typical vegetation includes cattails, bulrushes, and reeds. The Yellow-headed Blackbirds will commonly feed on insects near their breeding area in the summer. Outside of the breeding season, they form flocks and forage in uplands, eating grains and weed seeds from farm fields. The Yellow-headed Blackbird's diet can consist of beetles, grasshoppers, dragonflies, caterpillars, flies, ants, spiders, grains, and seeds (Cornell, 2014). Although, the Yellow-headed Blackbird forages for emergent aquatic insects over water, given the large amount of potential foraging area, the emergent aquatic insects from treated conveyances or basins would likely contribute an insignificant percentage of the total diet. Therefore, risk due to copper exposure is anticipated to be insignificant.

Fish

Department conveyances and basins within the project area are not suitable habitat for any of the fish found in the CNDDB query. As such, project activities will not adversely influence movement of any native resident or migratory fish.

Invertebrates

No appropriate habitat for invertebrates of concern exists downstream from treated conveyances or basins. Additionally, no vernal pool core areas, as identified by the Vernal Pool Recovery Plan, exist in the project area (USFWS 2013).

Mammals

Pallid Bat (*Antrozous pallidus)*
Pallid bats inhabit arid deserts and grasslands, often near rocky outcrops and water. They are less abundant in evergreen and mixed conifer woodland. They usually roost in a rock crevice or building, less often in cave, tree hollow, mine, etc. (NatureServe 2004). In Oregon, night roosts were in buildings, under rock overhangs, and under bridges; bats generally were faithful to particular night roosts both within and between years (Lewis 1994 in NatureServe 2004). They prefer narrow crevices in caves as hibernation sites (Caire *et al*. 1989 in NatureServe 2004). The primary diet is arthropods which are captured on the ground, after an aerial search. They also capture some food (large insects) in flight, within a few meters of ground vegetation. Food items include flightless arthropods, Jerusalem crickets, moths, beetles, etc.; may eat small vertebrates (NatureServe 2004). Since the diet consists of mostly terrestrial insects, the exposure

to copper-containing aquatic herbicides introduced into Department conveyances and basins for control of algae or aquatic weeds would be insignificant.

Western Red Bat (*Lasiurus blossevillii)*
The western red bat inhabits grasslands, shrublands, open woodlands, and riparian areas. They typically roost in forests or woodlands, showing a preference for edge habitat (NatureServe 2004, Zeiner *et al.* 1988). Western red bats often roost in tree foliage along edge habitat, with preference given to sites with protection from above and below. They feed on moths, crickets, beetles and flying ants (Zeiner *et al.* 1988). The diet of the western red bat is made up of terrestrial insects; therefore exposure to copper-containing aquatic herbicides introduced into Department conveyances and basins for control of algae or aquatic weeds would be insignificant.

Hoary bat (*Lasiurus cinereus)*
The hoary bat is the most widespread bat in the United States. The bat winters along the coast of California and breeds inland. The bat tends to roost in dense foliage of trees and cavities, such as woodpecker holes (Shump and Shump 1982). They forage in open areas within forest, woodland riparian, and wetland habitats primarily after sundown (Shump and Shump 1982). The primary food source for hoary bats are moths, but they also eat other insects including beetles, flies, grasshoppers, and dragonflies (Shump and Shump 1982). Since their diet consists of mostly terrestrial insects, the risk posed from aquatic herbicides for the control of aquatic weeds in drainage conveyances or basins is insignificant.

Plants

Watershield (*Brasenia schreberi*)
Watershield is a perennial aquatic plant identified by its distinctive thick coating of gelatinous slime covering the underside of the leaves and coating the stems and buds (CalFlora 2014; WSDE 2014). The species is found throughout most of the United States and southern Canada, but is also known to occur in Central America, Cuba, Africa, East Asia, and Australia. Its habitat includes shallow ponds, lakes, and slowing-moving streams where it grows in water typically 0.5-3 m deep (WSDE, 2014). It is included in the CNPS Inventory of Rare and Endangered Plants on list 2B.3 (common elsewhere and not very endangered in CA) (CNPS 2014). According to the CalFlora Database, there are no reported occurrences of this species within the project area (CalFlora 2014). Watershield is a floating aquatic plant that grows in standing water. Direct exposure to stalks and leaves in addition to indirect root zone exposure may occur following treatment. However, leaf exposure is not likely to have any effect due to the plant's mucous membrane. Watershield is considered resilient to copper toxicity as copper treatments have been shown as ineffective in controlling watershield (DiTomaso 2013).

Bristly sedge (*Carex comosa)*
Bristly sedge is a monocot, perennial sedge that is about 2-3.5' tall and forms a large tuft of leaves and flowering culms and is native to California (Hilty, J 2013). The species is native to California and is also found throughout North America. It is included in the CNPS Inventory of Rare and Endangered Plants on list 2.1 (rare, threatened, or endangered in CA; common elsewhere). According to the CalFlora Database there are no reported occurrences of this species within the project area (CalFlora 2014). Furthermore the species is not a submerged aquatic plant and is not expected to grow in standing water, but may grow on moist banks of Department conveyances and basins. Exposure of bristly sedge to water in Department conveyances and basins containing aquatic herbicides is indirect, if any. Exposure will only occur through root uptake of soil water. The chemical properties of copper-containing aquatic herbicides make it unlikely that copper will be able to move through soil pore water to the roots of the plant. As such, exposure to copper-containing aquatic herbicides introduced into Department conveyances and basins for control of algae or aquatic weeds would be insignificant.

Bolander's water-hemlock (*Cicuta maculate var. bolanderi*)
Bolander's water-hemlock is a perennial herb in the Apiaceae family (CalFlora 2014). The species is found at various places within the United States including California, Arizona, New Mexico and Washington (CNPS 2014). Its habitat includes coastal salt marshes and swamps. It is included in the CNPS Inventory of Rare and Endangered Plants on list 2B.1 (rare, threatened, or endangered in California; common elsewhere) (CNPS 2014). According to the CalFlora Database there are no reported occurrences of this species within the project area (CalFlora 2014). Furthermore, the species is not an emergent plant and is not expected to grow in standing water, but may grow on moist banks of Department conveyances and basins. Exposure of Bolander's water-hemlock to water in Department conveyances and basins containing aquatic herbicides is indirect, if any. Exposure will only occur through root uptake of soil water. The chemical properties of copper-containing aquatic herbicides make it unlikely that copper will be able to move through soil pore water to the roots of the plant. As such, exposure to copper-containing aquatic herbicides introduced into Department conveyances and basins for control of algae or aquatic weeds would be insignificant.

Peruvian dodder (*Cuscuta obtusiflora var. glandulosa)*
The Peruvian dodder is a dicot, annual herb or vine that is native to California (CalFlora 2014). It is included in the CNPS Inventory of Rare and Endangered Plants on list 2,2 (rare, threatened, or endangered in CA; common elsewhere). Its habitat is freshwater marshes and swamps (CNPS 2012). The plant blooms July through October (CalFlora 2014). According to the CalFlora Database, there are no reported occurrences of Peruvian dodder within the project area (CalFlora 2014). Additionally, Peruvian dodder is not an emergent plant and therefore is not expected to grow in standing water, but may grow on moist banks of Department conveyances and basins. Exposure of Peruvian dodder to water in Department conveyances and basins containing aquatic herbicides is indirect, if any. Exposure will only occur through root uptake of soil water. The chemical properties of copper-containing aquatic herbicides make it unlikely that copper will be able to move through soil pore water to the roots of the plant. As such, exposure to copper-containing aquatic herbicides introduced into Department conveyances and basins for control of algae or aquatic weeds would be insignificant.

Boggs Lake hedge-hyssop (*Gratiola heterosepala)*
Boggs Lake hedge-hyssop is a California endangered semi-aquatic plant species. The species mostly occurs in the Central Valley, inner north coast range, Sierra Nevada foothills, and Modoc Plateau (CDFW 2013). It also occurs within the Southern Sierra Foothills, Solano-Colusa, Lake-Napa, and Northwestern Sacramento Valley Vernal Pool regions. The plant is restricted to clay soils in or near shallow water like lakes and vernal pools (CDFW 2013). It blooms April through September. Major threats to the species include habitat loss from development, invasion by exotic weeds, livestock, and road erosion (CDFW 2013). It is included in the CNPS Inventory of Rare and Endangered Plants on list 1 (rare, threatened, or endangered in CA only). According to the CalFlora Database no reported occurrences of this species exist within the project area (CalFlora 2014). Additionally, the plant is not a submerged aquatic plant. Exposure of the species to water in Department conveyances or basins containing aquatic herbicides is indirect, if any. Exposure will only occur through root uptake of soil water. The chemical properties of copper-containing aquatic herbicides make it unlikely that copper will be able to move through soil pore water to the roots of the plant. As such, exposure to copper-containing aquatic herbicides introduced into Department conveyances and basins for control of algae or aquatic weeds would be insignificant.

Woolly Rose-mallow (*Hibiscus lasiocarpos var. occidentalis*)
Rose-mallow is a rhizomatous dicot in the Malvaceae family (CalFlora 2014). This native California species can be found in freshwater marsh habitat, but has also been known to grow on moist banks of rivers, streams, canals and ditches (CNDDB 2005). Potential habitat for this species is present in the project area, however according to the CalFlora Database, no reported occurrences of the species exist within the project area (CalFlora 2014). Woolly rose-mallow is not an emergent plant. Exposure of the species to water in Department conveyances or basins containing aquatic herbicides is indirect, if any. Exposure will only occur through root uptake of soil water. The chemical properties of copper-containing aquatic herbicides make it unlikely that copper will be able to move through soil pore water to the roots of the plant. As such, exposure to copper-containing aquatic herbicides introduced into Department conveyances and basins for control of algae or aquatic weeds would be insignificant.

Delta Tule Pea (*Lathyrus jepsonii var. jepsonii*)
The delta tule pea is a rhizomatous perennial dicot in the Fabaceae family. The species is native and endemic to California. Its habitat includes both freshwater and brackish marshes and swamps (CNPES 2014). It is included in the CNPS Inventory of Rare and Endangered Plants on list 1B.2 (rare, threatened, or endangered in California and elsewhere). According to the CalFlora Database, there are no reported occurrences of this species within the project area (CalFlora 2014). Furthermore, the species is not an emergent plant and is not expected to grow in standing water, but may grow on moist banks of Department conveyances and basins. Exposure of delta tule pea to water in Department conveyances and basins containing aquatic herbicide is indirect, if any. Exposure will only occur through root uptake of soil water. The chemical properties of copper containing herbicides make it unlikely that copper will be able to move through soil pore water to the roots of the plants. As such, exposure to copper-containing aquatic herbicides introduced into Department conveyances and basins for control of algae or aquatic weeds would be insignificant.

Delta mudwort (*Limosella australis*)
The delta mudwort is a perennial herb in the family Scrophulariaceae (CalFlora 2014). This native California species grows in marshes and swaps, usually in muddy banks (CNPS 2014). It is included in the CNPS Inventory of Rare and Endangered Plants on list 2B.1 (rare, threatened, or endangered in California; common elsewhere) (CNPS 2014). According to the CalFlora Database, there are no reported occurrences of this species within the project area (CalFlora 2014). Furthermore, the species is not an emergent plant and is not expected to grow in standing water, but may grow on moist banks of Department conveyances and basins. Exposure of delta mudwort in Department conveyances and basins containing aquatic herbicides is indirect, if any. Exposure will only occur through root uptake of soil water. The chemical properties of copper-containing aquatic herbicides make it unlikely that copper will be able to move through soil pore water to the roots of the plant. As such, exposure to copper-containing aquatic herbicides introduced into Department conveyances and basins for control of algae or aquatic weeds would be insignificant.

Sanford's Arrowhead (*Sagittaria sanfordii*)
Sanford's arrowhead is a rhizomatous monocot that is native and endemic to California (CalFlora 2014). It is an aquatic perennial herb that occurs in freshwater wetlands, marshes, swamps, and other assorted shallow freshwater (CNPS 2012). Sanford's arrowhead is a member of the Water Plantain family; it is an obligate wetland plant. Its habitat includes the margins of wetland areas such as streams, rivers, ponds, drainage channels, or irrigation canals. It is native to California and is endemic (limited) to California alone. It is included in the CNPS Inventory of Rare and Endangered Plants on list 1B.2 (rare, threatened, or endangered in CA and elsewhere). Potential habitat for the species is in the project area, however according to the CalFlora Database there are no reported occurrences of the species within the project area (CalFlora 2014). Furthermore, Sanford's arrowhead is not a submerged aquatic plant. Exposure of Sanford's arrowhead to copper treated water is indirect, if any. Exposure will only occur through root uptake of soil water. The chemical properties of copper-containing aquatic herbicides make it unlikely that copper will be able to move through soil pore water to the roots of the plant. As such, exposure to copper-containing aquatic herbicides introduced into Department conveyances and basins for control of algae or aquatic weeds would be insignificant.

Marsh Skullcap (*Scutellaria galericulata*)
Marsh skullcap is rhizomatous perennial dicot in the Lamiaceae family (CalFlora 2014). The species is native to California and is also found elsewhere in North America and beyond. Its habitat includes meadows, marshes, and lower montane coniferous forests (CNPS 2014). It is included in the CNPS Inventory of Rare and Endangered Plants on list 2B.2 (fairly endangered in California; common elsewhere). According to the CalFlora database there are no reported occurrences of this species within the project area (CalFlora 2014). Furthermore, the species is not an emergent plant and is not expected to grow in standing water, but may grow on moist banks of Department conveyances and basins. Exposure of marsh skullcap to water in Department conveyances and basins containing aquatic herbicide is indirect, if any. Exposure will only occur through root uptake of soil water. The chemical properties of copper-containing aquatic herbicides make it unlikely that copper will be able to move through soil pore water to the roots of the plant. As such, exposure to copper-containing aquatic

herbicides introduced into Department conveyances and basins for control of algae or aquatic weeds would be insignificant.

Side-flowering Skullcap (*Scutellaria lateriflora*)
Side-flowering skullcap is a rhizomatous perennial dicot in the Lamiaceae family (CalFlora 2014). The species is native to California and is also found elsewhere in North America and beyond. Its habitat includes meadows, marshes, and swamps (CNPS 2014). It is included in the CNPS Inventory of Rare and Endangered Plants on list 2B.2 (fairly endangered in California; common elsewhere). According to the CalFlora database there are no reported occurrences of this species within the project area (CalFlora 2014). Furthermore, the species is not an emergent plant and is not expected to grow in standing water, but may grow on moist banks of Department conveyances and basins. Exposure of marsh skullcap to water in Department conveyances and basins containing aquatic herbicide is indirect, if any. Exposure will only occur through root uptake of soil water. The chemical properties of copper-containing aquatic herbicides make it unlikely that copper will be able to move through soil pore water to the roots of the plants. As such, exposure to copper-containing aquatic herbicides introduced into Department conveyances and basins for control of algae or aquatic weeds would be insignificant.

Suisun Marsh Aster (*Symphyotrichum lentum)*
The Suisun Marsh aster is a dicot, perennial herb that is native and endemic to California (CalFlora 2014). It is included in the CNPS Inventory of Rare and Endangered Plants on list 1B.2 (rare, threatened, or endangered in CA and elsewhere). The species grows in brackish or freshwater marshes along the banks of sloughs typically in the Suisun Bay and Sacramento-San Joaquin river delta. The plant flowers May through November (CalFlora 2014). According to the CalFlora Database there are no reported occurrences of the species within the project area (CalFlora 2014). The species is not an emergent plant so it does not grow in standing water, but may grow on moist banks of Department's drainage conveyances and basins. Exposure of Suisun Marsh aster to water in Department conveyances and basins containing aquatic herbicides is indirect, if any. Exposure will only occur through root uptake of soil water. The chemical properties of copper-containing aquatic herbicides make it unlikely that copper will be able to move through soil pore water to the roots of the plant. As such, exposure to copper-containing aquatic herbicides introduced into Department conveyances and basins for control of algae or aquatic weeds would be insignificant.

Saline Clover (*Trifolium hydrophilum*)
Saline clover is an annual dicot in the Fabaceae family (CNPS 2012). This native herb can be found in freshwater marshes and swamps, Valley and foothill grassland, and along the margins of vernal pools (CNDDB 2012). Saline clover has potential habitat in the project area, however according to the CalFlora Database, no reported occurrences of this species exist within the project area (CalFlora 2014). Saline clover is not an emergent plant; exposure of the species to water in Department conveyances and basins containing aquatic herbicides is indirect, if any. Exposure will only occur through root uptake of soil water. The chemical properties of copper-containing aquatic herbicides make it unlikely that copper will be able to move through soil pore water to the roots of the plant. As such, exposure to copper-containing aquatic herbicides introduced into Department conveyances and basins for control of algae or aquatic weeds would be insignificant.

Reptiles

Western Pond Turtle (*Emys marmorata)*
The Western Pond turtle historically existed from western Washington and British Columbia to northern Baja California, west of the Cascade-Sierra crest (Ernst et al 1994). They occupy a wide variety of wetland habitats including lakes, ponds, reservoirs, rivers and streams, stock ponds, and sewage treatment lagoons (Holland 1994). Optimal habitat has adequate emergent basking sites, emergent vegetation, refugia in the form of banks, submerged vegetation, mud, rocks, and logs (Holland 1994). Populations are in decline mainly due to habitat destruction. The species diet consists of a variety of food items including algae, various plants, snails, crustaceans, isopods, insects, fish, and frogs (Bury, 1986). Their habitat requirements and feeding habits

indicate western pond turtle may be exposed to herbicide-treated water. Refer to **Section 3.4** of the MND and **Appendix B** for a summary of exposure and risk analysis for the western pond turtle.

Giant Garter Snake (*Thamnophis gigas*)
Giant garter snakes occur in streams and sloughs, usually with mud bottoms (Stebbins 1985 in NatureServe 2004). One of the most aquatic of garter snakes; usually in areas of freshwater marsh and low-gradient streams with emergent vegetation, also drainage canals and irrigation ditches (CDFG 1990 in NatureServe 2004) and ponds and small lakes (USFWS 1993 in NatureServe 2004). Usually in areas of permanent water, sometimes in areas of temporary water such as irrigation/drainage canals and (less often) rice fields (Biosystems Analysis, Inc. 1989 in NatureServe 2004, USFWS 1993 in NatureServe 2004). Adult and immature snakes eat small mammals, invertebrates, and fish (NatureServe 2004). Their habitat requirements and feeding habits indicate giant garter snakes may be exposed to pulses of herbicide-treated water. Refer to **Section 3.4** of the **MND** and **Appendix B** for a summary of exposure and risk analysis for the giant garter snake.

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Appendix B

(Copper Species-Specific Risk and Ecological Toxicity Data)

Toxicity Reference Values and Risk

For contaminants frequently considered in ecological risk assessments, regulatory agencies, such as USEPA, have developed Toxicity Reference Values (TRVs) for each contaminant. However, published TRVs generally do not exist for pesticides. Therefore, pesticide-specific TRVs were derived as part of this document (USEPA 1999). Endpoints from studies available from the published literature or government reports and databases can be used to establish TRVs. The endpoints used to estimate risk of copper to the giant garter snake and western pond turtle were found in USEPA's OPP database.

The U.S. EPA (1989) suggests applying a 20X safety factor to median toxicity values for aquatic threatened or endangered species and a 10X safety factor for terrestrial threatened or endangered species. In this analysis, safety factors to all species regardless of their specific designation.

For certain pesticides, no toxicity results were available for various taxonomic groups. For example, database and literature searches for copper toxicity testing of reptiles did not yield any useable studies. In this case, avian (bird) toxicity endpoints were used in place of specific toxicity values for reptile species and terrestrial-phase amphibians. The uncertainty involved with using avian endpoint data to estimate risk to a reptile species does not require the application of an additional safety factors (USEPA 2004).

Once a TRV has been derived, it may be compared to an exposure estimate to evaluate whether an adverse effect for a given species is likely to occur. Exposures may be estimated using parameters from the Wildlife Exposure Factors Handbook (1993). If an estimated exposure is lower than the derived TRV, the exposure scenario is not considered to pose a risk.

Risk is estimated by comparing the estimated environmental concentration (EEC) an organism may be exposed to the derived TRV to calculate a risk. Risk is present when the EEC divided by the TRV is greater than or equal to 1.0. There is no risk given the scenario and assumptions if the result is less than 1.0.

$$\text{Risk} = \text{EEC}/\text{TRV}$$

Where:
EEC = Estimated Environmental Concentration
TRV = derived Toxicity Reference Value

Copper

Since no adequate published TRVs for copper was available for reptiles such as turtles and snakes, the approach used here was to select the most sensitive avian endpoint found in the USEPA's OPP database. The most sensitive endpoint for birds is 357.9 mg copper/kg body weight (OPP 2014). This endpoint was used for derivation of a reptilian TRV by applying recommended 10X safety factor for threatened terrestrial species for a total safety factor of 10X. The derived reptilian TRV of 35.79 mg copper/kg body weight was used to determine if the exposure to copper-treated water presents a risk to the giant garter snake or western pond turtle.

Use of a standard water intake factor (multiplier used to water intake based on metabolic need and body weight), and an estimate of the concentration of copper in water the snake or turtle might drink or indirectly consume was calculated. The methodology for estimating this value is contained in USEPA's Wildlife Factors Handbook (1993). From this, the amount of copper consumed per kg of body weight per day was calculated and compared to the TRV to assess the extent of risk.

It was estimated that applications of copper at the maximum label application rate (2.0 mg/L) will not lead to a dietary exposure greater than or equal to the dietary TRV for reptiles of 35.79 mg copper/kg body weight/day. Thus, copper applied to conveyance and basin systems for aquatic weed and algae control does not appear to pose risk to the giant garter snake or western pond turtle. In support of this statement, the California Department of Fish and Wildlife conducted a study on the effects of oral and dermal exposure to copper (ethylenediamine complex) on two species of garter snakes and did not observe any acute adverse effects (2004).

Copper Ecological Toxicity Studies Used to Evaluate Risk

Species (Common Name)	Species (Scientific Name)	Exposure Method	Purity (% A.I.)	Study Duration	Endpoint	Endpoint Estimate	Source
Bobwhite quail	*Colinus virginianus*	Administration of the toxicant ad libitum in the diet	99%	8 day	Oral LC50 (ppm)	>1,000	(1)
Bobwhite quail	***Colinus virginianus***	**Oral gavage or capsule administration of the toxicant**	**99%**	**14 day**	**Oral LD50 (mg/kg-bw)**	**357.9**	**(2)**
Bobwhite quail	*Colinus virginianus*	Oral gavage or capsule administration of the toxicant	99%	14 day	Oral LD50 (mg/kg-bw)	368	(3)
Mallard duck	*Anas platyrhynchos*	Administration of the toxicant ad libitum in the diet	99%	8 day	Oral LC50 (ppm)	>1,000	(4)
Ring-necked pheasant	*Phasianus colchicus*	Administration of the toxicant ad libitum in the diet	NR	8 day	Oral LC50 (ppm)	>40,000	(5)

General Notes:
The bolded study endpoint estimate was used for derivation of a reptilian TRV.

Abbreviations:
A.I. - Active Ingredient
LC50 - Median Lethal Concentration
LD50 - Median Lethal Dose
OPP - Office of Pesticide Programs
NR - Not Reported

References:
(1) Retrieved online from the OPP Pesticide Ecotoxicity Database (July 9, 2012):
http://www.ipmcenters.org/Ecotox/Details.cfm?RecordID=3837
(2) Retrieved online from the OPP Pesticide Ecotoxicity Database (July 9, 2012):
http://www.ipmcenters.org/Ecotox/Details.cfm?RecordID=3840
(3) Retrieved online from the OPP Pesticide Ecotoxicity Database (September 22, 2014):
http://www.ipmcenters.org/Ecotox/Details.cfm?RecordID=3836
(4) Retrieved online from the OPP Pesticide Ecotoxicity Database (July 9, 2012):
http://www.ipmcenters.org/Ecotox/Details.cfm?RecordID=3838
(5) Retrieved online from the OPP Pesticide Ecotoxicity Database (July 9, 2012):
http://www.ipmcenters.org/Ecotox/Details.cfm?RecordID=3839

Exposure Assessment
For terrestrial wildlife species, we used the procedures suggested in the U.S. EPA's Wildlife Exposure Factors Handbook (1993). We used uptake rates or equations to calculate uptake rates published by the U.S. EPA (1999 and 1993).

Risk Assessment
To determine whether adverse effects were likely, the anticipated exposure was compared to the TRV. Whenever the exposure estimate exceeded the TRV, we concluded a potential risk was present. For terrestrial animals, exposure to drinking the treated water, and consuming exposed prey items or vegetation were included in the exposure estimate.

COPPER

Persistence:	Hydrolysis – Not Applicable, Not Available Photodegradation in water – Not Applicable, Not Available Photodegradation on soil – Not Applicable, Not Available Aerobic soil metabolism – Not Applicable, Not Available Anaerobic aquatic metabolism – Not Applicable, Not Available Terrestrial Field Dissipation – Not Available

Physical Properties

Water Solubility:	Copper Sulfate: 230.5 g/kg (25ºC) (Tomlin 2002)
Volatility:	Not Volatile (Tomlin 2002)
Octanol/Water Partitioning Coefficient (K_{ow})	Not Available (K_{ow} > 100 indicates EPA may require Fish Bioaccumulation Test)

Bioaccumulation

Edwards *et al.* 1998
The uptake of copper in common nettle (*Urtica dioica*) and earthworms (*Eisenia fetida*) from a contaminated dredge spoil was measured. In the aerial portions of the common nettle, the biological absorption coefficient (concentration in plant tissue ÷ concentration in soil) was 0.072 to 0.265. In root tissue, the biological absorption coefficient was 0.075 to 0.303. To determine the uptake of copper in earthworms, contaminated soil was brought into the laboratory and earthworms introduced for 28 days. Soil copper levels were 16 times higher in the contaminated soil than in control soil, but the concentrations in the earthworms only differed by 2.6 times. The earthworms did absorb copper from the contaminated soils, but not to an extent reflecting the level of contamination.

Gintenreiter *et al.* 1993
Copper concentrations in the tissues of the gypsy moth (*Lymantria dispar*) increased from earlier to later developmental stages, but the trend was not smooth. Fourth instars showed a decrease when compared to 3rd instars, and adults had lower concentrations than pupae. Concentration factors were 2 to 5. Copper concentrations were passed from one generation to the next.

Gomot and Pihan 1997
Bioconcentration of copper was evaluated in two subspecies of land snails, *Helix aspersa aspersa* and *Helix aspersa maxima*. These snails showed a tendency to accumulate copper in excess of the amount available from its diet. The subspecies exhibited different bioconcentration factors for different tissues. For the foot, *H. a. aspersa* had factors ranging from 2.3 to 13.2, whereas *H. a. maxima* had factors ranging from 1.7 to 10.2. For the viscera, *H. a. aspersa* had factors ranging from 2.1 to 9.1, whereas *H. a. maxima* had factors ranging from 1.9 to 9.0. Differences in the bioconcentration factor appear to be more related to the other components of the diet, not the copper concentration in the diet.

Gomot de Vaufleury and Pihan 2000
Copper concentrations were measured in terrestrial snails (*Helix aspersa*). Differences were demonstrated among laboratory and field values. However, no soil or vegetation samples for the laboratory and field sites were analyzed for copper, so it is not possible to determine whether copper was accumulated at rates above background or whether they reflect some fraction of background levels.

Han *et al.* 1996
Shellfish accumulated copper in natural and aquaculture ponds in Taiwan. The sediments in the aquaculture ponds were finer grain and contained 4X concentrations of copper. Five mollusks were collected, but only purple clams (*Hiatula diphos*) and hard clams (*Meretrix lusoria*) were collected from both environments. The relative accumulation in each environment did not show a consistent pattern for both species indicating that the concentration in the shellfish was not controlled only by total copper concentrations in the sediments.

Haritonidis and Malea 1999
Copper concentrations in green algae (*Ulva rigida*) (2.2 ± 0.2 μg/g dry weight) collected from Thermaikos Gulf, Greece were less than seawater concentrations (1.5 ± 0.08 μg/L) and sediment (2.7 ± 0.5 μg/g dry weight). This suggests that copper will not bioconcentrate in algae.

Harrahy and Clements 1997
Bioaccumulation factors were calculated for the benthic invertebrate, *Chironomus tentans,* to be 16.63 and 12.99 during two uptake tests. Depuration was rapid. Copper concentrations were similar to background within four days. The authors caution that the bioaccumulation factors presented may be related to bioavailability that is driven by sediment characteristics.

Hendriks *et al.* 1998
Bioaccumulation ratios were determined for zebra mussels (*Dreissena polymorpha*) from the Rhine-Meuse Delta in the Netherlands. For copper, the ratio between mussels and suspended solids was 0.31 indicating tissue concentrations did not exceed environmental concentrations and that copper had not bioaccumulated

Janssen and Hogervorst 1993
Concentration factors were calculated for nine arthropod species inhabiting the forest litter layer in a clean reference site and a polluted site in The Netherlands: pseudoscorpion (*Neobisium muscorum*), harvestman (*Paroligolophus agrestis*), carabids (*Notiophilus biguttatus* and *Calathus melanocephalus*), mites (*Pergamasus crassipes*, *P. robustus*, and *Platynothrus peltifer*), dipluran (*Campodea staphylinus*), and collembolan (*Orchesella cincta*). Copper concentration factors for the eight species ranged from 0.85 – 4.08 in the reference site versus 0.40 – 1.62 in the polluted site. Copper was concentrated more when copper leaf litter concentrations were lower.

Khan *et al*. 1989
Bioconcentration factors in grass shrimp (*Palaemonetes pugio*) were determined for two populations, one from an industrialized site and another from a relatively pristine site. Levels of copper measured in shrimp from the industrialized site were greater than from the pristine site, but the industrialized site showed a concentration factor of 0.07, whereas the pristine site showed a concentration factor of 1.1 when compared to sediment concentrations.

Marinussen *et al* 1997a
Earthworms (*Dendrobaena veneta*) were exposed to soils containing various levels of copper. Earthworm tissue concentrations increased proportionally to the soil copper concentrations up to 150 ppm. Above 150 ppm in the soils, tissue concentrations leveled off at about 60 ppm.

Marinussen *et al* 1997b
Soil, containing 815 ± 117 ppm Cu, was collected from a contaminated site in The Netherlands. Earthworms (*Dendrobaena veneta*) were introduced to the soil in the laboratory. Earthworms appeared to reach equilibrium with the soil exhibiting tissue concentrations of *c.* 60 ppm through 56

days of exposure. At 112 days exposure, the tissue concentrations increased to *c.* 120 ppm. The authors did not have an explanation for this anomaly. After being transferred to uncontaminated soil, the earthworms eliminated the copper according to a two-compartment model with the half-life times being, $t_{1/2\text{-}1}$ = 0.36 d and $t_{1/2\text{-}2}$ = 37 d.

Morgan and Morgan 1990
Earthworms (*Lumbricus rubellus*) were collected from an uncontaminated site and four metalliferous mine sites. Copper concentrations in soil and in tissues were measured. The worms were held under clean conditions to allow eliminate soil from their alimentary canal. The concentrations of copper in earthworm tissues reflected the concentrations in the soil. The authors conclude that there was no evidence that copper was sequestered in earthworms.

Morgan and Morgan 1999
Copper concentrations in earthworm (*Aporrectodea caliginosa* and *Lumbricus rubellus*) tissue were lower than in their ingesta. This suggests that copper does not bioaccumulate in earthworms.

Neuhauser *et al.* 1995
Overall, copper did not bioconcentrate in earthworm in contaminated soil, but showed a slight tendency to bioconcentrate when soil copper concentrations were low.

Pyatt *et al.* 1997
Appreciable concentrations (0.3 – 4.6%) of copper were measured in all tissues of the freshwater snail (*Lymnaea stagnalis*), whereas no measurable quantities of copper were found in food or water. The authors conclude that bioaccumulation occurred.

Svendsen and Weeks 1997a,b
There is an inverse relationship between the bioconcentration factors and soil concentrations under laboratory conditions for the earthworm *Eisenia andrei* and under field conditions for the earthworm *Lumbricus rubellus.* Bioconcentration factors ranged from 4.0 using control soil and 0.30 using soil amended with 339 ppm Cu under laboratory conditions. Bioconcentration factors in the field ranged from 4.1 under control conditions to 0.4 when the soil plots contained 231 ppm Cu.

Fish Dietary Toxicity

Berntssen *et al.* 1999
Laboratory tests were conducted to determine the effects of dietary copper on Atlantic salmon (*Salmo salar*). Dietary concentrations were 0, 35, and 700 mg Cu/kg diet for an experiment lasting 28 days. Addition of the copper supplemented diet did not cause an increase in the water concentrations of copper. Dietary exposure significantly increased intestinal cell proliferation and apoptosis (degeneration of cells into membrane-bound particles that are then phagocytosed by other cells). The copper exposed groups did not grow during the trial.

Lundebye *et al.* 1999
Laboratory tests were conducted to determine the effects of dietary copper on Atlantic salmon (*Salmo salar*). Dietary concentrations were 0, 35, and 700 mg Cu/kg diet for an experiment lasting 28 days, and 5, 35, 500, 700, 900, and 1750 mg Cu/kg diet in an experiment lasting 12 weeks. Mean weights of fish used in the tests were 72 and 0.9 g in the first and second experiments, respectively. No mortality was observed in the first experiment, and only 2% died in the second experiment. Food consumption was not altered in either experiment at any dietary concentration. Cells of the intestinal lining were damaged in fish at both dietary concentrations in the first experiment. Growth of fish in

the second experiment was reduced at dietary concentrations ≥900 mg/kg after 10 weeks and at dietary concentrations ≥700 mg/kg after 12 weeks.

Miller *et al.* 1993
When rainbow trout (*Oncorhynchus mykiss*) were exposed in the laboratory simultaneously to dietary Cu concentrations of up to 684 µg/g dry weight and water concentrations of up to 127 µg/L, no overt signs of toxicity were noted. Fish were fed to satiation three times daily. Dietary exposure was the principal source of tissue Cu, but as water concentrations were increased, uptake from water increased. However, exposure to waterborne Cu was more effective at inducing tolerance to subsequent exposure to toxic concentrations of Cu.

Handy 1993
Rainbow trout (*Oncorhynchus mykiss*) were fed commercial trout chow with and without 10 mg Cu/kg dry weight for 28 days. The water concentrations of Cu remained below 1 ppb. Fish were hand-fed to satiation daily. No outward signs of toxicity were noted and a single mortality occurred in the Cu-treated fish on day 6 of treatment. Despite some regurgitation of diet pellets, no body weight loss was noted. Dietary copper increased tissue concentrations at day 28 to 2.52, 72.66, and 0.636 µg Cu/g weight in the gills, liver and muscle. Concentration in the kidneys were not elevated.

Murai *et al.* 1981
Channel catfish were provided diets containing supplemental copper at concentrations of 0, 2, 4, 8, 16, and 32 mg/kg for 16 weeks. At the end of 4 weeks, average weight gain had been reduced in the group receiving 32 mg/kg in the diet. After 16 weeks, average weight gain was reduced in the group receiving 16 mg/kg also. Weight gain/diet consumed was reduced for catfish receiving ≥ 8 mg/kg dietary Cu after 16 weeks. Packed cell volume in the blood and hemoglobin were not adversely affected, but the number of erythrocytes was reduced in the group receiving 16 mg/kg.

Mount *et al.* 1994
Rainbow trout (*Oncorhynchus mykiss*) were fed brine shrimp (*Artemia* sp.) enriched with Cu, Cd, Pb, and Zn alone or as a mixture along with As for 60 days. The water contained 12 µg/L Cu, 1.1 µg/L Cd, 3.2 µg/L Pb, and 50 µg/L Zn. Cu concentrations in the shrimp were 20, 40, and 80 µg/g fresh weight when trout were exposed to Cu alone. Survival of trout was decreased in the medium and high Cu treatments with 69 and 72% survival, respectively. Weight and length of trout were not impacted by feeding on brine shrimp containing Cu. Cu concentrations in whole fish were elevated as compared to controls either in clean water or metal-containing water, but the Cu concentrations did not differ among dietary treatment levels. No detrimental impacts were observed in the exposures to multiple metals via the diet. In that exposure scenario, concentrations in the diet were 0.5, 1, 1.5 and 2X the low concentrations from the first scenario.

Farag *et al.* 1994
Rainbow trout were fed invertebrates collected from the Clark Fork River, Montana and from an uncontaminated reference site for 21 days. Juvenile fish received invertebrates containing 1.54 As, 0.10 Cd, 18.57 Cu, 0.86 Pb, 32.09 Zn (all µg/g wet weight). Adult fish received invertebrates containing 3.20 As, 0.24 Cd, 26.13 Cu, 1.77 Pb, 68.99 Zn (all µg/g wet weight). Water was either standard laboratory water or contained metal concentrations based on the U.S. EPA's water-quality criteria with concentrations of 2.2 µg Cd/L, 24 µg Cu/L, 6.4 µg Pb/l and 100 µg Zn/L. Mortality of juveniles was significantly greater in tanks with metal-treated water regardless of whether the dietary invertebrates contained metals. Mortality was slightly increased in juveniles in laboratory water that received invertebrates with metals. No differences in growth were observed in any treatment. No mortality was observed in adult trials. Exposure to metals either in the water or via diet caused scale

loss in adults. Juveniles were too small to evaluate scale loss. Physiological condition of fish fed invertebrates containing metals was compromised.

Woodward *et al*. 1995
Rainbow trout (*Oncorhynchus mykiss*) and brown trout (*Salmo trutta*) were held in standard laboratory water or contained metal concentrations based on 50% the U.S. EPA's water-quality criteria with concentrations of 1.1 µg/L Cd, 12 µg/L Cu, 3.2 µg/L Pb, and 50 µg/L Zn from hatching to 88 days of age. Three diets were provided that comprised of benthic invertebrates collected from three locations on the Clark Fork River, Montana. Fish received pelleted invertebrates containing 6.5 As, no Cd, 87 Cu, 6.9 Pb, and 616 Zn (all mg/g dry weight); 19 As, no Cd, 178 Cu, 15 Pb, and 650 Zn (all mg/g dry weight); or 19 As, 0.26 Cd, 174 Cu, 15 Pb, and 648 Zn (all mg/g dry weight). Survival was not affected for either species by any combination of water or diet. Growth of brown trout was reduced in the groups receiving the diets with higher metals concentration and by exposure to metal-containing water from day 26 onward in the test. In rainbow trout, no effects were seen on growth at day 18, but by day 53, growth was reduced in fish exposed to higher metal concentrations in diet or water. However, the rainbow trout exposed to diets with higher metals concentrations had similar growth patterns regardless of whether they were also exposed to metals-containing water. Also, the growth of the rainbow trout exposed to treated water and the diet with low metal concentrations recovered by day 88 and were no longer significantly different from fish in untreated water.

Draves and Fox 1998
In a reach of the Montreal River in northern Ontario contaminated from gold mine tailings, water concentrations were significantly higher for Cu, Cd, and Pb, but not for Zn. Juvenile yellow perch (*Perca flavescens*), a benthic feeding species, had significantly less food in their stomachs in the contaminated reach than perch in an uncontaminated reach. However, body weights of juvenile perch did not differ between the contaminated and uncontaminated reaches. Within the contaminated reach, Cu body burdens were significantly negatively correlated with body weight. Concentrations of Cu in Chironomidae, Hemiptera, Cladocera, Odonata, and Amphipoda were compared between reaches. Concentrations in Chironomidae, Hemiptera, Cladocera, and Amphipoda were greater in the contaminated reach, but Cu concentrations were greater in Odonata in the uncontaminated reach.

Sublethal Effects

Folmar 1976
Rainbow trout (*Oncorhynchus mykiss*) fry showed strong avoidance to copper ($CuSO_4 \cdot 5H_2O$) at concentrations of 0.0001 to 0.01 ppm in the laboratory.

Folmar 1978
Mayfly nymphs (*Ephemerella walkeri*) showed strong avoidance to copper ($CuSO_4 \cdot 5H_2O$) at a concentration of 0.1 ppm but not 0.001 or 0.01 ppm in the laboratory.

Copper Ecological Aquatic Toxicity Studies

Chemical	Species Name	Common Name	Study Duration (days)	Effect Type	Response Measurement	>,<	Response Value	Response Unit	Reference
Copper ethanolamine complex	*Egeria densa*	Brazilian waterweed	1	Biochemical	LOEL	None	1000	ug/L	USEPA, 2013
Copper ethanolamine complex	*Egeria densa*	Brazilian waterweed	1	Biochemical	NOEL	None	1000	ug/L	USEPA, 2013
Copper ethanolamine complex	*Lepomis macrochirus*	Bluegill sunfish	4	Mortality	NOEL	None	2000	ug/L	USEPA, 2014
Copper ethanolamine complex	*Lepomis macrochirus*	Bluegill sunfish	4	Mortality	LC50	None	42000	ug/L	USEPA, 2014
Copper ethanolamine complex	*Oncorhynchus mykiss*	Rainbow Trout	4	Mortality	LC50	None	1500	ug/L	USEPA, 2014
Copper ethylenediamine complex	*Landoltia punctata*	Duckweed	2	Biochemical	NOEL	None	100	ug/L	USEPA, 2013
Copper ethylenediamine complex	*Landoltia punctata*	Duckweed	2	Biochemical	NOEL	None	100	ug/L	USEPA, 2013
Copper triethanolamine complex	*Landoltia punctata*	Duckweed	2	Biochemical	NOEL	None	100	ug/L	USEPA, 2013
Copper triethanolamine complex	*Landoltia punctata*	Duckweed	2	Biochemical	NOEL	None	100	ug/L	USEPA, 2013
Copper triethanolamine complex	*Anas platyrhynchos*	Mallard Duck	9	Mortality	NOEL	>	5000	mg/kg	USEPA, 2014

Chemical	Species Name	Common Name	Study Duration (days)	Effect Type	Response Measurement	>,<	Response Value	Response Unit	Reference
Copper triethanolamine complex	*Anas platyrhynchos*	Mallard Duck	9	Mortality	LC50	>	5000	mg/kg	USEPA, 2014
Copper triethanolamine complex	*Colinus virginianus*	Northern Bobwhite Quail	8	Mortality	LC50	>	5000	mg/kg	USEPA, 2014
Copper triethanolamine complex	*Lepomis macrochirus*	Bluegill sunfish	4	Mortality	LC50	None	17600	ug/L	USEPA, 2014
Copper triethanolamine complex	*Lepomis macrochirus*	Bluegill sunfish	4	Mortality	NOEL	None	18500	ug/L	USEPA, 2014
Copper triethanolamine complex	*Lepomis macrochirus*	Bluegill sunfish	4	Mortality	LC50	None	51000	ug/L	USEPA, 2014
Copper triethanolamine complex	*Lepomis macrochirus*	Bluegill sunfish	4	Mortality	LC50	None	57000	ug/L	USEPA, 2014
Copper triethanolamine complex	*Lepomis cyanellus*	Green sunfish	4	Mortality	LC50	None	1300	ug/L	USEPA, 2014
Copper triethanolamine complex	*Oncorhynchus mykiss*	Rainbow Trout	4	Mortality	LC50	None	840	ug/L	USEPA, 2014
Copper triethanolamine complex	*Oncorhynchus mykiss*	Rainbow Trout	4	Mortality	NOEL	None	100	ug/L	USEPA, 2014
Copper triethanolamine complex	*Oncorhynchus mykiss*	Rainbow Trout	2	Mortality	LC50	None	790	ug/L	USEPA, 2014
Copper triethanolamine complex	*Oncorhynchus mykiss*	Rainbow Trout	4	Mortality	LC50	None	26	ug/L	USEPA, 2014

Chemical	Species Name	Common Name	Study Duration (days)	Effect Type	Response Measurement	>,<	Response Value	Response Unit	Reference
Copper sulfate pentahydrate	*Anabaena flos-aquae*	bluegreen algae	5	Population	NOEL	None	20	ug/L	USEPA, 2014
Copper sulfate pentahydrate	*Selenastrum capricornutum*	Green algae	5	Population	NOEL	None	2	ug/L	USEPA, 2014
Copper sulfate pentahydrate	*Lemna minor*	Duckweed	5	Growth	NOEL	None	100	ug/L	USEPA, 2014
Copper sulfate pentahydrate	*Lemna minor*	Duckweed	5	Growth	EC50	None	2300	ug/L	USEPA, 2014
Copper sulfate pentahydrate	*Colinus virginianus*	Northern Bobwhite Quail	14	Mortality	LC50	None	368	mg/kg b.w.	USEPA, 2014
Copper sulfate pentahydrate	*Colinus virginianus*	Northern Bobwhite Quail	14	Mortality	LC50	None	357.9	mg/kg b.w.	USEPA, 2014
Copper sulfate pentahydrate	*Colinus virginianus*	Northern Bobwhite Quail	14	Mortality	NOEL	<	120	mg/kg b.w.	USEPA, 2014
Copper sulfate pentahydrate	*Lepomis macrochirus*	Bluegill sunfish	4	Mortality	LC50	None	2870	ug/L	USEPA, 2014
Copper sulfate pentahydrate	*Lepomis macrochirus*	Bluegill sunfish	4	Mortality	LC50	None	1300	ug/L	USEPA, 2014
Copper sulfate pentahydrate	*Lepomis macrochirus*	Bluegill sunfish	4	Mortality	NOEL	None	650	ug/L	USEPA, 2014
Copper sulfate pentahydrate	*Lepomis macrochirus*	Bluegill sunfish	4	Mortality	NOEL	None	1000	ug/L	USEPA, 2014
Copper sulfate pentahydrate	*Oncorhynchus mykiss*	Rainbow Trout	4	Mortality	NOEL	None	1960	ug/L	USEPA, 2014
Copper sulfate pentahydrate	*Oncorhynchus mykiss*	Rainbow Trout	4	Mortality	LC50	None	3580	ug/L	USEPA, 2014
Copper sulfate pentahydrate	*Oncorhynchus mykiss*	Rainbow Trout	4	Mortality	NOEL	None	56	ug/L	USEPA, 2014

Chemical	Species Name	Common Name	Study Duration (days)	Effect Type	Response Measurement	>,<	Response Value	Response Unit	Reference
Copper sulfate pentahydrate	*Oncorhynchus mykiss*	Rainbow Trout	4	Mortality	LC50	None	130	ug/L	USEPA, 2014
Copper (II) sulfate	*Microcystis aeruginosa*	bluegreen algae	1	Biochemical	NOEC	None	250	ug/L	USEPA, 2013
Copper (II) sulfate	*Euglenophyceae*	Euglenoid Class	27	Population	NOEL	None	65.3	ug/L	USEPA, 2013
Copper (II) sulfate	*Chlorella sp.*	Green Algae	3	Population	NOEC	None	2.3	ug/L	USEPA, 2013
Copper (II) sulfate	*Chlorella sp.*	Green Algae	3	Population	LOEC	None	7.9	ug/L	USEPA, 2013
Copper (II) sulfate	*Pseudokirchneriella subcapitata*	Green Algae	3	Population	NOEC	None	4.2	ug/L	USEPA, 2013
Copper (II) sulfate	*Chlorella sp.*	Green Algae	2	Population	LOEL	None	0.4	ug/L	USEPA, 2013
Copper (II) sulfate	*Xenopus laevis*	African Clawed Frog	4	Mortality	LC50	None	1370	ug/L	USEPA, 2013
Copper (II) sulfate	*Xenopus laevis*	African Clawed Frog	4	Growth	NOEC	None	100	ug/L	USEPA, 2013
Copper (II) sulfate	*Bufo boreas*	Boreal Toad	4	Mortality	LC50	None	120	ug/L	USEPA, 2013
Copper (II) sulfate	*Epidalea calamita*	Natterjack toad	4	Mortality	LC50	None	80	ug/L	USEPA, 2013
Copper (II) sulfate	*Epidalea calamita*	Natterjack toad	4	Growth	NOEC	None	100	ug/L	USEPA, 2013
Copper (II) sulfate	*Epidalea calamita*	Natterjack toad	4	Growth	LOEC	None	50	ug/L	USEPA, 2013
Copper (II) sulfate	*Gammarus balcanicus*	Amphipod	4	Biochemical	NOEL	None	10000	ug/L	USEPA, 2013

Chemical	Species Name	Common Name	Study Duration (days)	Effect Type	Response Measurement	>,<	Response Value	Response Unit	Reference
Copper (II) sulfate	*Tetrahymena sp.*	Ciliate Protozoan	1	Mortality	LC50	None	3300	ug/L	USEPA, 2013
Copper (II) sulfate	*Mesocyclops pehpeiensis*	Copepod	2	Mortality	LC50	None	75	ug/L	USEPA, 2013
Copper (II) sulfate	*Mesocyclops pehpeiensis*	Copepod	9	Growth	EC50	None	25	ug/L	USEPA, 2013
Copper (II) sulfate	*Barytelphusa cunicularis*	Crab	4	Mortality	LC50	None	215000	ug/L	USEPA, 2013
Copper (II) sulfate	*Cherax destructor*	Crayfish	4	Mortality	LC50	None	379	ug/L	USEPA, 2013
Copper (II) sulfate	*Cherax destructor*	Crayfish	4	Mortality	LC50	None	379	ug/L	USEPA, 2013
Copper (II) sulfate	*Astacus leptodactylus*	Crayfish	14	Biochemical	LOEL	None	10	ug/L	USEPA, 2013
Copper (II) sulfate	*Orconectes immunis*	Crayfish	5	Physiology	LOEL	None	160	ug/L	USEPA, 2013
Copper (II) sulfate	*Astacus leptodactylus*	Crayfish	14	Biochemical	NOEL	None	10	ug/L	USEPA, 2013
Copper (II) sulfate	*Cherax destructor*	Crayfish	3	Mortality	LC50	None	509	ug/L	USEPA, 2013
Copper (II) sulfate	*Orconectes immunis*	Crayfish	5	Mortality	LC50	None	20000	ug/L	USEPA, 2013
Copper (II) sulfate	*Spiralothelphusa hydrodroma*	Freshwater Field Crab	15	Biochemical	LOEC	None	25460	ug/L	USEPA, 2013
Copper (II) sulfate	*Macrobrachium dayanum*	Freshwater Prawn	2	Cellular	NOEC	None	418	ug/L	USEPA, 2013
Copper (II) sulfate	*Macrobrachium dayanum*	Freshwater Prawn	4	Mortality	LC50	None	418	ug/L	USEPA, 2013

Chemical	Species Name	Common Name	Study Duration (days)	Effect Type	Response Measurement	>,<	Response Value	Response Unit	Reference
Copper (II) sulfate	*Macrobrachium dayanum*	Freshwater Prawn	1	Cellular	LOEC	None	418	ug/L	USEPA, 2013
Copper (II) sulfate	*Macrobrachium rosenbergii*	Giant River Prawn	7	Biochemical	NOEC	None	10	ug/L	USEPA, 2013
Copper (II) sulfate	*Macrobrachium rosenbergii*	Giant River Prawn	7	Biochemical	LOEC	None	50	ug/L	USEPA, 2013
Copper (II) sulfate	*Macrobrachium rosenbergii*	Giant River Prawn	4	Mortality	LC50	None	452	ug/L	USEPA, 2013
Copper (II) sulfate	*Hydra viridissima*	Hydra	4	Mortality	LC50	None	28	ug/L	USEPA, 2013
Copper (II) sulfate	*Chasmagnathus granulata*	Neohelice Crab	14	Growth	NOEL	None	100	ug/L	USEPA, 2013
Copper (II) sulfate	*Hyalella sp.*	Scud	4	Mortality	LC50	None	170	ug/L	USEPA, 2013
Copper (II) sulfate	*Typha latifolia*	Cattail	8	Biochemical	NOEC	None	500	ug/L	USEPA, 2013
Copper (II) sulfate	*Typha latifolia*	Cattail	4	Biochemical	NOEC	None	500	ug/L	USEPA, 2013
Copper (II) sulfate	*Typha latifolia*	Cattail	8	Biochemical	LOEC	None	500	ug/L	USEPA, 2013
Copper (II) sulfate	*Typha latifolia*	Cattail	4	Biochemical	LOEC	None	1000	ug/L	USEPA, 2013
Copper (II) sulfate	*Typha latifolia*	Cattail	2	Biochemical	LOEC	None	5000	ug/L	USEPA, 2013
Copper (II) sulfate	*Ceratophyllum demersum*	Coontail	1	Physiology	LOEC	>	2500	ug/L	USEPA, 2013
Copper (II) sulfate	*Ceratophyllum demersum*	Coontail	1	Physiology	LOEC	>	100	ug/L	USEPA, 2013

Chemical	Species Name	Common Name	Study Duration (days)	Effect Type	Response Measurement	>,<	Response Value	Response Unit	Reference
Copper (II) sulfate	*Lemna gibba*	Duckweed	14	Growth	NOEC	None	100	ug/L	USEPA, 2013
Copper (II) sulfate	*Lemna gibba*	Duckweed	14	Growth	LOEC	None	250	ug/L	USEPA, 2013
Copper (II) sulfate	*Lemna minor*	Duckweed	10	Growth	EC50	None	470	ug/L	USEPA, 2013
Copper (II) sulfate	*Lemna minor*	Duckweed	4	Biochemical	LOEC	None	5000	ug/L	USEPA, 2013
Copper (II) sulfate	*Lemna minor*	Duckweed	4	Biochemical	NOEC	None	500	ug/L	USEPA, 2013
Copper (II) sulfate	*Lemna minor*	Duckweed	4	Biochemical	LOEC	None	500	ug/L	USEPA, 2013
Copper (II) sulfate	*Lemna minor*	Duckweed	4	Biochemical	NOEC	None	50	ug/L	USEPA, 2013
Copper (II) sulfate	*Lemna minor*	Duckweed	4	Biochemical	NOEC	None	50	ug/L	USEPA, 2013
Copper (II) sulfate	*Cabomba aquatica*	Fanwort	4	Physiology	LOEC	None	12	ug/L	USEPA, 2013
Copper (II) sulfate	*Elodea canadensis*	Pondweed	4	Physiology	LOEC	None	12	ug/L	USEPA, 2013
Copper (II) sulfate	*Eichhornia crassipes*	Water Hyacinth	14	Biochemical	NOEC	None	500	ug/L	USEPA, 2013
Copper (II) sulfate	*Eichhornia crassipes*	Water Hyacinth	14	Biochemical	LOEC	None	1000	ug/L	USEPA, 2013
Copper (II) sulfate	*Gallus domesticus*	Domestic Chicken	12	Growth	NOEC	None	2	mg/kg	USEPA, 2013
Copper (II) sulfate	*Gallus domesticus*	Domestic Chicken	15	Biochemical	LOEL	None	20	mg/kg	USEPA, 2013

Chemical	Species Name	Common Name	Study Duration (days)	Effect Type	Response Measurement	>,<	Response Value	Response Unit	Reference
Copper (II) sulfate	*Lepomis macrochirus*	Bluegill sunfish	4	Mortality	LC50	None	2640	ug/L	USEPA, 2013
Copper (II) sulfate	*Ictalurus punctatus*	Channel catfish	4	Mortality	LC50	None	710	ug/L	USEPA, 2013
Copper (II) sulfate	*Pimephales promelas*	Fathead Minnow	2	Mortality	LC50	None	7.2	ug/L	USEPA, 2013
Copper (II) sulfate	*Pimephales promelas*	Fathead Minnow	2	Mortality	LC50	None	5.9	ug/L	USEPA, 2013
Copper (II) sulfate	*Pimephales promelas*	Fathead Minnow	4	Mortality	LC50	None	96.6	ug/L	USEPA, 2013
Copper (II) sulfate	*Gambusia affinis*	Mosquitofish	4	Mortality	LC50	None	250	ug/L	USEPA, 2013
Copper (II) sulfate	*Oncorhynchus mykiss*	Rainbow Trout	4	Mortality	LC50	None	94	ug/L	USEPA, 2013
Copper (II) sulfate	*Oncorhynchus mykiss*	Rainbow Trout	7	Biochemical	NOEC	None	41.06	ug/L	USEPA, 2013
Copper (II) sulfate	*Oncorhynchus mykiss*	Rainbow Trout	4	Mortality	LC50	None	80	ug/L	USEPA, 2013
Copper (II) sulfate	*Pelodiscus sinensis*	Chinese Softshell Turtle	112	Growth	NOEC	None	10.9	mg/kg	USEPA, 2013
Copper (II) sulfate	*Pelodiscus sinensis*	Chinese Softshell Turtle	112	Growth	LOEC	None	20.4	mg/kg	USEPA, 2013
Copper (II) sulfate	*Pelodiscus sinensis*	Chinese Softshell Turtle	112	Biochemical	NOEC	None	41.8	mg/kg	USEPA, 2013
Copper (II) sulfate	*Pelodiscus sinensis*	Chinese Softshell Turtle	112	Biochemical	LOEC	None	78.6	mg/kg	USEPA, 2013

Notes:
EC50 - Effective concentration for 50% of the population
LC50 - Lethal concentration for 50% of the population
LD50 - Lethal dose for 50% of the population
LOEC - Lowest Observable Effect Concentration
LOEL - Lowest Observable Effect Level
NOEC - No Observable Effect Concentration
NOEL - No Observable Effect Level
Biochemical - Measurement of biotransformation or metabolism of chemical compounds, modes of toxic action, and biochemical responses in plants and animals. Examples of biochemical effects include changes in enzyme or hormonal activity.
Behavior - Overt activity measurement of an organism including but not limited to avoidance, aggression, and feeding behavior.
Cellular - Measurements regarding changes in structure and chemical composition of cells and tissues of plants or animals as related to their functions.
Growth - Measurements that include changes in body weight, morphology, and development.
Mortality - Measurements where the cause of death can be attributed to the chemical.
Physiology - Measurement regarding basic activity within tissues and cells of plants or animals. Effects include physiological responses such as injury, immunity, and intoxication.
Population - Measurements related to changes in a group of organisms of the same species occupying the same area at a given time.

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Appendix C

(Copper Speciation Graphs from the Biotic Ligand Model)

Biotic Ligand Model Copper Speciation Graphs for Varying Water Parameters

In addition to using a hardness based approach to quantifying copper water quality criteria, the USEPA suggests the use of another model, described below, to analyze and/or predict toxicity of bioavailable copper in the water column. In the 2007 revision of Aquatic Life Ambient Freshwater Quality Criteria-Copper (EPA 2007), the USEPA recommended the Biotic Ligand Model (BLM) as a more accurate approach for assessing toxicity and deriving freshwater quality criteria for copper. The BLM supplements USEPA's previously published recommendation of using the hardness-based estimation and better accounts for the reduction in copper bioavailability that results from competitive binding of copper to other molecules in the water column.

The BLM was developed to predict copper toxicity to aquatic organisms in relation to water quality parameters including pH, hardness, alkalinity, and dissolved organic carbon (DOC). According to the BLM, copper bioavailability is strongly influenced by these parameters. The free cupric ion (Cu^{2+}) is the primary driver of copper bioavailability and toxicity in aquatic ecosystems (EPA 2007).

In order to derive freshwater quality criterion for copper, the BLM uses ten water quality inputs: temperature; pH; dissolved organic carbon (DOC); major cations including calcium (Ca), magnesium (Mg), sodium (Na), potassium (K); major anions including sulfate (SO_4), chloride (Cl); and alkalinity. Copper may be measured for comparison with site-specific criteria, but it is not required as an input to the model to determine copper freshwater quality criteria. The BLM-based water quality criterion for copper may be more or less stringent than the hardness-based criteria depending on the water quality parameters. However, it is more accurate than hardness-based criteria because it is based on copper bioavailability to aquatic species.

The BLM may also be used to predict copper toxicity and speciation in varying water conditions. When the model is run in toxicity prediction mode, it predicts the concentration of dissolved copper that produces a particular endpoint (e.g. NOAEL, LOAEL, or LC_{50}) for the selected aquatic species. When run in speciation prediction mode, the model can determine the various forms (e.g. $CuCO_3$, Cu^{2+}, copper bound to DOC) and concentrations of copper in the water when known copper concentration in water is input in the model.

Using the Biotic Ligand Model in copper speciation prediction mode, a total of 27 graphs have been generated to illustrate how variations in water quality parameters including pH, hardness, alkalinity, and dissolved organic carbon (DOC) influence the concentration of bioavailable Cu^{2+}. See the tables and graphs below. Generally, an increase in one or more of the four water parameters lowers the concentration of the Cu^{2+} species, thereby lowering the bioavailability of copper. Graph 19 and Graph 20 demonstrate how increased pH causes a lower free cupric ion concentration, and an increase in DOC-bound (bio-unavailable) copper concentrations.

Graph #	Dissolved Organic Carbon (mg/L)	pH (unitless)	Alkalinity & Hardness (mg CaCO3/L)
1	2	7	50
2	2	8	50
3	2	9	50
4	2	7	100
5	2	8	100
6	2	9	100
7	2	7	200
8	2	8	200
9	2	9	200
10	4	7	50
11	4	8	50
12	4	9	50
13	4	7	100
14	4	8	100
15	4	9	100
16	4	7	200
17	4	8	200
18	4	9	200
19	6	7	50
20	6	8	50
21	6	9	50
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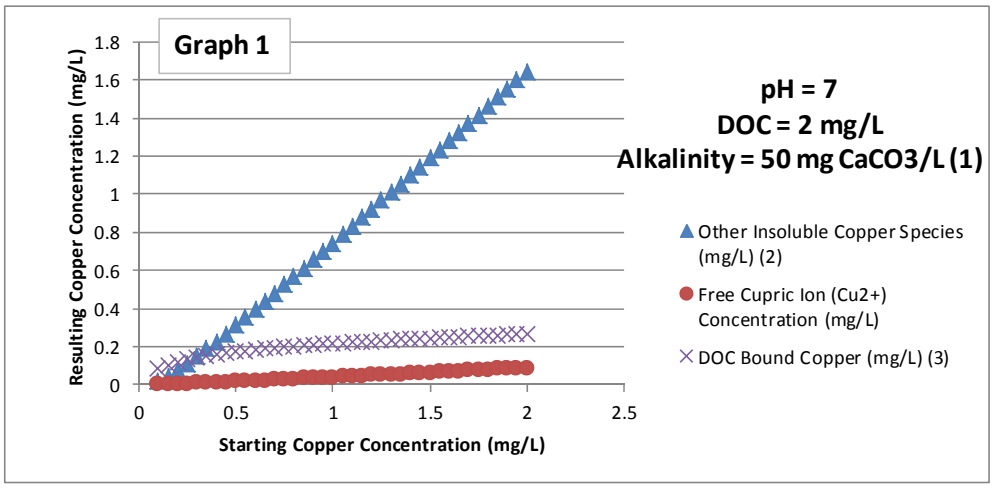
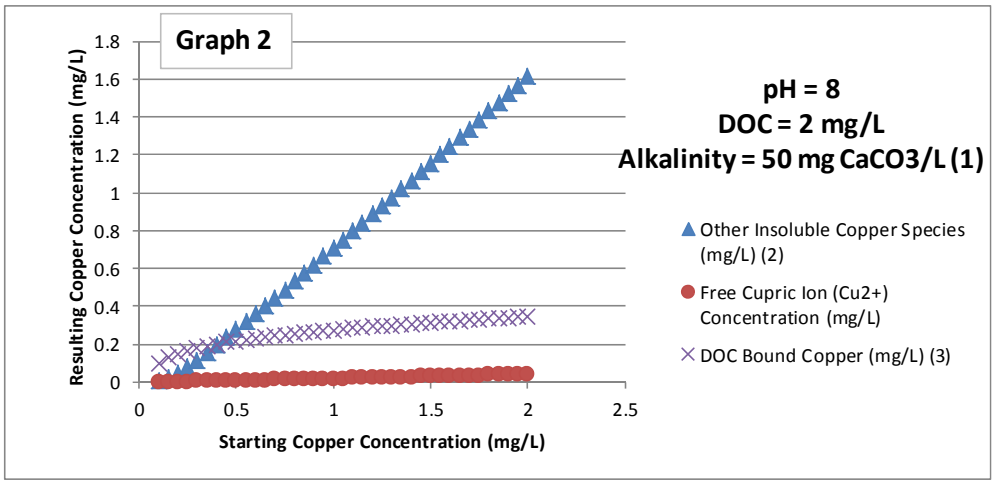
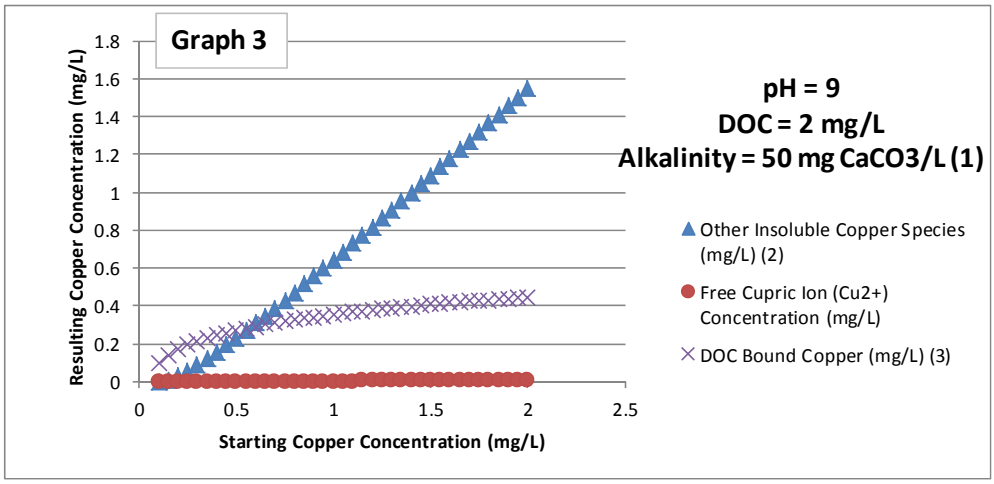
24	6	9	100
25	6	7	200
26	6	8	200
27	6	9	200





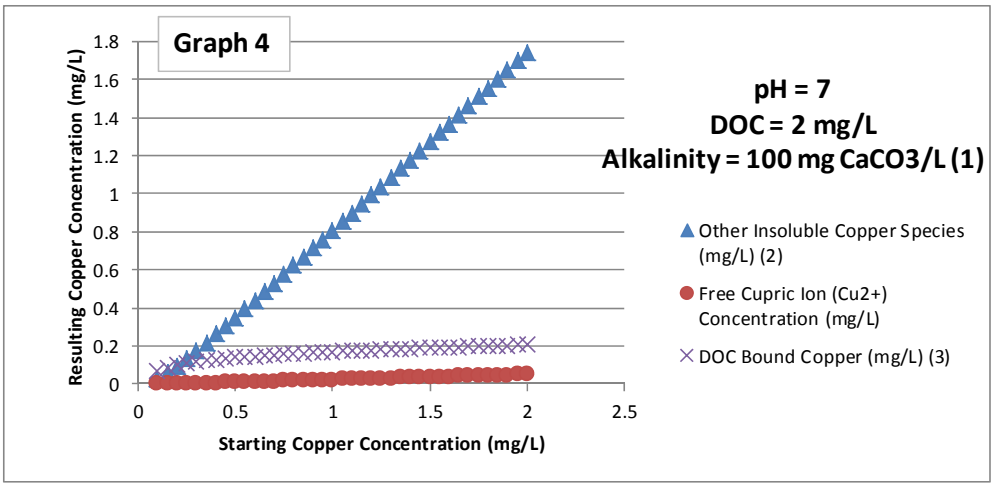


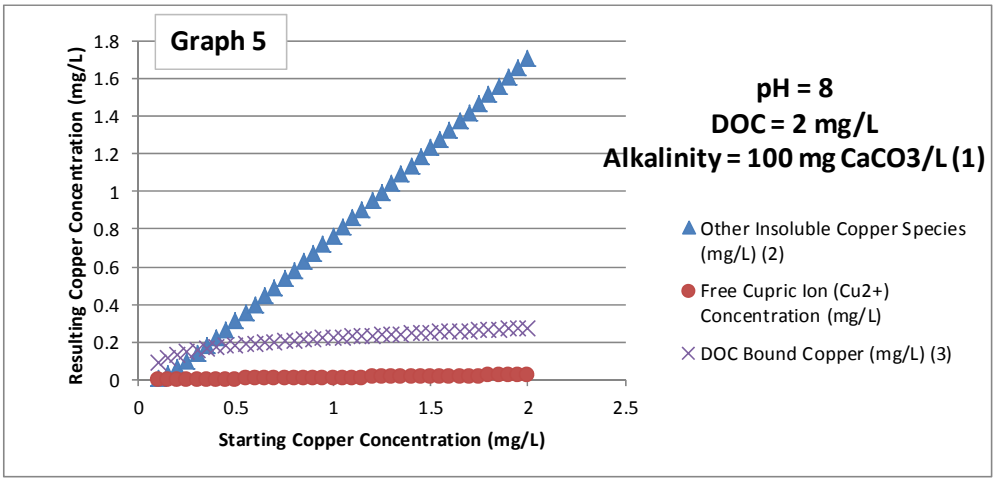
Notes:

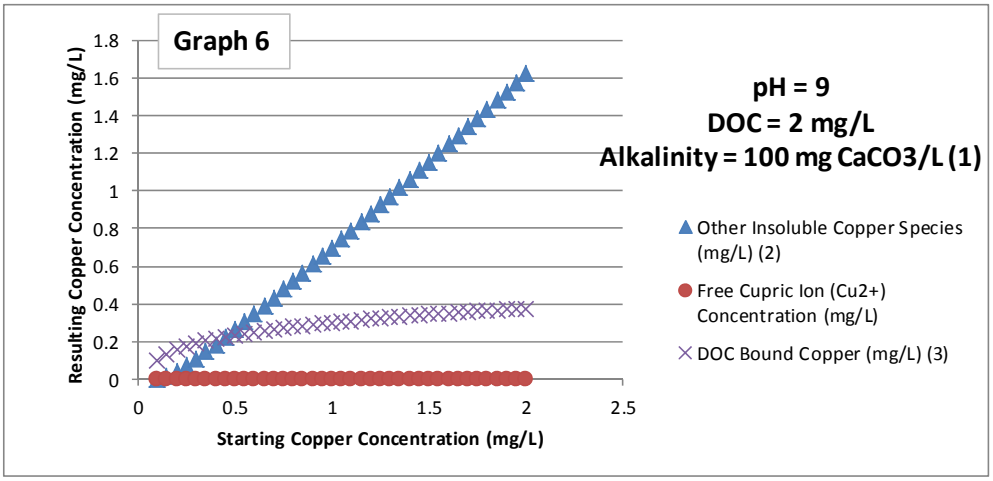
(1) Hardness and Alkalinity are both expressed as CaCO3 and are assumed equal.

(2) "Other Insoluble Copper Species" is the copper not accounted for by "Free Cupric Ion" and "DOC Bound Copper" species. It exists as various copper-ligands and/or copper salts, including but not limited to: CuCO3, CuHCO3+, and Cu(OH)2.

(3) DOC is the dissolved organic carbon content capable of complexing with copper cations, rendering them non-bioavailable. The humic acid content of the DOC was assumed to be 10%.







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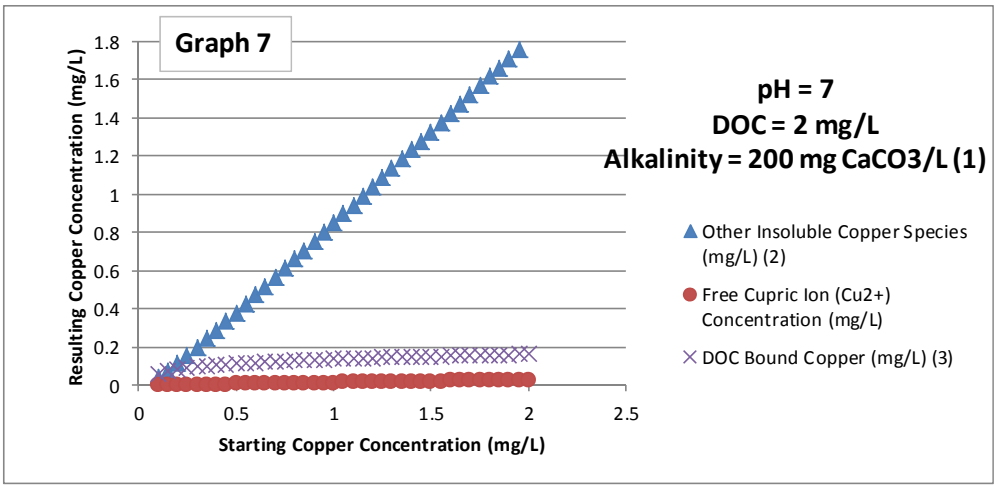

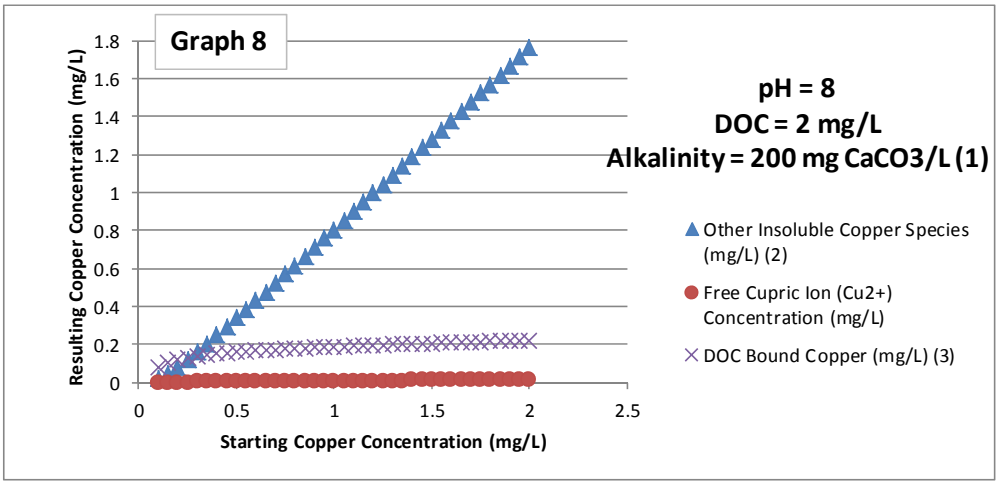

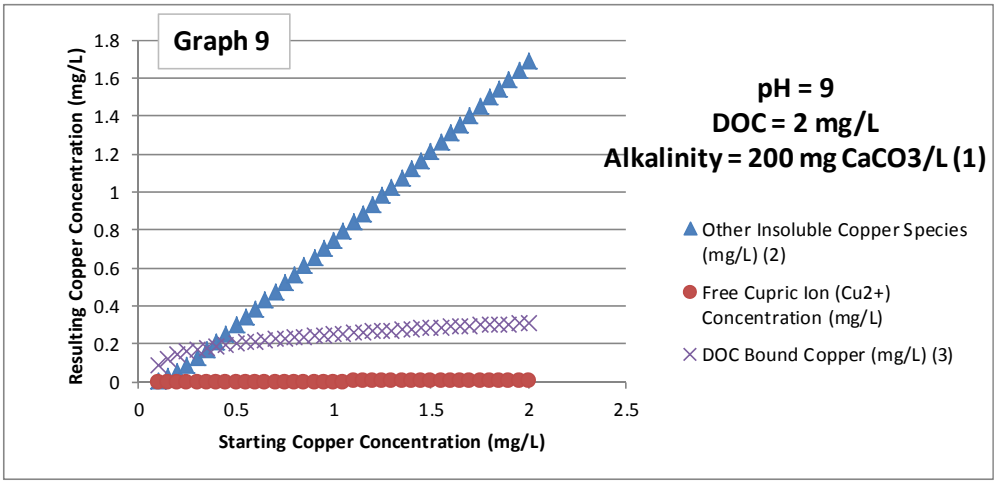

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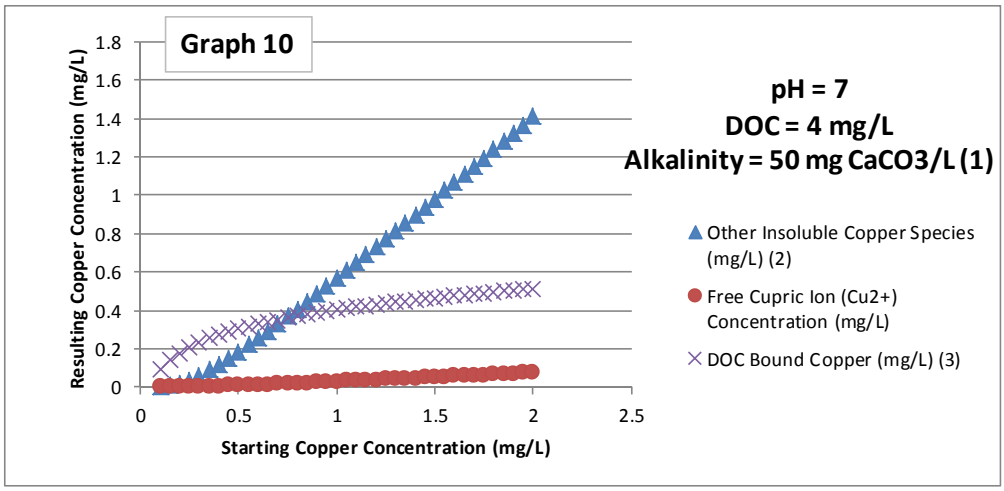

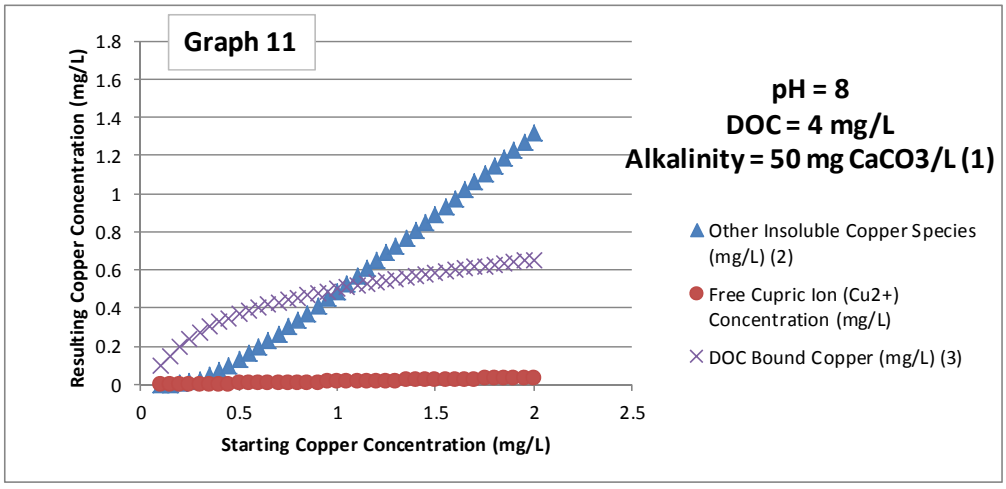

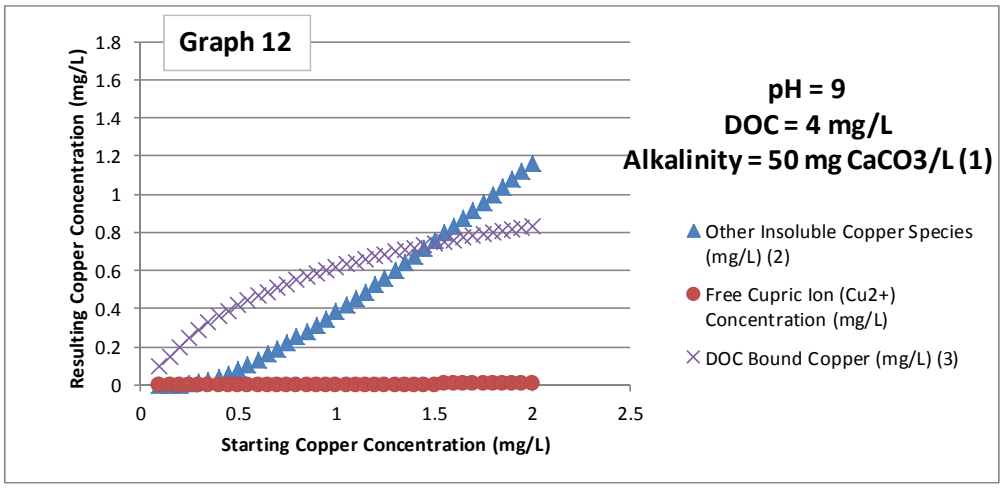

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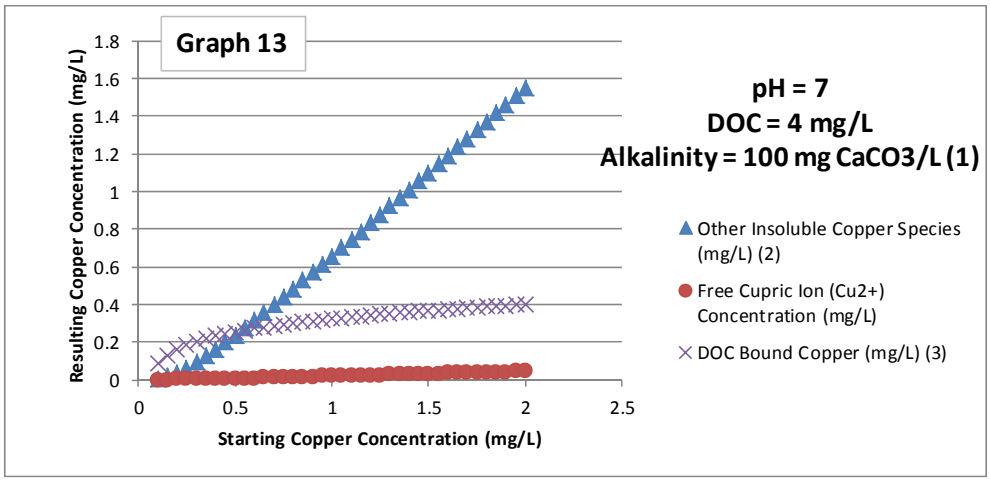

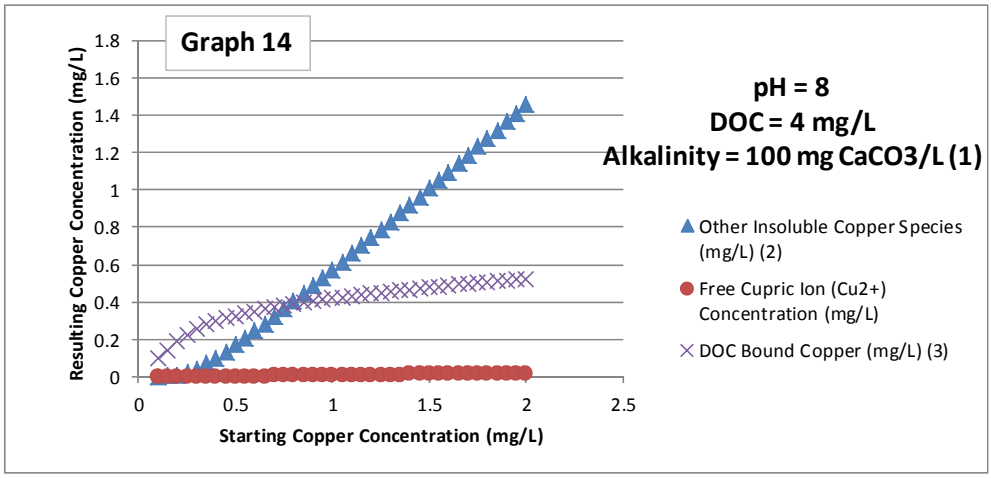

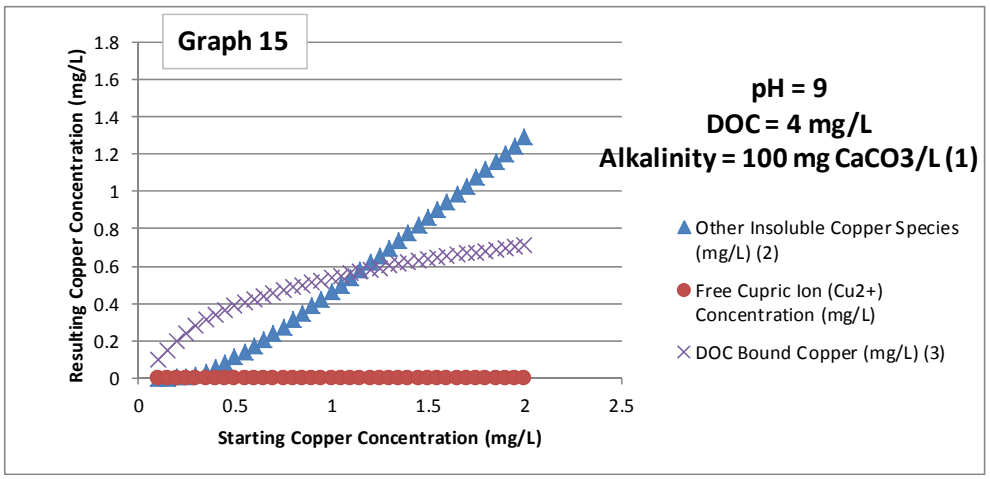

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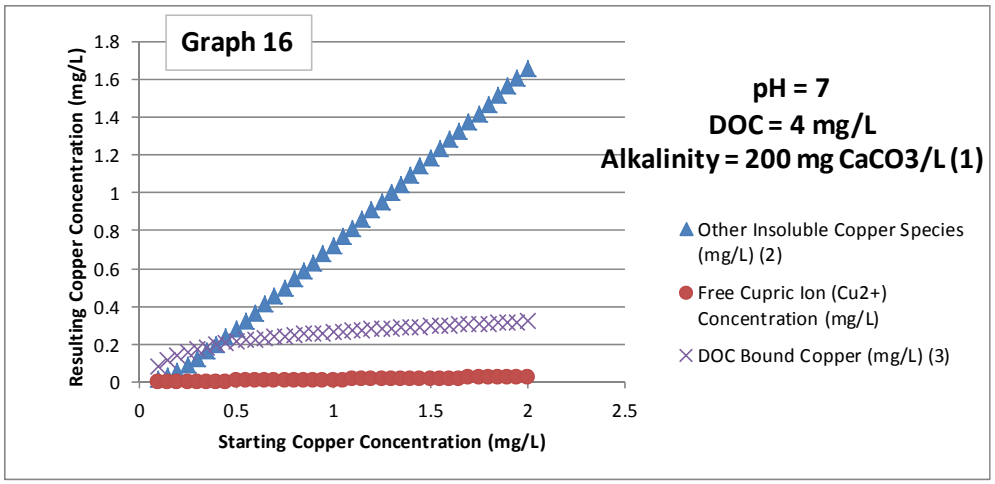

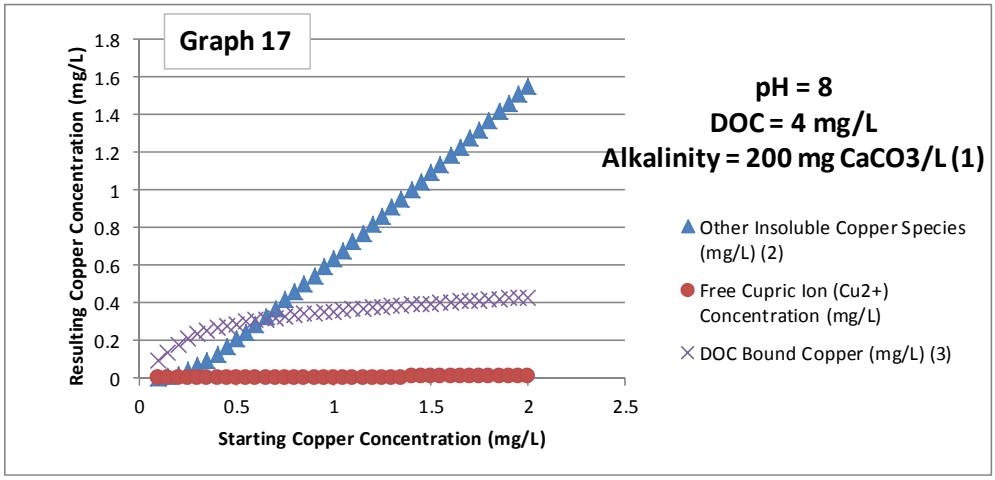

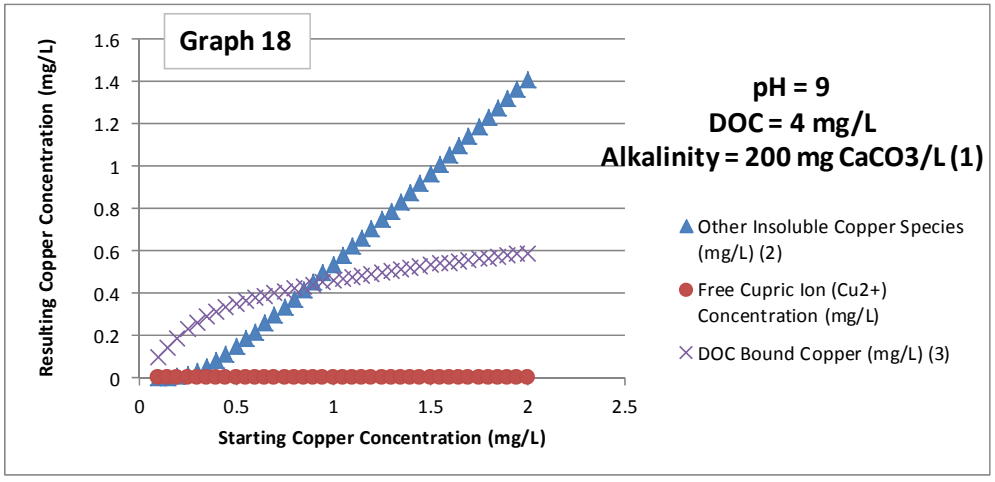

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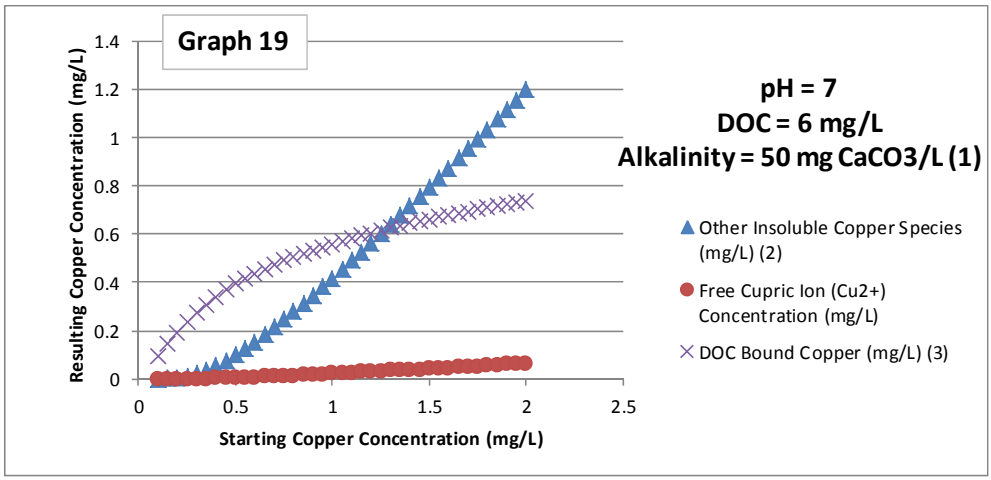

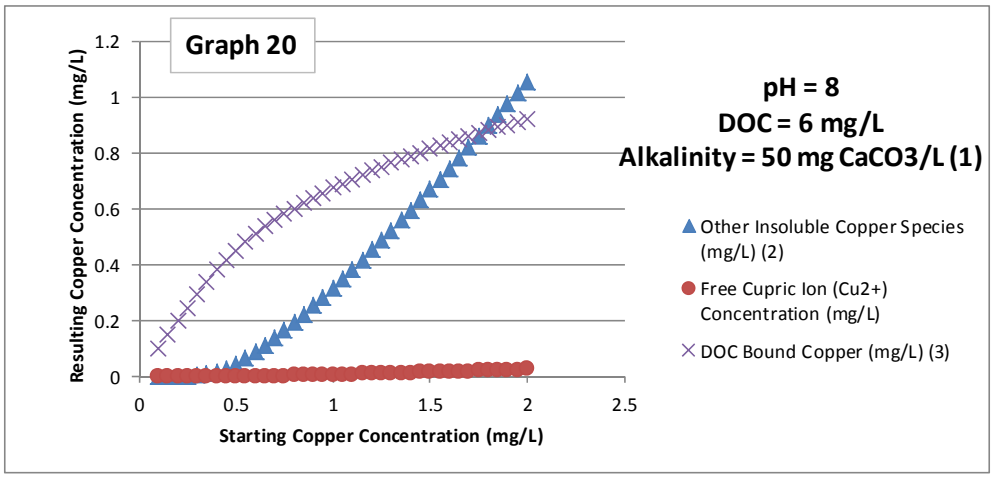

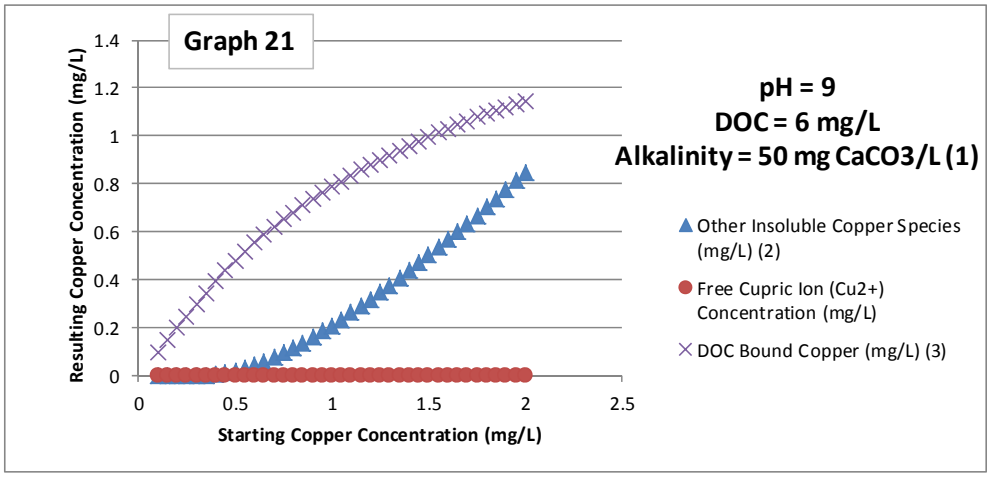

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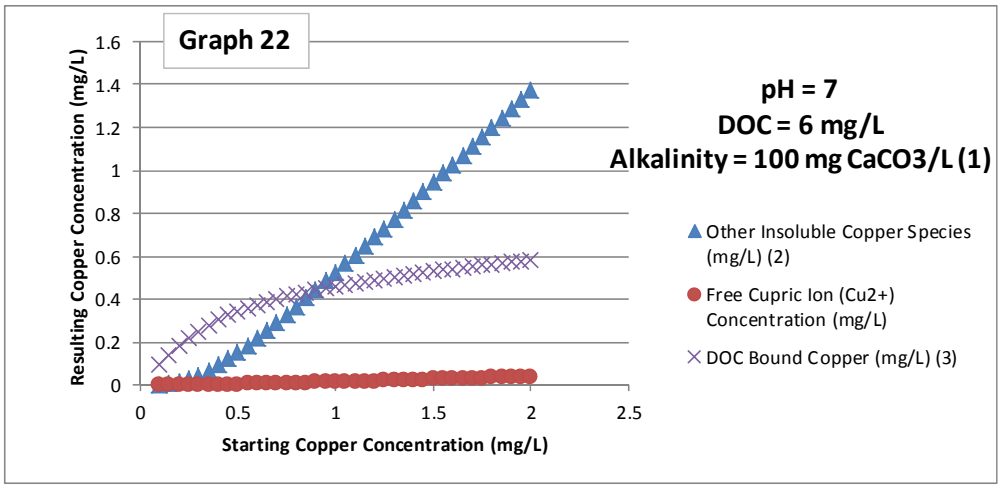

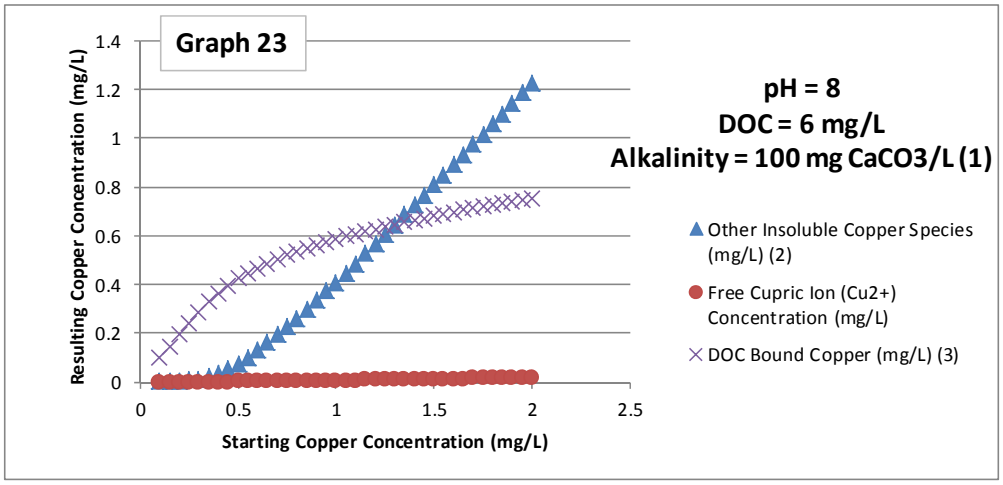

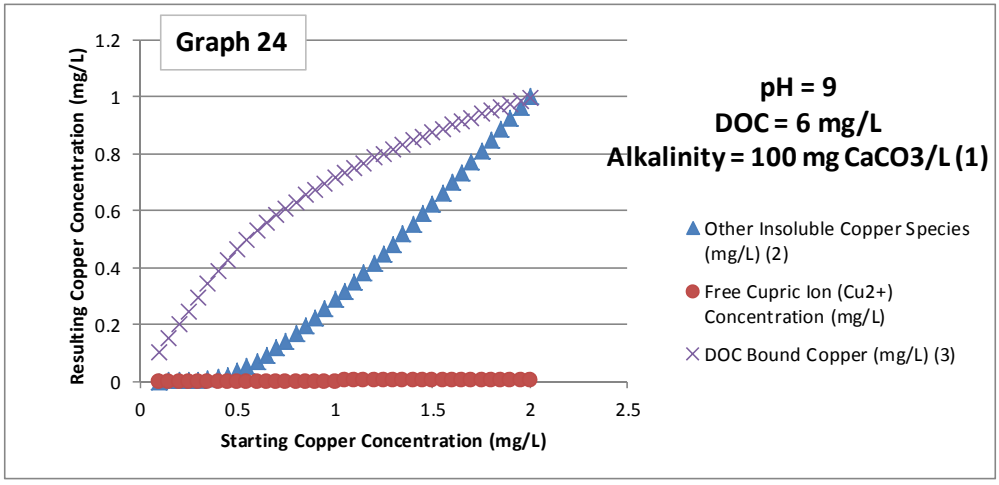

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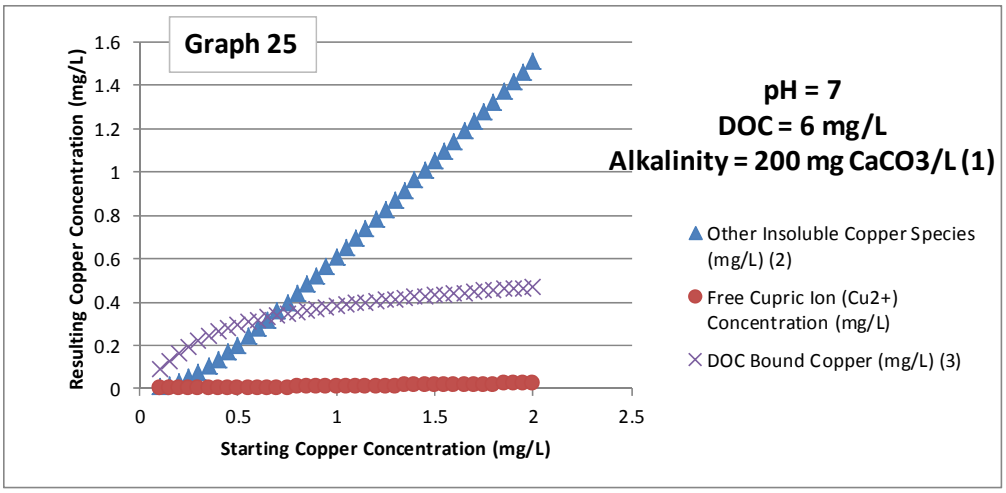

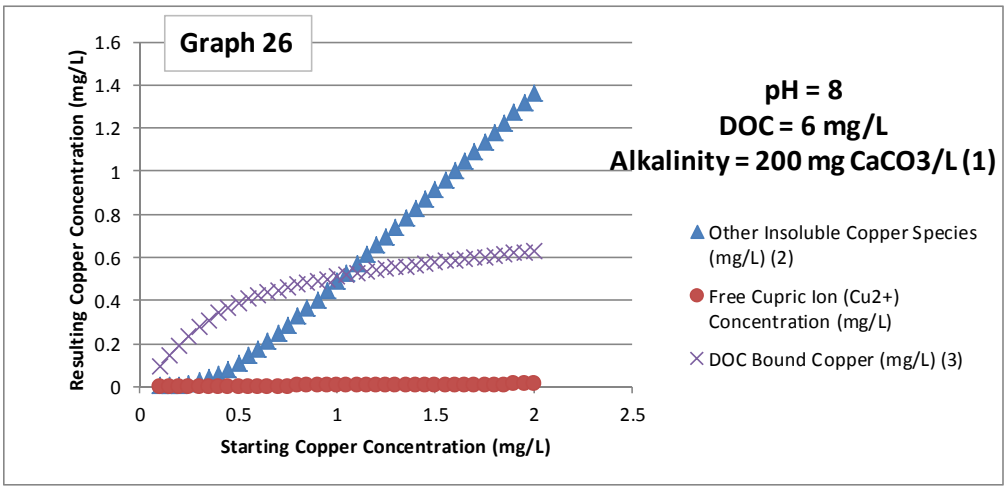

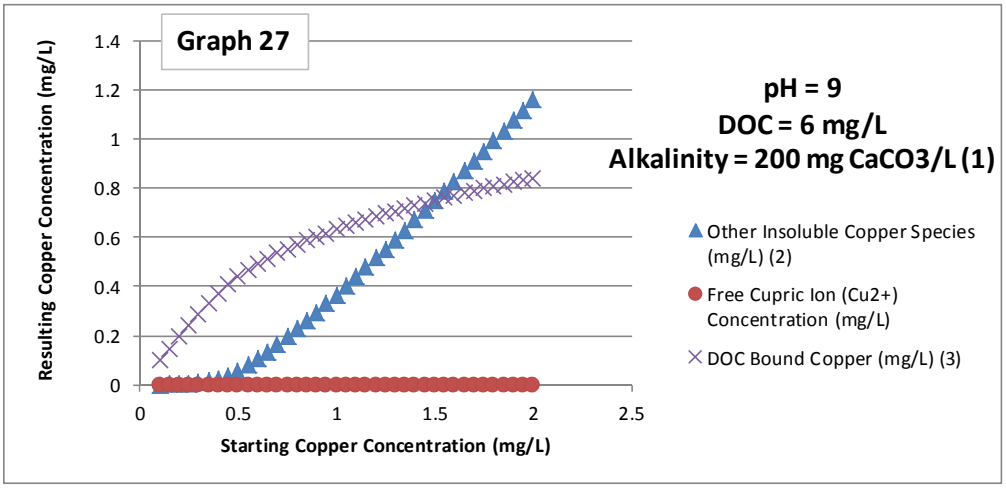

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Appendix D

(DPR PCA Recommendation Form)

Pest Control Recommendation

1. Operator of the Property.			2.Recommendation Expiration Date
Address	City	County	
3. Location to be Treated			
4. Commodity to be Treated			5. Acres or Units to be Treated
6. Method of Application: ☐ Air ☐ Ground ☐ Fumigation ☐ Other _____			7. Pest(s) to be Controlled

8. Name of Pesticide(s)	Rate per Acre or Unit	Dilution Rate	Volume per Acre or Unit

9. Hazards and/or Restrictions: ☐ 1. Highly toxic to bees. ☐ 2. Toxic to birds, fish and wildlife. ☐ 3. Do not apply when irrigation or run-off is likely to occur. ☐ 4. Do not apply near desirable plants. ☐ 5. Do not allow to drift onto humans, animals, or desirable plants. ☐ 6. Keep out of lakes, streams, and ponds. ☐ 7. Birds feeding on treated area may be killed. ☐ 8. Do not apply when foliage is wet (dew, rain, etc.). ☐ 9. May cause allergic reaction to some people. ☐10. This product is corrosive and reacts with certain materials (see label). ☐11. Closed system required. ☐12. Restricted use pesticide (California and/or EPA). ☐13. Hazardous area involved (see map and warnings) ☐14. Other (see attachment)	10. Schedule, Time or Conditions 11. Surrounding Crop Hazards 12. Proximity of Occupied Dwellings, People, Pets, or Livestock 13. Non-Pesticide Pest Control, Warnings and Other Remarks 14. Criteria Used for Determining Need for Pest Control Treatment: ☐ Sweep Net Counts ☐ Leaf or Fruit Counts ☐ Preventative ☐ Field Observation ☐ Pheromone or Other Trap ☐ Soil Sampling ☐ Other

15. Crop and Site Restrictions: ☐ 1. Worker reentry interval _____ days. ☐ 2. Do not use within _____ days of harvest/slaughter. ☐ 3. Posting required? ☐ Yes ☐ No ☐ 4. Do not irrigate for at least _____ days after application. ☐ 6. Do not feed treated foliage or straw to livestock. ☐ 7. Plantback restrictions (see label) ☐ 8. Other (see attachment)		N	
16. I certify that I have considered alternatives and mitigation measures that would substantially lessen any significant impact on the environment, and have adopted those feasible. Adviser Signature Date	W		E
Adviser License Number			
Employer			
Employer's Address		S	

Appendix E

(Example Product Labels and MSDS Sheets)

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

50 LBS. NET WEIGHT (22.7 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 77040-6519
TEL. (713) 896-9966

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

STORAGE AND DISPOSAL

Do not contaminate water, food or feed by storage or disposal.
STORAGE: Store in original container and place in a locked storage area.
PESTICIDE DISPOSAL: Call your local solid waste agency (or 1-800-CLEANUP or equivalent organization) for disposal instructions. Unless otherwise instructed, place in the trash. Never pour unused product down the drain or on the ground.
CONTAINER DISPOSAL: Do not reuse this container. Do not rinse unless required for recycling. Place in trash.

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 CaCO3.
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]

Crop	Pounds per Acre					
	Sands		Loams,silts,clays		Organic	
	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 in its unopened package conforms to the chemical description on the label. THERE ARE NO OTHER WARRANTIES EXPRESS OR IMPLIED, INCLUDING A WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE. This warranty does not extend to the handling or use of this product contrary to label instructions or under abnormal conditions or under conditions not reasonably foreseeable to seller and buyer assumes all risk of any such use.

CHEM ONE LTD.
8017 Pinemont Drive, Suite 100
HOUSTON, TEXAS 77040-6519
TEL: (713) 896-9966

ENVIRONMENTALLY HAZARDOUS SUBSTANCES
SOLID, N.O.S. (CUPRIC SULFATE) UN3077, RQ

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, Small, Medium, Large, FCC IV, and Very High Purity

Supplier Information

Chem One Ltd. (Importer of record)
8017 Pinemont Drive, Suite 100
Houston, Texas 77040-6519

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 **Personal Protective Equipment:** E = chemical goggles, impervious gloves, dust respirator.

Hazard Scale: 0 = Minimal 1 = Slight 2 = Moderate 3 = Serious 4 = Severe * = Chronic hazard

* * * Section 4 - First Aid Measures * * *

First Aid: Eyes

In case of contact with eyes, rinse immediately with plenty of water for at least 20 minutes. Seek immediate medical attention.

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 victim 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 not 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
Method Used: Not applicable
Upper Flammable Limit (UEL): Not applicable
Lower Flammable Limit (LEL): Not applicable
Auto Ignition: Not applicable
Flammability Classification: Not applicable
Rate of Burning: 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 = Minimal 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, 30 minutes, average value (copper and inorganic copper compounds)
	0.1 mg/m^3 TWA Peak, 30 minutes, average value (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.

PERSONAL PROTECTIVE EQUIPMENT

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: 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 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-contained air supply is required under OSHA's Respiratory Protection Standard (1910.134-1998). If airborne concentrations are above the applicable exposure limits, use NIOSH-approved respiratory protection. If airborne concentrations are above the applicable exposure limits, use NIOSH-approved respiratory protection. 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

Have an eyewash fountain and safety shower available in the work area

* * * 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:	Blue 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 cupric 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 vigorous reaction, especially in solution. This product can corrode steel and iron. Copper Sulfate Pentahydrate is incompatible with magnesium, strong bases, alkalines, phosphates, acetylene, hydrazine, and zirconium. Copper Sulfate Pentahydrate can be corrosive to aluminum.

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 caustic (alkaline) 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 LD_{50}: = 300 mg/kg; 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 tubules (including acute renal failure, acute tubular necrosis); Blood: hemorrhage; Oral-Human 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; Subcutaneous-rat 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 weeks-continuous: 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: post-implantation 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 manganese. 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.

* * * Section 13 - Disposal Considerations (Continued) * * *

Disposal Instructions

All wastes must be handled in accordance with local, state and federal regulations. This material can be converted to a less hazardous material by weak reducing agents followed by neutralization. Do not reuse empty containers. Do not rinse unless required for recycling. If partly filled, call local solid waste agency or (1-800-CLEANUP or equivalent organization) 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 for guidance.

* * * Section 14 - Transportation Information * * *

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 I.M.O., I.C.A.O. (I.A.T.A.) and 49 CFR to assure regulatory compliance.

US DOT Information

Shipping Name: Environmentally Hazardous Substance, solid, n.o.s. (cupric sulfate)
Hazard Class: 9 (Miscellaneous Hazardous Materials)
UN/NA #: UN 3077
Packing Group: III
Required Label(s): Class 9 (Miscellaneous Hazardous Materials)
RQ Quantity: 10 lbs (4.54 kg)[Cupric Sulfate]

Additional Shipping Information

Cupric Sulfate is a Severe Marine Pollutant (49 CFR 172.322) and requires the marine pollutant mark for vessel transportation. Because Copper Sulfate is listed as a Severe Marine Pollutant as found in Appendix B to 172.101 and when shipped by vessel, each inner package which exceeds 500 g (17.6 ounces) will need a marine pollutant marking. UN-certified package, marked with the Proper Shipping Name, UN Number will be required when shipped by vessel, when each inner package exceeds 500 g (17.6 ounces).

Limited Quantity Shipments: Inner packagings less than 500 g (17.6 ounces) will not need to be in a UN-approved box and will not need a Marine Pollutant marking. Such 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 30 kg (66 pounds). For a shipment by air the class 9 label will be required.

Domestic Transportation Exception

49 CFR 172.504(f)(9) Domestic transportation, a Class 9 placard is not required. A bulk packaging containing a Class 9 material must be marked with the appropriate identification number displayed on a Class 9 placard, an orange panel or a white-square-on-point display configuration as required by subpart D of this part. 49 CFR 172(d)(3) allows the use of the class 9 placard to replace the marine pollutant marking for domestic shipments.

* * * Section 14 - Transportation Information (Continued) * * *

International Air Transport Association (IATA)

For Shipments by Air transport: We classify this product as hazardous (Class 9) when shipped by air because 49 CFR 173.140 (a). "For the purposes of this subchapter, miscellaneous hazardous material (Class 9) means a material which presents a hazard during transportation, but which does not meet the definition of any other hazard class. This class includes: (a) Any material which has an anesthetic, noxious, or other similar property which could cause extreme annoyance or discomfort to a flight crew member so as to prevent the correct performance of assigned duties."

Proper Shipping Name: Environmentally hazardous substance, solid, n.o.s. (cupric sulfate)
Hazard Class: 9
UN: UN 3077
Packing Group: III
Passenger & Cargo Aircraft Packing Instruction: 911
Passenger & Cargo Aircraft Maximum Net Quantity: No Limit
Limited Quantity Packing Instruction (Passenger & Cargo Aircraft): Y911
Limited Quantity Maximum Net Quantity (Passenger & Cargo Aircraft): 30 kg
Special Provisions: A97
ERG Code: 9L

International Maritime Organization (I.M.O.) Classification

For shipments via marine vessel transport, the following classification information applies.

Proper Shipping Name: Environmentally hazardous substance, solid, n.o.s. (Cupric sulfate)
Hazard Class: class 9
UN #: UN3077
Packing Group: III
Special Provisions: 274, 909, 944
Limited Quantities: 500g.
Packing Instructions: P002, LP02
Packing Provisions: PP12
IBC Provisions: IBC07
IBC Provisions: B3
EmS: Fire F-A Spill S-B
Stowage and Segregation: Category A

This material is considered a severe marine pollutant by the IMO and shipments of the material must carry the marine pollutant mark label. Refer to IMO Amendment 31-02 Chapter 2.10.

* * * 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)

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

* * * Section 15 - Regulatory Information (Continued)* * *

US Federal Regulations (continued)

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		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):

DANGER! MAY BE 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.

* * * Section 15 - Regulatory Information (Continued)* * *

US Federal Regulations (continued)

Labeling Information for Pesticide Use of Product (continued):

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 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 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 r 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 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, waterproof gloves, shoes, plus socks and protective eyewear.

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 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 this 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. Revision date: 05/31/01

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
223/03: 2:21 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 entire Section 14 Transportation Information to include IATA, IMO transport information.

This is the end of MSDS # C1-121A

Specimen Label

Nautique*

Aquatic Herbicide

For control of floating, emersed, and submersed vegetation 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 systems (canals, laterals, and ditches), fish, golf course, ornamental, swimming, and fire ponds and aquaculture including fish and shrimp.

Active Ingredient	
Copper Carbonate†	15.9%
Inert Ingredients	84.1%
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.)

Precautionary Statements

Hazards to Humans and Domestic Animals

DANGER: Corrosive. Causes irreversible eye damage and skin burn. May be fatal if absorbed through skin. Harmful if swallowed. Do not get in eyes on skin or on clothing. Wear goggles, face shield, or safety glasses, protective clothing and chemical-resistant gloves. Prolonged or frequently repeated skin contact may cause allergic reactions in some individuals. Wash thoroughly with soap and water after handling and before eating, drinking and using tobacco. Remove contaminated clothing and wash before reuse.

Environmental Hazards

Fish toxicity is dependent on the hardness of the water. In soft water, trout and other species of fish may be killed at application rates recommended on this label. Do not use in waters containing trout or other sensitive species if the carbonate hardness of the water is less than 50 ppm. Fish toxicity generally decreases when the hardness of water increases. Do not treat more than one-half of lake or pond at one time to avoid depletion of oxygen levels due to decaying vegetation. Consult State Fish and Game Agency or other responsible Agency before applying this product to public 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 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.
If inhaled	• Move person to fresh air. • If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably mouth-to-mouth if possible. • Call a poison control center or doctor for further treatment advice.

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

Refer to inside of label booklet for additional precautionary information and Directions for Use.

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

For product information, visit our web site at **www.sepro.com**.

EPA Reg. No. 67690-10
FPL 070705

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

Directions for Use

It is a violation of Federal Law to use this product in a manner inconsistent with its label directions.

GENERAL INFORMATION

Nautique may be applied to potable water sources, lakes, rivers, reservoirs, ponds, slow-flowing or quiescent water bodies, crop and non-crop irrigation systems (ditches, canals, and laterals), fish, golf course, ornamental, swimming, and fire ponds, and aquaculture including fish and shrimp. In waters with greater calcium carbonate hardness, the higher use rates are recommended for improved plant control.

Target Species

Nautique Aquatic Herbicide is a double chelated copper formulation that provides effective control of floating, submersed, and emersed aquatic plants having a sensitivity to copper absorption including:

Coontail
Curlyleaf Pondweed
Egeria (*Brazilian Elodia*)
Elodea
Eurasian Watermilfoil[†]
Horned Pondweed[†]
Hydrilla
Naiads
Thin Leaf Pondweed
Vallisneria
Water Lettuce
Water Hyacinth
Widgeon Grass
Pondweed (e.g., Sago, American,)[†]

[†]Variable control may be obtained in waters with greater calcium carbonate hardness.

Timing of Treatments

When target vegetation is actively growing, apply Nautique Aquatic Herbicide to the area of greatest concentration of foliage in such a way as to evenly distribute the herbicide. In lakes, reservoirs, ponds, and static canals, the application site is defined by this label as the specific location where Nautique is applied. In slow moving and flowing canals and rivers, the application site is defined by this label as the target location for plant control. In order to maximize effectiveness, apply Nautique early in the day under bright or sunny conditions when water temperatures are at least 60° F (15° C). The activity of this product may be reduced if there is insufficient penetration of light into the water or if the plants and weeds are covered with silt, scale, or algae. If algae mats are thick, use high pressure when spraying to break up the algae mats.

Dissolved Oxygen Consideration

Treatment of aquatic plants and weeds can result in a reduction of dissolved oxygen due to the decomposition of the dead vegetation. This loss of dissolved oxygen can cause fish suffocation. To minimize this possible hazard treat 1/3 to 1/2 of the water area in a single operation, then wait 10 - 12 days before treating the remaining area. Begin treatment in the shallow areas, gradually proceeding outward in bands to permit the fish to move into the untreated area.

Application Options

Nautique Aquatic Herbicide can be applied directly as a surface spray, subsurface through trailing weighted hoses, or in combination with other aquatic herbicides and algaecides, surfactants, sinking agents, polymers, or penetrants. These products are used to improve the retention time, sinking, and distribution of the herbicide. For surface application, this product may be applied diluted or undiluted, whichever is most suitable to insure uniform coverage of the area to be treated.

Aquatic plants and weeds will typically drop below the surface within 4 - 7 days after treatment. The complete results of treatment will be observed in 3 - 4 weeks in most cases. In heavily infested areas a second application may be necessary after 10 - 12 weeks. Repeating application of this product too soon after initial application may have no effect.

Use the lower rates for treating shallow water and the higher rates for treating deeper water and heavier infestations. Surface applications may be made from shore into shallow water along the shoreline.

Nautique Aquatic Herbicide 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.

NO RESTRICTIONS ON WATER USE

Waters treated with Nautique may be used immediately after application for swimming, fishing, drinking, livestock watering, or irrigating turf and ornamental plants.

Permits

Some states may require permits for the application of this product to public waters. Check with your local authorities.

APPLICATION RATES

Recommended application rates in the chart below 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 lakes, reservoirs, ponds, and static canals, the application site is defined by this label as the specific location where Nautique is applied. In conveyance systems where significant water flow results in rapid off-site movement of copper, consult the Flowing Water Treatment Instructions for the recommended application instructions.

APPLICATION RATES		GALLONS PER SURFACE ACRE				LITERS PER SURFACE HECTARE			
		Depth in Feet				Depth in meters			
Relative Density	**ppm**	**1**	**2**	**3**	**4[2]**	**0.5**	**0.75**	**1.0**	**1.25[2]**
Low	.5	1.5	3.0	4.5	6.0	12.0	24.1	36.1	48.2
Density	.6	1.8	3.6	5.4	7.2	14.9	29.8	44.7	59.6
Medium	.7	2.1	4.2	6.3	8.4	17.2	34.4	51.6	68.8
Density	.8	2.4	4.8	7.3	9.6	19.5	39.0	58.5	78.0
High	.9	2.7	5.4	8.1	10.8	21.8	43.6	65.4	87.2
Density	1.0[3]	3.0	6.0	9.0	12.0	24.1	48.2	72.3	96.4

[1] For depths greater than 4 ft. (1.25 m) add rates given for the sum of the corresponding depths in the chart.
[2] Do not apply more than 1.0 ppm copper per application.

Free-Floating Plants Apply Nautique at a rate of 8 - 12 gallons/acre for control of water hyacinth and salvinia and 4 - 6 gallons/acre for control of water lettuce. Add Nautique and appropriate surfactant to 100 gallons of water and use an adequate spray volume to insure good coverage of the plant.

TANK-MIX

Nautique + Sonar® A.S. Tank-Mix (Except CA)

The following mixture can be used to provide rapid control of dense infestations of coontail, duckweed, egeria, elodea, Eurasian watermilfoil, hydrilla, sago and American pondweed, naiads, and other susceptible species. Apply 1 to 4 gallons of Nautique per surface acre in conjunction with normal Sonar rates. Observe all cautions and restrictions on the labels of both products used in this mixture.

Nautique + Reward® Tank-Mix

The following mixture can be used to enhance control of coontail, duckweed, egeria, elodea, Eurasian watermilfoil, hydrilla, pondweeds (Potamogeton species), salvinia, water lettuce, water hyacinth, and other susceptible species. Tank-mix a ratio of 2:1 or 1.5:1 Nautique to Reward. This can be applied as a tank mix or metered in as a concentrate. The addition of a surfactant is recommended to enhance performance on floating plants. Observe all cautions and restrictions on the labels of both products used in this mixture. **DO NOT MIX CONCENTRATES IN TANK WITHOUT FIRST ADDING WATER.**

FLOWING WATER TREATMENT:

Drip System or Metering Pump Application for Canals, Ditches, and Laterals

This product should be applied as soon as submersed macrophytes begin to 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 chemical distribution resulting in unsatisfactory control. Under these conditions increasing the water flow rate during application may be necessary. In flowing canals the application site is defined by this label as the target location for aquatic plant control.

To achieve desired control with Nautique herbicide in flowing waters, it is recommended that a minimum exposure period of three hours be maintained. Other factors to consider include: plant species and density of infestation and water temperature and hardness. Treatment on bright sunny days will tend to enhance efficacy of this product.

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:

   Average width (ft.) x Average Depth (ft.) x
   Average Velocity (ft./sec.) = Cubic Feet per Second (CFS)

   The velocity can be estimated by determining the length of time it takes a floating object to travel a defined distance. Divide the distance (ft.) by the time (sec.) to estimate velocity (ft./sec). 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 C.F.S. or gallons/minute, find the corresponding drip rate in the chart below.

Water Flow Rate		ppm Copper	Chemical Drip Rate	
C.F.S.	Gal/Min.		Quart/Hr.	Ml/Min.
1	450	0.5 – 1.0	0.5 – 1.0	8.0 – 16.0
2	900	0.5 – 1.0	1.0 – 2.0	16.0 – 32.0
3	1350	0.5 – 1.0	1.5 – 3.0	23.5 – 47.0
4	1800	0.5 – 1.0	2.0 – 4.0	31.5 – 63.0
5	2250	0.5 – 1.0	2.5 – 5.0	39.5 – 79.0

Calculate the amount of product needed to maintain the drip rate for a treatment period of 3 or more hours by multiplying quart/hr x 3; ml / min. by 180; or fl. oz. / min x 180. Dosage will maintain 1.0 ppm copper concentration in the treated water for the treatment period. Introduction of the chemical should be made in the channel at weirs or other turbulence-creating structures to promote the dispersion of the chemical.

Pour the required amount of this product into a drum or tank equipped with a brass needle valve and constructed 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. This product can also be applied by using metering pumps that adjust to flow rates in the canal.

Results can vary depending upon species and density of vegetation, desired distance of control and flow rate, and impact of water quality on copper residues and efficacy. Consult an Aquatic Specialist to determine optimal use rate and treatment period under local conditions. Periodic maintenance treatments may be required to maintain seasonal control.

Irrigation Ponds

When applying to irrigation ponds, 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.

GENERAL TREATMENT NOTES

The following suggestions apply to the use of this product as an algaecide or herbicide in all approved use sites. For optimum effectiveness:

- Apply early in the day under calm, sunny conditions when water temperatures are at least 60° F.
- Treat when growth first begins to appear or create a nuisance, if possible.
- Apply in a manner that will ensure even distribution of the chemical within the treatment area.
- Re-treat areas if regrowth begins to appear and seasonal control is desired. Allow one to two weeks between consecutive treatments.
- Allow seven to ten days to observe the effects of treatment (bleaching and breaking apart of plant material).

Storage and Disposal

Store in a cool, dry place.

PESTICIDE DISPOSAL: Do not contaminate water, food or feed by storage and disposal. Wastes resulting from the use of this product may be disposed of on site or at an approved waste disposal facility. 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: Triple rinse (or equivalent). Then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or incinerate, or, if allowed by state and local authorities, by burning. If burned, stay out of smoke.

Warranty Disclaimer

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

Inherent Risks Of Use

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

Limitation of Remedies

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

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

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

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

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	: KMK 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

Applicators should refer to the product label for personal protective clothing and equipment.

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 : 12.03 [Conc. (% w/w): 1%]Typical

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 of 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 : 153

Regulatory information	UN number	Proper shipping name	Classes	PG*	Label	Additional information
DOT Classification	UN2735	AMINES, LIQUID, CORROSIVE, N.O.S. (1,2-Diaminoethane)	8	III		-
IMDG Class	UN2735	AMINES, LIQUID, CORROSIVE, N.O.S. (1,2-Diaminoethane)	8	III		-
IATA-DGR Class	UN2735	AMINES, LIQUID, CORROSIVE, N.O.S. (1,2-Diaminoethane)	8	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.

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.) :

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 : 07/15/2009
Date of previous issue : 01/15/2009
Version : 2.1

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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Appendix F

(CEQA Documentation)

SWRCB SIP Exception Info Sheet
CEQA NOD
CEQA NOI
CEQA NOC
City of Sacramento, Department of Utilities Board Resolution
State Clearinghouse Letter, Comments, Responses
DFW Filing Fee Receipts

State Implementation Policy (SIP) Section 5.3 Exception Information Sheet

Use of Copper to Control Algae and Aquatic Vegetation

in Drainage Conveyances and Basins

City of Sacramento, Department of Utilities

November 24, 2014

1. **Notification.** The City of Sacramento, Department of Utilities (Department) will notify potentially effected public and governmental agencies of the project. The project is described in the District's Initial Study/Mitigated Negative Declaration (IS/MND) dated November 20, 2014.

2. **Description of the Proposed Action.** The proposed action is the application of copper-containing aquatic herbicides to control aquatic vegetation. For a more detailed description, see the District's aforementioned IS/MND.

3. **Schedule.** The schedule for the action will be according to Integrated Pest Management (IPM) principles. For example, the application of aquatic herbicides will be done at times and frequencies when the type and density of aquatic vegetation equals or exceeds thresholds established by the Department. Aquatic herbicide applications typically take place annually between April 1st and November 30th.

4. **Discharge and Receiving Water Quality Monitoring Plan.** The Department has prepared and will use its Aquatic Pesticide Application Plan (APAP) as required in the Statewide General NPDES Permit for Residual Aquatic Pesticide Discharges to Waters of the United States from Algae and Aquatic Weed Control Applications #CAG990005 (#2013-0002-DWQ). The APAP describes in detail the requirements for sampling, analysis, and reporting before, during, and after the project. Further, the APAP contains a Quality Assurance Project Plan (QAPP) that describes in detail the quality assurance and quality control procedures used for the project.

5. **Contingency Plans.** The Department will maintain its ability to use other herbicides and/or manual removal of aquatic vegetation and aquatic herbicides that do not contain copper. Alternative aquatic weed and algae control methods are not always as cost-effective, easy to apply, or efficacious as copper. Refer to the aforementioned IS/MND for a discussion of the use of copper-containing aquatic herbicides.

6. **Identification of Alternate Water Supply.** No alternative water supply exists for the Department.

7. **Residual Waste Disposal Plans.** The Department's use of copper to control aquatic weeds does not create residual waste.

8. **Certification by a Qualified Biologist.** At the annual completion of the project, the Department will provide certification by a qualified biologist that the receiving water beneficial uses have been maintained. Pre- and post-project certification will take into account natural variations in project site conditions and the influence these conditions have on beneficial uses.

Notice of Determination

ENDORSED
SACRAMENTO COUNTY
MAR 11 2015
DONNA ALLRED, CLERK/RECORDER
BY _____ DEPUTY

To: Sacramento County Clerk
600 8th Street
Sacramento, CA 95814

From: City of Sacramento, Department of Utilities
1395 35th Avenue
Sacramento, CA 95822

Subject: FILING OF NOTICE OF DETERMINATION IN COMPLIANCE WITH SECTION 21108 OF THE PUBLIC RESOURCES CODE

Project Title: Use of Copper to Control Algae and Aquatic Vegetation in Drainage Conveyances and Basins

Contact Person: William Roberts, phone: 916-808-6955

A copy of the Mitigated Negative Declaration adopted for this project and related documents are available for public examination at the Department office at the above address and telephone number.

- Project Location: within Sacramento County, CA
- Project Description: The use of copper containing aquatic herbicides to treat algae and aquatic weeds in water bodies within the Department's jurisdiction. The City of Sacramento, Department of Utilities (Department) has prepared the Initial Study/Mitigated Negative Declaration to meet requirements of 1) The State Implementation Plan (SIP) Section 5.3 and 2) NPDES Permit #CAG990005

Determination: This notice is to advise that the Department approved the above-described project on February 24, 2015 and has made the following determinations:

1. The project ☐ will have a significant effect on the environment.
   ☒ 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 Mitigated 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 this project.
4. A statement of Overriding Considerations ☐ was, ☒ was not, adopted for this project.
5. California State Department of Fish & Wildlife fees (AB 3158)
   a) ☐ The project has been found to be de minimis thus not subject to the provisions of AB 3158
   b) ☒ The project is not de minimis and is, therefore, subject to the following fees:
      ☒ $2,210.00 for review of a Mitigated Negative Declaration
      ☐ $3,069.75 for review of an Environmental Impact Report
      ☐ $50 for County Fish and Wildlife program processing fees

William Roberts, Superintendent of Drainage Services

2/25/15
Date

NOTICE OF INTENT

140525

To Adopt a Mitigated Negative Declaration for
the City of Sacramento, Department of Utilities

FILED
SACRAMENTO COUNTY
NOV 26 2014
DAVID VILLANUEVA, CLERK RECORDER
BY

Use of Copper to Control Algae and Aquatic Vegetation In Drainage Conveyances and Basins

The City of Sacramento, Department of Utilities (Department) is proposing to begin to use copper-based aquatic herbicides to control aquatic weeds in its water bodies within the Department's jurisdiction in Sacramento County, California.

The proposed project would include the following elements:

- Application of copper-based aquatic herbicides; and
- Monitoring and reporting to the State Water Resource Control Board (SWRCB) and the Regional Water Quality Control Board (RWQCB)

To comply with the requirements of the California Environmental Quality Act (CEQA), the Department authorized Blankinship & Associates, Inc. to prepare an Initial Study for the proposed project. The Initial Study includes an environmental checklist that evaluates the potential environmental impacts of the proposed project. Based on the results of the Initial Study, the Department has determined that the proposed project can be carried out without significant impacts on the environment. Therefore, the Department proposes to adopt a Mitigated Negative Declaration in order to meet its obligation under CEQA.

Prior to taking final action on the proposed Mitigated Negative Declaration, the Department will consider public comments on the Initial Study and proposed Mitigated Negative Declaration. All interested parties are invited to submit written comments to:

William Roberts
C/o Roxanne Dilley
Superintendent of Drainage Services
City of Sacramento, Department of Utilities
1395 35th Avenue
Sacramento, CA 95822

The Initial Study and proposed Mitigated Negative Declaration are available for public review at the above address during normal working hours, 8:00 a.m. to 5:00 p.m. The public review period begins on 12/01/14 and ends on 01/09/15. **All written comments must be received by the close of business on the last day of the review period.**

A public hearing on the proposed Mitigated Negative Declaration will be held during the City of Sacramento City Council Meeting scheduled for **February 24, 2015 at 6:00pm** at the new City Hall, located at 915 I Street, Sacramento, CA 95814. After consideration of all comments, the Department will either certify or reject the proposed Mitigated Negative Declaration.

POSTED BY SACRAMENTO CO. CLERK-RECORDER
FROM: Nov. 26, 2014 TO: Dec. 26, 2014

Print Form

Appendix C

2014112063

Notice of Completion & Environmental Document Transmittal

Mail to: State Clearinghouse, P.O. Box 3044, Sacramento, CA 95812-3044 (916) 445-0613
For Hand Delivery/Street Address: 1400 Tenth Street, Sacramento, CA 95814

SCH #

Project Title: Use of Copper to Control Algae and Aquatic Vegetation in Drainage Conveyances and Basins

Lead Agency: City of Sacramento, Department of Utilities — Contact Person: William Roberts

Mailing Address: 1395 35th Avenue — Phone: (916) 808-6955

City: Sacramento — Zip: 95822 — County: Sacramento

Project Location: County: Sacramento — City/Nearest Community: Sacramento

Cross Streets: Water bodies within the Department's jurisdiction — Zip Code: 95822

Longitude/Latitude (degrees, minutes and seconds): ____° ____′ ____″ N / ____° ____′ ____″ W Total Acres: 64000

Assessor's Parcel No.: Various — Section: Various Twp.: ____ Range: ____ Base: ____

Within 2 Miles: State Hwy #: 5, 80, 99, 50 — Waterways: Sacramento River, American River, various creeks

Airports: Sacramento Executive — Railways: Southern Pacific — Schools: Various

Document Type:

CEQA: ☐ NOP ☐ Early Cons ☐ Neg Dec ☒ Mit Neg Dec ☐ Draft EIR ☐ Supplement/Subsequent EIR (Prior SCH No.) ____ Other: ____

NEPA: ☐ NOI ☐ EA ☐ Draft EIS ☐ FONSI Other: ☐ Joint Document ☐ Final Document ☐ Other: ____

RECEIVED
MAY 26 2014
STATE CLEARING HOUSE

Local Action Type:

☐ General Plan Update ☐ General Plan Amendment ☐ General Plan Element ☐ Community Plan
☐ Specific Plan ☐ Master Plan ☐ Planned Unit Development ☐ Site Plan
☐ Rezone ☐ Prezone ☐ Use Permit ☐ Land Division (Subdivision, etc.)
☐ Annexation ☐ Redevelopment ☐ Coastal Permit ☒ Other: NPDES Permit

Development Type:

☐ Residential: Units ____ Acres ____
☐ Office: Sq.ft. ____ Acres ____ Employees ____
☐ Commercial: Sq.ft. ____ Acres ____ Employees ____
☐ Industrial: Sq.ft. ____ Acres ____ Employees ____
☐ Educational: ____
☐ Recreational: ____
☒ Water Facilities: Type all MGD ____
☐ Transportation: Type ____
☐ Mining: Mineral ____
☐ Power: Type ____ MW ____
☐ Waste Treatment: Type ____ MGD ____
☐ Hazardous Waste: Type ____
☒ Other: Algae & Aquatic Weed Mgt with Herbicides

Project Issues Discussed in Document:

☒ Aesthetic/Visual
☒ Agricultural Land
☒ Air Quality
☒ Archeological/Historical
☒ Biological Resources
☐ Coastal Zone
☐ Drainage/Absorption
☐ Economic/Jobs
☐ Fiscal
☐ Flood Plain/Flooding
☐ Forest Land/Fire Hazard
☒ Geologic/Seismic
☒ Minerals
☒ Noise
☒ Population/Housing Balance
☒ Public Services/Facilities
☒ Recreation/Parks
☒ Schools/Universities
☐ Septic Systems
☐ Sewer Capacity
☐ Soil Erosion/Compaction/Grading
☐ Solid Waste
☒ Toxic/Hazardous
☒ Traffic/Circulation
☒ Vegetation
☒ Water Quality
☒ Water Supply/Groundwater
☒ Wetland/Riparian
☐ Growth Inducement
☐ Land Use
☐ Cumulative Effects
☐ Other: ____

Present Land Use/Zoning/General Plan Designation:

Urban and Agriculture

Project Description: *(please use a separate page if necessary)*

The use of copper to treat algae and aquatic weeds in water bodies within the Department's jurisdiction. The City of Sacramento, Department of Utilities is preparing this Initial Study/Mitigated Negative Declaration to meet requirements of 1) The State Implementation Plan (SIP) Section 5.3 and 2) NPDES Permit #CAG990005. See CEQA Initial Study and Mitigated Negative Declaration for details.

Note: The State Clearinghouse will assign identification numbers for all new projects. If a SCH number already exists for a project (e.g. Notice of Preparation or previous draft document) please fill in.

Revised 2010

Reviewing Agencies Checklist

Lead Agencies may recommend State Clearinghouse distribution by marking agencies below with and "X".
If you have already sent your document to the agency please denote that with an "S".

____	Air Resources Board	____	Office of Historic Preservation
____	Boating & Waterways, Department of	____	Office of Public School Construction
____	California Emergency Management Agency	____	Parks & Recreation, Department of
____	California Highway Patrol	X	Pesticide Regulation, Department of
____	Caltrans District # ____	____	Public Utilities Commission
____	Caltrans Division of Aeronautics	X	Regional WQCB #5
____	Caltrans Planning	____	Resources Agency
X	Central Valley Flood Protection Board	____	Resources Recycling and Recovery, Department of
____	Coachella Valley Mtns. Conservancy	____	S.F. Bay Conservation & Development Comm.
____	Coastal Commission	____	San Gabriel & Lower L.A. Rivers & Mtns. Conservancy
____	Colorado River Board	____	San Joaquin River Conservancy
____	Conservation, Department of	____	Santa Monica Mtns. Conservancy
____	Corrections, Department of	____	State Lands Commission
____	Delta Protection Commission	____	SWRCB: Clean Water Grants
____	Education, Department of	X	SWRCB: Water Quality
____	Energy Commission	____	SWRCB: Water Rights
X	Fish & Game Region #2	____	Tahoe Regional Planning Agency
X	Food & Agriculture, Department of	____	Toxic Substances Control, Department of
____	Forestry and Fire Protection, Department of	____	Water Resources, Department of
____	General Services, Department of		
____	Health Services, Department of	X	Other: Sacramento Co Ag Commissioner
____	Housing & Community Development	____	Other:
____	Native American Heritage Commission		

Local Public Review Period (to be filled in by lead agency)

Starting Date 12/1/2014 Ending Date 1/9/2015

Lead Agency (Complete if applicable):

Consulting Firm: Blankinship & Associates, Inc.
Address: 1590 Drew Ave, Ste 120
City/State/Zip: Davis, CA 95618
Contact: Michael Blankinship
Phone: (530) 757-0941

Applicant: City of Sacramento, Department of Utilities
Address: 1395 35th Avenue
City/State/Zip: Sacramento, CA 95822
Phone: (916) 808-6955

Signature of Lead Agency Representative: William R. Ritter **Date:** 11/20/14

Authority cited: Section 21083, Public Resources Code. Reference: Section 21161, Public Resources Code.

RESOLUTION NO. 2015-0050

Adopted by the Sacramento City Council

February 24, 2015

ADOPTING THE MITIGATED NEGATIVE DECLARATION AND MITIGATION MONITORING AND REPORTING PROGRAM FOR THE USE OF COPPER TO CONTROL AQUATIC VEGETATION IN DRAINAGE CONVEYANCES AND BASINS

BACKGROUND

A. The State Water Resources Control Board released a Statewide General National Pollutant Discharge Elimination System (NPDES) Permit for the Discharge of Aquatic Pesticides for Aquatic Weed Control in Waters of the United States (Permit), and the Department of Utilities (Department) has obtained coverage under this Permit to apply aquatic pesticides to water quality detention basins and controlled drainage conveyance channels.

B. The Department desires to include aquatic algaecides containing copper on an "as needed" basis to more efficiently control algae in these basins and channels. The Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries in California, also known as the State Implementation Plan (SIP) assigns effluent limitations for California Toxics Rule priority pollutants, including the aquatic herbicide copper. The SIP also prohibits discharges of priority pollutants in excess of applicable water quality criteria outside the mixing zone.

C. Although the SIP prohibits the discharge of copper in excess of applicable water quality criteria into receiving waters, Section 5.3 of the SIP allows for short-term or seasonal exceptions if determined to be necessary to implement control measures for resource or pest management (i.e., weed control) conducted by public entities. The Department has determined that it meets the criteria for gaining a Section 5.3 SIP exception for the use of copper to control algae in basins and controlled conveyance channels.

D. Pursuant to this exception, the Department proposes to apply aquatic herbicides containing copper to control aquatic vegetation, when determined to be the most effective treatment measure, in its drainage basins and conveyances (the "Project"). Control of this vegetation is necessary in order to efficiently convey stormwater and urban runoff and prevent nuisance conditions.

E. Pursuant to the California Environmental Quality Act (CEQA), the City prepared an Initial Study and Mitigated Negative Declaration for the Project dated November 20, 2014.

F. The Initial Study and Mitigated Negative Declaration were circulated for public review and comment as required under CEQA, and a Mitigation Monitoring and Reporting Program has been prepared.

G. The City has received and responded to public comments on the Mitigated Negative Declaration and the Initial Study.

BASED ON THE FACTS SET FORTH IN THE BACKGROUND, THE CITY COUNCIL RESOLVES AS FOLLOWS:

Section 1. The City Council finds as follows:

A. Following preparation of an Initial Study for the Project, a Mitigated Negative Declaration (MND) for the Project was completed, noticed, and circulated in accordance with the requirements of the California Environmental Quality Act (CEQA), the State CEQA Guidelines, and the Sacramento Local Environmental Procedures.

B. A Notice of Intent to Adopt the MND (NOI) dated November 26, 2014, was circulated for public comment for a public review period beginning December 1, 2014 and ending January 9, 2015. The NOI was posted in the office of the Sacramento County Clerk and sent to those public agencies that have jurisdiction by law with respect to the proposed Project and to other interested parties and agencies.

Section 2. The City Council has reviewed and considered the information contained in the MND, including the Initial Study, and the comments received during the public review process and the public hearing on the Project. The City Council has determined that the MND constitutes an adequate, accurate, objective, and complete review of the environmental effects of the Project.

Section 3. Based on its review of the MND and on the basis of the whole record, the City Council finds that the MND reflects the City Council's independent judgment and analysis and that there is no substantial evidence that the Project will have a significant effect on the environment.

Section 4. The City Council adopts the MND for the Project.

Section 5. Pursuant to CEQA section 21081.6 and CEQA Guidelines section 15074, and in support of its approval of the Project, the City Council adopts a Mitigation Monitoring and Reporting Program to require all reasonably feasible mitigation measures be implemented by means of Project conditions, agreements, or other measures, as set forth in the Mitigation Monitoring and Reporting Program.

Section 6. The City Council approves the Project and authorizes the Department of Utilities to proceed with Project implementation in accordance with City policies and requirements and Section 5.3 of the State Implementation Plan, by submitting the City's SIP exception request to the State Water Resources Control Board.

Section 7. City staff shall file or cause to be filed a Notice of Determination with the Sacramento County Clerk and the State Clearinghouse, pursuant to section 21152(a) of the Public Resources Code and section 15075 of the CEQA Guidelines.

Section 8. Pursuant to CEQA Guidelines section 15091(e), the documents and other materials that constitute the record of proceedings upon which the City Council has based its decision are located in and may be obtained from, the Office of the City Clerk at 915 I Street, Sacramento, California. The City Clerk is the custodian of records for all matters before the City Council.

Section 9. Exhibits A, B, and C are made a part of this Resolution.

Table of Contents

Adopted by the City of Sacramento City Council on February 24, 2015, by the following vote:

Ayes: Members Ashby, Carr, Hansen, Harris, Jennings, Schenirer, Warren and Mayor Johnson

Noes: None

Abstain: None

Absent: None

Vacant: District 6

Attest:

Digitally signed by Shirley A. Concolino
DN: cn=Shirley A. Concolino, o=City of Sacramento, ou=City Clerk, email=sconcolino@cityofsacramento.org, c=US
Date: 2015.02.25 21:09:50 -08'00'

Shirley Concolino, City Clerk

STATE OF CALIFORNIA

Governor's Office of Planning and Research

State Clearinghouse and Planning Unit

Edmund G. Brown Jr.
Governor

Ken Alex
Director

January 12, 2015

William Roberts
City of Sacramento
1395 35th Avenue
Sacramento, CA 95822

Subject: Use of Copper to Control Algae and Aquatic Vegetation in Drainage Conveyances and Basins
SCH#: 2014112063

Dear William Roberts:

The State Clearinghouse submitted the above named Mitigated Negative Declaration to selected state agencies for review. On the enclosed Document Details Report please note that the Clearinghouse has listed the state agencies that reviewed your document. The review period closed on January 9, 2015, and the comments from the responding agency (ies) is (are) enclosed. If this comment package is not in order, please notify the State Clearinghouse immediately. Please refer to the project's ten-digit State Clearinghouse number in future correspondence so that we may respond promptly.

Please note that Section 21104(c) of the California Public Resources Code states that:

> "A responsible or other public agency shall only make substantive comments regarding those activities involved in a project which are within an area of expertise of the agency or which are required to be carried out or approved by the agency. Those comments shall be supported by specific documentation."

These comments are forwarded for use in preparing your final environmental document. Should you need more information or clarification of the enclosed comments, we recommend that you contact the commenting agency directly.

This letter acknowledges that you have complied with the State Clearinghouse review requirements for draft environmental documents, pursuant to the California Environmental Quality Act. Please contact the State Clearinghouse at (916) 445-0613 if you have any questions regarding the environmental review process.

Sincerely,

Scott Morgan
Director, State Clearinghouse

Enclosures
cc: Resources Agency

Document Details Report
State Clearinghouse Data Base

SCH# 2014112063
Project Title Use of Copper to Control Algae and Aquatic Vegetation in Drainage Conveyances and Basins
Lead Agency Sacramento, City of

Type MND Mitigated Negative Declaration
Description The use of copper to treat algae and aquatic weeds in water bodies within the Department's jurisdiction. The City of Sacramento, Department of Utilities is preparing this IS/MND to meet requirements of 1) The State Implementation Plan (SIP) Section 5.3 and 2) NPDES Permit #CAG990005.

Lead Agency Contact

Name William Roberts
Agency City of Sacramento
Phone 916 808 6955 **Fax**
email
Address 1395 35th Avenue
City Sacramento **State** CA **Zip** 95822

Project Location

County Sacramento
City Sacramento
Region
Lat / Long
Cross Streets Water bodies within the Department's jurisdiction
Parcel No. Various
Township **Range** **Section** Varies **Base**

Proximity to:

Highways Hwy 5, 80, 99, 50
Airports Sacramento Executive
Railways SPRR
Waterways Sacramento River, American River, various creeks
Schools Various
Land Use Urban and Agriculture

Project Issues Aesthetic/Visual; Agricultural Land; Air Quality; Archaeologic-Historic; Biological Resources; Geologic/Seismic; Minerals; Noise; Population/Housing Balance; Public Services; Recreation/Parks; Schools/Universities; Toxic/Hazardous; Traffic/Circulation; Vegetation; Water Quality; Water Supply; Wetland/Riparian

Reviewing Agencies Resources Agency; Department of Fish and Wildlife, Region 2; Department of Parks and Recreation; Department of Water Resources; Caltrans, District 3 S; Department of Food and Agriculture; Air Resources Board; State Water Resources Control Board, Division of Water Quality; Regional Water Quality Control Bd., Region 5 (Sacramento); Department of Toxic Substances Control; Native American Heritage Commission; Department of Pesticide Regulation

Date Received 11/26/2014 **Start of Review** 11/26/2014 **End of Review** 01/09/2015

Note: Blanks in data fields result from insufficient information provided by lead agency.

State of California – Natural Resources Agency
DEPARTMENT OF FISH AND WILDLIFE
North Central Region/Region 2
1701 Nimbus Road, Suite A
Rancho Cordova, CA 95670
www.wildlife.ca.gov

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

December 29, 2014

William Roberts
City of Sacramento, Department of Utilities
1395 35th Ave
Sacramento, CA 95822

Subject: Comments on the Mitigated Negative Declaration for the Use of Copper to Control Algae and Aquatic Vegetation in Drainage Conveyances and Basins; SCH# 2014112063

Dear Mr. Roberts:

The California Department of Fish and Wildlife (CDFW) is providing comments on the Initial Study (IS)/Mitigated Negative Declaration (MND) for the Use of Copper to Control Algae and Aquatic Vegetation in Drainage Conveyances and Basins (proposed project) as both a trustee agency and responsible agency under the California Environmental Quality Act (CEQA). As trustee for the State's fish and wildlife resources, the CDFW has jurisdiction over the conservation, protection, and management of fish, wildlife, native plants, and the habitats necessary for biologically sustainable populations of such species. The CDFW may also be a responsible agency, for a project affecting biological resources where we will exercise our discretion after the lead agency, to approve or carry out a proposed project or some facet thereof.

The proposed project includes the use of copper to treat algae and aquatic weeds in water conveyances, including irrigation canals, creeks, ditches, detention basins, and storm drains. The Project involves the use of copper-based aquatic herbicides introduced into the City of Sacramento-Department of Utilities (Department) drainage conveyances and basins at concentrations that temporarily exceed California Toxics Rule water quality objectives.

The proposed project encompasses water conveyances within the City of Sacramento in Sacramento County, California. The City of Sacramento is approximately 100 square miles in size. The approximate centroid of the proposed project is located at Latitude 38.495125 N, Longitude -121.469994 W.

The CDFW's primary concern is the potential significant impact to the giant garter snake (*Thamnophis gigas*), which is federally and State-listed as threatened. The IS/MND indicates that giant garter snake may occur in the vicinity of the proposed project. Giant garter snakes are associated with low-gradient streams, irrigation channels, wetlands and marshes, and regions supporting rice agriculture. The CDFW does not believe that the IS/MND adequately analyzes the impacts to the giant garter snake, or that the mitigation proposed is sufficient to reduce impacts to a less-than-significant level and is recommending the inclusion of the following in to the IS/MND:

- Further evaluation of the invertebrate ecosystem impacts should be conducted. Giant garter snake diet consists primarily of amphibians and fish, and those organisms in turn depend on invertebrate food supplies. The IS/MND discusses the toxicity of copper in the water column, but this evaluation does not include the impacts of giant garter snake

food-base organism exposure to acrolein and copper and the potential bio-accumulative toxic implications to the giant garter snake via diet;

- A bio-assessment for macroinvertebrates should be conducted to evaluate baseline conditions for these ecosystem food base organisms and post-treatment to determine and assess potential impacts. For example, frogs and bats consume terrestrial insects, and many of those insects have an aquatic life stage (e.g., mayfly, dragon/damselfly, mosquitos). Since aquatic organisms such as frogs, tadpoles, and invertebrates may utilize sediment habitat, the CDFW recommends that settling and absorption of the herbicide in sediment be evaluated for toxic impacts to sediment dwelling organisms;

- The copper sulfate material safety data sheet (MSDS) requires an Environmental Protection Agency (EPA) bulletin for endangered species. Further information regarding this bulletin for Sacramento County should be included in the IS/MND;

- Chemical removal of aquatic vegetation should only be used in areas where giant garter snake does not have the potential to occur. If aquatic vegetation must be removed where giant garter snake has the potential to occur, then CDFW recommends that it is removed by other means, including but not limited to hand-removal and other mechanical means which do not include earth disturbing activities. The IS/MND should quantify the loss of habitat as a result of the proposed project (i.e. removal of vegetative cover);

- Due to the cryptic nature of giant garter snakes, the CDFW does not believe that the mitigation proposed (HWQ-1), which is a general permit calling for subsurface sampling, is adequate to reduce impacts to a less-than-significant level. In addition, the toxin will reduce the vegetative cover within the waterways and therefore increase the likelihood that giant garter snake would be vulnerable to predation;

- A qualified biologist or monitor familiar with the species in the region should be present to monitor on-site compliance with all minimization measures. If any giant garter snake or other special-status species is detected on-site during the proposed project activities, work will cease immediately and the species shall be allowed to freely move out of the project area. Capture and relocation of trapped or injured giant garter snake should only be attempted by personnel or individuals with a current CDFW Incidental Take Permit for this project. The CDFW or U.S. Fish and Wildlife Service should be notified in the event that any special status species are encountered;

- The CDFW strongly encourages irrigation agencies and other water delivery entities to evaluate and consider less-environmentally toxic aquatic weed control treatments;

- Water quality monitoring for copper concentrations in lateral canals should be required during and after treatment. After the 6-day holding period and before water is released into fish-bearing waters, the canal and lateral water shall be tested for acrolein and/or copper (as appropriate for the treatment chemical) and have non-detectable herbicide concentrations; and

- The proposed project will have an impact to fish and/or wildlife habitat and should be evaluated in such a manner to reduce its impacts to biological resources. Assessment of fees under Public Resources Code §21089 and as defined by Fish and Game Code

(FGC) §711.4 is necessary. Fees are payable by the project applicant upon filing of the Notice of Determination by the lead agency.

Furthermore, it is unlawful to take a State-listed endangered or threatened species (FGC §2050 et seq). Take is defined as "hunt, pursue, catch, capture or kill or attempt to hunt, pursue, catch, capture or kill" (FGC §86). If the proposed project has the potential to result in take of a State-listed plant or wildlife species over the life of the proposed project, California Endangered Species Act (CESA) take authorization should be obtained.

Issuance of an Incidental Take Permit (ITP/CESA take authorization) is a discretionary action and subject to CEQA. As a responsible agency and to be able to issue the ITP, the CDFW would rely on the final CEQA document for the project. The CEQA document must adequately specify impacts, mitigation measures, and include a mitigation monitoring and reporting program for the project. An ITP may only be obtained if the impacts of the authorized take of the species are minimized and fully mitigated and adequate funding has been ensured to implement the mitigation measures. Issuance of a CESA permit may take up to 180 days from receipt of an application from the applicant.

Pursuant to Public Resources Code §21092 and §21092.2, the CDFW requests written notification of proposed actions and pending decisions regarding the proposed project. Written notifications shall be directed to: California Department of Fish and Wildlife Region 2, 1701 Nimbus Road, Rancho Cordova, CA 95670.

Thank you for considering our concerns for the proposed project. CDFW personnel are available for consultation regarding biological resources and strategies to minimize impacts. If you have questions please contact Amy Kennedy, Environmental Scientist, by e-mail at Amy.Kennedy@wildlife.ca.gov or by phone at (916) 358-2842.

Sincerely,

For

Tina Bartlett
Regional Manager

ec: California Department of Fish and Wildlife
Jeff Drongesen
Isabel Baer
Carol Oz
Joel Trumbo
Tanya Sheya
Amy Kennedy

State Clearinghouse

References

U.S. Department of the Interior. 1994. Biological Report 23. Acrolein Hazards to Fish, Wildlife, and Invertebrates: A Synoptic Review. http://scholar.google.com/scholar_url?hl=en&q=http://www.dtic.mil/cgi-bin/GetTRDoc%3FAD%3DADA323207&sa=X&scisig=AAGBfm3FdP7YqR2bzzgxybTlzxqmm8rYkg&oi=scholarr

Material Safety Data Sheet. http://www.mathesongas.com/pdfs/msds/MAT00330.pdf

City of
SACRAMENTO
Department of Utilities

January 27, 2015

To: Tina Bartlett
Regional Manager
California Department of Fish and Wildlife
North Central Region/Region 2
1701 Nimbus Road, Suite A
Rancho Cordova, CA 95670

CC: Carol Oz, Tanya Shaya, Amy Kennedy

From: William Roberts WR
City of Sacramento, Department of Utilities
1395 35th Avenue
Sacramento, CA 95822

Re: CDFW Comments on City of Sacramento, Department of Utilities Mitigated Negative Declaration for the Use of Copper to Control Algae and Aquatic Vegetation in Water Conveyances; SCH# 2014112063

Dear Ms. Bartlett;

The City of Sacramento, Department of Utilities ("Department") received the comments described above from the California Department of Fish and Wildlife (CDFW) on December 29, 2014. The Department held a conference call with the Department's consultant, Blankinship & Associates, and Carol Oz of CDFW on January 9, 2015 to discuss the comments received on the Project. The Department is the entity responsible for water, storm drainage, and sewer services for the City of Sacramento ("City"). The Department maintains and operates the drainage system for the City to allow surface water to flow to collection points, prevent flooding, and is able to pump water from its collection points, detention basins, and canals. The Department's drainage system facilities are designed to provide urban flood protection in a series of drainage zones throughout the City. The drainage system includes a large network of storm drains and underground pipes, detention basins, creeks, ditches, canals, and pumping stations, to convey urban runoff and stormwater.

The Department experiences issues resulting in reduced capacity and impeded flow in its aboveground, controlled drainage facilities due to the presence of aquatic vegetation. Additionally, detention basins and channels in residential areas are prone to infestation by nuisance vegetation and algae that can create mosquito breeding habitat, citizen complaints of odor and impede efficient water flow. In order to control nuisance algae and aquatic vegetation

to allow for the safe and efficient movement of stormwater and recirculated water, the Department proposes as part of its Integrated Pest Management (IPM) program to apply on as-needed and short-term or seasonal basis, algaecides and/or aquatic herbicides containing copper to its controlled conveyance system and basins (the Project). In accordance with the California Environmental Quality Act (CEQA), the Department prepared an Initial Study and Mitigated Negative Declaration (IS/MND) for the Project, dated November 20, 2014. The IS/MND was circulated for public review. Comments were received by the Department from CDFW prior to the close of the comment period.

The Department implements non-chemical efforts to prevent and minimize issues with algae and aquatic vegetation in its conveyances and basins including aeration, sediment removal, using pumps to move water in stagnant areas, addressing water quality issues and run-off received from surrounding development and industrial areas. The Department conducts its maintenance efforts within the guidelines set out in its CDFW 1600 Streambed Alteration Agreement Routine Maintenance Agreement (RMA). The Department works closely with Amy Kennedy of CDFW when conducting maintenance activities within its jurisdiction and follows the guidance set out in the RMA regarding timing of work, and where maintenance activities are done. Additionally, all crews working in the conveyances and basins receive annual training to help familiarize them with special status species habitat and identification.

Aquatic herbicide applications made by the Department are completed under the guidance of the Department's Statewide General Aquatic Pesticide NPDES Permit (Permit No. 2013-0002-DWQ; Waste Discharger Identification No. 5A34AP00011). Reports are submitted to the Central Valley Regional Water Quality Control Board and the State Water Resources Control Board.

Any pesticide (e.g., insecticide, herbicide, algaecide, etc.) applications conducted by the City must also adhere to the requirements set forth in the City's Municipal Separate Storm Sewer System (MS4) NPDES Permit (Order No. R5-2008-0142). The goal of the pesticide requirements within this MS4 NPDES Permit is to reduce the discharge of pesticides from municipal storm water systems to urban creeks. When using pesticides, the City is also subject to State and Federal pesticide regulations, and includes requirements for training, licensing, proper pesticide use and storage, record keeping, and reporting. The MS4 NPDES Permit also includes further pesticide regulations that requires the implementation of IPM practices (coverage under the Aquatic Pesticide NPDES Permit is consistent with IPM principles) and oversight of pesticide applications by Certified Pesticide Applicators. All pesticide applications are conducted by, or under the supervision of, a person holding a Qualified Applicator License/Certificate, in the category appropriate for the application. City staff involved with pesticide applications also receives training on pesticide related surface water toxicity, less toxic methods of pest prevention and control, and IPM principles.

Consistent with the January conference call, the Department will notify Carol Oz at CDFW Region 2's Rancho Cordova office in writing each year prior to the application of copper-containing algaecides or aquatic herbicides. The Department will send a copy of its Aquatic Pesticide NPDES Permit annual report to CDFW each year it uses copper-containing algaecides or aquatic herbicides.

Please refer to the Department's responses to CDFW's comments below:

Comment #1

Further evaluation of the invertebrate ecosystem impacts should be conducted. Giant garter snake diet consists primarily of amphibians and fish, and those organisms in turn depend on invertebrate food supplies. The IS/MND discusses the toxicity of copper in the water column, but this evaluation does not include the impacts of giant garter snake food-base organism exposure to acrolein and copper and the potential bio-accumulative toxic implications to the giant garter snake via diet;

Response:

Consistent with our conference call, this was discussed in Appendix A (page 16) and Appendix B (page 19). Also, the Project is specific to the application of copper-containing products, not acrolein. The citations summarized in Appendix B include:

Harrahy and Clements 1997

Bioaccumulation factors were calculated for the benthic invertebrate, *Chironomus tentans,* to be 16.63 and 12.99 during two uptake tests. Depuration was rapid. Copper concentrations were similar to background within four days. The authors caution that the bioaccumulation factors presented may be related to bioavailability that is driven by sediment characteristics.

Hendriks *et al.* 1998

Bioaccumulation ratios were determined for zebra mussels (*Dreissena polymorpha*) from the Rhine-Meuse Delta in the Netherlands. For copper, the ratio between mussels and suspended solids was 0.31 indicating tissue concentrations did not exceed environmental concentrations and that copper had not bioaccumulated.

California Department of Fish and Game 2004

The California Department of Fish and Game (CDFG) conducted a study evaluating if exposure to aquatic herbicides, including copper, used to control submersed and emergent plants pose an acute threat to the giant garter snake (CDFG, 2004). Two sympatric, closely related species of garter snakes, the common garter snake (Thamnophis sirtalis) and the western terrestrial garter snake (Thamnophis elegans), were collected from the wild and used as surrogates for the giant garter snake (Thamnophis gigas). To simulate a worst-case exposure scenario, snakes were both orally and

dermally dosed with solutions of Komeen® (copper ethylenediamine complex) at a concentration of 1.05 mg/L, which is slightly above the maximum label rate of 1.00 mg/L. Experimental oral and dermal exposure doses ranged from 0.010 to 0.011 mg/kg-bw . Snakes were monitored daily for seven days post-exposure then reexamined at the end of seven days to assess overall health. No acute effects (lethal or sub-lethal) in either of the species of garter snakes were observed, indicating that even if snakes were inadvertently sprayed directly or were to consume any of the undiluted spray solution, acute toxicity is not expected.

Action: None. As cited above, ecosystem impacts are adequately addressed.

Comment #2

A bio-assessment for macroinvertebrates should be conducted to evaluate baseline conditions for these ecosystem food base organisms and post-treatment to determine and assess potential impacts. For example, frogs and bats consume terrestrial insects, and many of those insects have an aquatic life stage (e.g., mayfly, dragon/damselfly, mosquitos). Since aquatic organisms such as frogs, tadpoles, and invertebrates may utilize sediment habitat, the CDFW recommends that settling and absorption of the herbicide in sediment be evaluated for toxic impacts to sediment dwelling organisms;

Response:

The Department acknowledges CDFW's concerns regarding the food base organisms. However, given the hydrology and conditions present in the basins and conveyance system, and the results of an extensive literature review, the Department does not believe that bioassessments for macroinvertebrates and site-specific evaluation of sediment would provide any information that will improve the Department's approach of using copper-containing aquatic herbicides. Consistent Section 3.17 of the IS/MND, copper, when applied as an algaecide or aquatic herbicide, adsorbs to sediment rapidly after application (Murray-Gulde, Heatley et al. 2002). While bound to the sediment, copper is rendered largely unavailable to aquatic receptors (Huggett, Gillespie et al. 1999; Gallagher, Duke et al. 2005; Murray-Gulde, Bearr et al. 2005). Only the bioavailable portion of copper, primarily the free cupric ion, is the form of copper which causes toxicity.

As presented in Appendix C of the IS/MND, under a variety of circumstances, "free" or "bioavailable" copper in the water column is limited and accordingly, exposure to macroinvertebrates in the water column is similarly limited. For example, Graphs 26 and 27 of Appendix C are the most relevant for details on copper speciation under typical conditions observed in the Department's basins and conveyances.

Studies examining the relationship between sediment copper concentration and toxicity support the conclusion that sediment-bound copper is not bioavailable. Deaver *et al.* (1996) compared limnetic water and copper-amended sediment toxicity to *Hyalella azteca*, an epibenthic detritivore sentinel species, and found that sediment concentrations were not predictive of copper toxicity across various

water and sediment conditions. The limnetic water median lethal concentration (LC_{50}) of the free cupric ion, however, varied by <4% in the sediment-toxicity tests, indicating that the form of copper associated most strongly with toxicity (i.e. the bioavailable fraction) is aquatic phase rather than sediment-bound copper. These results are corroborated by those of Suedel *et al.* (1996) which showed that copper toxicity to several aquatic organisms, including fish, water fleas, a midge, and an amphipod species, were correlated with overlying (limnetic) water concentration rather than sediment or pore water concentration. As noted in the IS/MND, copper-containing herbicides rapidly dissipate and/or become permanently insoluble, and as a result, are not bioavailable shortly after application (CDFA 2002; Trumbo 1997, 1998; WA DOE 2004).

Toxicity studies have also been conducted using water and sediment samples from copper herbicide application sites. Gallagher et al. (2005) collected water and sediment samples from a 20,234 hectare lake treated for 10 years in some areas with Komeen, a form of chelated copper applied annually at concentrations of 1 mg Cu/L. This rate of application is similar to the rate and application interval to what the Department anticipates using. The Gallagher study also looked at untreated areas to assess bioavailability to *Hyalella azteca* and *Ceriodaphnia dubia*. No statistical differences in response of either *H. azteca* or *C. dubia* to treated (16.3-18.0 mg Cu/kg) and untreated (0.3 mg Cu/kg) sediments were observed when compared to control sediments. In a 10-day exposure study by Huggett *et al.* (1999), sediments were collected from Steilacoom Lake (WA) and amended with $CuSO_4$ (800-2,000 mg Cu/kg dry weight) to assess copper bioavailability to *H. azteca, Chironomous tentans,*and *C. dubia*. When comparing the no observable adverse effect concentrations (NOECs) derived under these experimental conditions (906-2,010 mg Cu/kg) with the current concentrations of copper in the lake sediment (180-1,110 mg Cu/kg), it is apparent that the sediment-bound copper in the lake is not bioavailable to the three species.

Action: None at this time.

Comment #3

The copper sulfate material safety data sheet (MSDS) requires an Environmental Protection Agency (EPA) bulletin for endangered species. Further information regarding this bulletin for Sacramento County should be included in the IS/MND;

Response:

We will download the EPA bulletins for the application areas as they become available, and if applicable. Bulletins are only available for the next six months (i.e. if accessed in January, bulletins are available up to June). A search of the of bulletins on January 2, 2015 for all pesticide application activities in the Sacramento area did not show any copper-specific bulletins were available for January through June (USEPA, 2015).

Action: None at this time.

Comment #4

Chemical removal of aquatic vegetation should only be used in areas where giant garter snake does not have the potential to occur. If aquatic vegetation must be removed where giant garter snake has the potential to occur, then CDFW recommends that it is removed by other means, including but not limited to hand-removal and other mechanical means which do not include earth disturbing activities. The IS/MND should quantify the loss of habitat as a result of the proposed project (i.e. removal of vegetative cover);

Response:

The Department's priority in its flood control conveyances is public safety. In order to provide flood protection, the Department's water conveyances were designed and are maintained to be free of aquatic vegetation, so that stormwater and runoff may move safely and efficiently through those conveyances. The basins were also designed to be free of algae or aquatic vegetation. Any algae or aquatic vegetation in the Department's conveyances or basins is present only temporarily, until the Department is able to take steps to control it. Accordingly, there will be no permanent or temporary loss of habitat as a result of the Project.

Action: None at this time.

Comment #5

Due to the cryptic nature of giant garter snakes, the CDFW does not believe that the mitigation proposed (HWQ-1), which is a general permit calling for subsurface sampling, is adequate to reduce impacts to a less-than-significant level. In addition, the toxin will reduce the vegetative cover within the waterways and therefore increase the likelihood that giant garter snake would be vulnerable to predation.

Response:

Please see the response to Comment 1 and Comment 4.

Further, note that the use of copper-containing herbicides are intended for the control of submersed aquatic vegetation which the giant garter snake does not use as refuge.

Action: None at this time.

Comment #6

A qualified biologist or monitor familiar with the species in the region should be present to monitor on-site compliance with all minimization measures. If any giant garter snake or other special-status species is detected on-site during the proposed project activities, work will cease immediately and the species shall be allowed to freely move out of the project area. Capture and relocation of trapped or injured giant garter snake should only be attempted by personnel or individuals with a current CDFW Incidental Take Permit for this project. The CDFW or U.S. Fish and Wildlife Service should be notified in the event that any special status species are encountered;

Response:

As discussed during the January conference call, the Department has two biologists on contract to complete special status species surveys, if needed. The Department provides annual training to all crews working in the conveyances and basins to help familiarize them with special status species habitat and identification.

Action: None at this time.

Comment #7

The CDFW strongly encourages irrigation agencies and other water delivery entities to evaluate and consider less-environmentally toxic aquatic weed control treatments;

Response:

The Department exercises extreme caution when any aquatic herbicide is used. As stated in the IS/MND, the Department contracts a Pest Control Advisor (PCA) licensed by the California Department of Pesticide Regulation (CDPR), and has qualified staff to make a determination of the need for aquatic herbicide use. The PCA puts the recommendation for algaecide or aquatic herbicide use in writing and certifies the recommendation as follows:

> I certify that I have considered alternatives and mitigation measures that would substantially lessen any significant impact on the environment, and have adopted those feasible.

If it is determined that there is a need for an aquatic herbicide application, it will be done only by staff licensed by CDPR. Rigorous annual and bi-annual training is required by all staff involved in aquatic herbicide application. Further, as described in the IS/MND, the Department uses an IPM approach to algae and aquatic weed management, including a careful evaluation of the tools available to accomplish a particular objective. Management tools considered include mechanical, biological, cultural, and chemical techniques. One or more of these techniques may be used to meet an algae, weed or nuisance vegetation management objective.

Action: None at this time

Comment #8

Water quality monitoring for copper concentrations in lateral canals should be required during and after treatment. After the 6-day holding period and before water is released into fish-bearing waters, the canal and lateral water shall be tested for acrolein and/or copper (as appropriate for the treatment chemical) and have non-detectable herbicide concentrations; and

Response:

To the Department's knowledge, there is no requirement for a 6-day holding period and related testing applicable to the use of aquatic herbicides that contain copper. Water quality testing will be done as described in the NPDES Aquatic Pesticide Permit.

Action: CDFW will be contacted by Blankinship & Associates staff in the late Spring or early Summer to coordinate a field trip to observe herbicide application and sampling activity.

Comment #9

The proposed project will have an impact to fish and/or wildlife habitat and should be evaluated in such a manner to reduce its impacts to biological resources. Assessment of fees under Public Resources Code §21089 and as defined by Fish and Game Code (FGC) §711.4 is necessary. Fees are payable by the project applicant upon filing of the Notice of Determination by the lead agency.

Response:

Agreed. The Department will submit the appropriate fees.

Action: Department to pay appropriate CDFW fees upon adoption of the IS/MND.

References

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REC'T # 0008543895
March 11, 2015 ---- 12:24:15 PM

Sacramento County Recorder
Donna Allred, Clerk/Recorder

Check Number 1845
RECD BY

State Fees	$2,210.00
CLERKS	$26.00
Total fee	$2,236.00
Amount Tendered...	$2,236.00
Change	$0.00

ARR,26/0/0

REC'T # 0008543896
March 11, 2015 ---- 12:24:34 PM

Sacramento County Recorder
Donna Allred, Clerk/Recorder

Check Number 1845
RECD BY

Refund	$24.00
Sub Total fee	$24.00
Total fee	$2,260.00
Amount Tendered...	$2,260.00
Change	$0.00

ARR,26/1/0